The Effects of Knowledge Spillovers, Incubators and Accelerator Programmes on the Product Innovation of High-Tech Start-Ups: A Mixed Methods Approach

Cuvero Calero, M.

The Effects of Knowledge Spillovers, Incubators and Accelerator Programmes on the Product Innovation of High-Tech Start-Ups: A Mixed Methods Approach

MARCO ANTONIO CUVERO CALERO

UNIVERSITY OF WESTMINSTER

WESTMINSTER BUSINESS SCHOOL

A thesis submitted in partial fulfilment of the requirements of the University of Westminster for the degree of Doctor of Philosophy

September 2020

Abstract

The Knowledge Spillover Theory of Entrepreneurship (KTSE) focuses on exploring how entrepreneurs use uncommercialised knowledge spillovers into funding a new venture. This phenomenon explores the role of geographical proximity on the exploration of entrepreneurial opportunities that result in the creation of start-ups that promote the evaluation of the economic growth in regions. However, the definition of knowledge spillovers and the mechanisms measurements to evaluate high-tech entrepreneurs during the first years of operation continues to be an elusive research area in the field of entrepreneurship and innovation. This doctoral thesis seeks to shed light on the effects of knowledge spillovers, incubators, and accelerators on high-tech start-ups performance and survival.

Knowledge Spillovers research focuses on the effects of economics and the characteristics of countries on start-ups. However, there is a clear gap in stating a definition of knowledge spillovers and taxonomy with other disciplines. Research so far assumes that entrepreneurs automatically absorb knowledge spillovers. This work takes a different approach by identifying the processes, mechanisms and companies that facilitate using knowledge spillovers towards innovation.

The doctoral research focused on obtaining primary data from entrepreneurs at the individual level. The study conducted a sequential mixed method exploratory design to empirically develop a model that identifies the types of knowledge spillovers used by companies at the seed and growth stages. A qualitative phase conducted a multiple-case study approach involving 32 semi-structured interviews with chief executive officers and co-founders of high-tech start-ups that attended incubator and accelerator programmes in Greater London, United Kingdom. The resultant conceptual model identified the start-up's strategic decisions to form alliances and partnerships through accelerator programmes, incubators and networking events. The results also suggest that entrepreneurs are likely to allocate Research and Development (R&D) budgets to hire human capital and invest in training to implement information technologies that allow them to overcome geographical proximity and engage in product innovation. The qualitative phase's objective was to identify the mechanisms, processes, definitions of knowledge spillovers, and to guide factor analysis to generalise the findings.

The qualitative findings guided the development of incoming and network knowledge spillovers formative constructs that evaluate alliances with organisations and information sources. The results led to quantitative models' development to evaluate the start-up's absorptive capacity and product innovation. The quantitative phase conducted a validation and generalisation of the qualitative model using factor analysis from a sample of 556 founders of high and medium-tech start-ups operating in the United Kingdom. The findings highlighted that tacit and explicit knowledge spillovers positively affect the company's creation during the process of potential absorptive capacity. The results suggested that the entrepreneur valuation of the business idea based on their experience, or by conducting market research through interviews, surveys, and asking experts in the field. The entrepreneurial journey is supported by incubators or accelerator programmes through networking events and the provision of headquarters. The activities undertaken in these programmes provide access to investment from venture capitalists, and headquarters for start-ups to run their operations. This process leads to the development of alliances and partnerships that enable access to knowledge spillovers.

Entrepreneurs wound to take the managerial decisions to hire highly skilled human capital and incorporate technological tools and conduct R&D. Furthermore, the model three variant of KST-QNCM proves that the founder's start-ups type of industry's background and academic qualifications influence start-ups operations and objectives.

The research's main contribution to knowledge is the developed Knowledge Spillovers model of High-Tech Start-ups (KMS-HTS). The model states propositions and the statistical effects from constructs and variables during the phases of identifying the business idea and creation of the company, establishment and development, and scaling up and the company's future. The model provides a clear description of entrepreneurs' processes and mechanisms to implement knowledge spillovers towards innovation. The model also provides a taxonomy and sources of knowledge under the classification of network and incoming knowledge spillovers that can be implemented in disciplines not linked to economic and econometric models.

The thesis provides strong empirical evidence on different approaches taken by entrepreneurs based on the type of industry. The model revealed that high-technology start-ups follow a unidirectional process of absorption and implementation of knowledge spillovers to develop new products through exploratory innovation. Thus, high-tech start-ups become potential sources of knowledge spillovers for entrepreneurs and companies through R&D that generate research outputs, patents, and academic publications. On the other hand, Medium-high technology and knowledge-intensive companies aim to engage in a product development cycle focused on developing a product prototype from existing technology to participate in local and international markets. Under this category, companies can engage in exploratory or exploitative innovation by using information technologies to acquire additional knowledge spillovers.

Table of Content

Contents

List of Tables

List of Figures

List of Acronyms

AEGIS	Advancing Knowledge-Intensive Entrepreneurship and Innovation for Growth and Social wellbeing in Europe
AJG	Academic Journal Guide
ABS	Association of Business Schools
B2B	Business to Business
B2C	Business to Customer
CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
DI	Diversification
EFA	Exploratory Factor Analysis
EJV	Equity Joint Ventures
EXI	Exploratory Innovation
EPI	Exploitative Innovation
HEIs	Higher Education Institutions
IN/AC	Incubators and Accelerator Programmes
KIBS	Knowledge-Intensive Industries
KMO	Kaiser-Meyer-Olkin
KSTE	Knowledge Spillover Theory of Entrepreneurship
KPF	knowledge production function
MBA	Master's in Business Administration
MGA	Multiple-Group Analysis
MVP	Minimum Viable Product
NACE	Nomenclature of Economic Activities
NKS	Network Knowledge Spillovers
NTBF	New Technology-Based Firm
ICT	Information and Communications Technology
INKS	Incoming Knowledge Spillovers
IP	Intellectual Property
IT	Information Technology
OECD	Organisation for Economic Co-operation and Development
PAC	Potential Absorptive Capacity
PLS-PM	Partial Least Squares Path Modelling
RAC	Realised Absorptive Capacity
R&D	Research and Development
SEM	Structural Equation Modelling
SIC	Industrial Classification Index
SMEs	Small and Medium-size Enterprises
STEM	Science, Technology, Engineering and Mathematics
STPs	Science and Technology Parks
TPG	Traditional Pearl Growing
TTO	Technology Transfer Office
TUR	Technological Turbulence
UK	United Kingdom
US	United States

Acknowledgements

First, I would like to show my appreciation to Dr Maria Granados, Prof. Alan Pilkington, and Dr Richard Evans, for the opportunity to accept me on the doctorate programme and supervise the development of this research. My extended gratitude for their advice, guidance, and support during the development of the doctoral thesis. Your motivation and encouragement enabled me to continue developing as an academic and as a person. Your support helped me to face challenging times and to continue growing by pushing myself to the limit. I am grateful for your understanding and encouragement during the hard times that enabled me to test my will and courage on the face of uncertainty and challenges. Thank you. I am finally grateful for providing support for my research and giving guidance on how to use my attained capabilities for the greater good through academic research.

Second, I would like to thank my family for their unconditional support and encouragement during this thesis's development. Their constant conversations, guidance and support during this doctorate and through my life set the foundation for setting high expectations for myself and overcoming any difficulties in front of me no matter the odds. This doctoral degree award is dedicated to their sacrifice to support me in attaining this achievement, despite being in different countries. I could not have done it without you.

I also extend my thanks to my academic colleagues and friends who supported and encouraged me through this journey. Their support enabled me to believe in my capabilities and to continue moving forward.

Declaration

I declare that all the material contained in this thesis is my own work

Marco Antonio Cuvero Calero

Publications

Journal publications

Cuvero, M., Granados, M. L., Pilkington, A., & Evans, R. D. (2019). The Effects of Knowledge Spillovers and Accelerator Programs on the Product Innovation of High-Tech Start-Ups: A Multiple Case Study. *IEEE Transactions on Engineering Management*, 1–14.

Conference proceedings

Cuvero, M., Granados, M., Pilkington., A. Evans, R. D. (2020). Knowledge Spillovers and Entrepreneurial Ecosystems: A Multiple Case Study on High-Tech Start-ups. *The 80th Annual Meeting of The Academy of Management*.

Cuvero, M., Evans, R. D., Granados, M., & Pilkington, A. (2019). A Taxonomy of Knowledge Spillovers for High-Tech Start-ups Development. *2019 IEEE Technology & Engineering Management Conference, TEMSCON 2019*.

Cuvero, M. A., Evans, R. D., Granados, M., & Pilkington, A. (2018). A Knowledge Spillover-based Approach to New Product Conceptualization. *2018 IEEE Technology and Engineering Management Conference, TEMSCON 2018*, 1–6.

1. CHAPTER I INTRODUCTION

The Knowledge Spillover Theory of Entrepreneurship (KSTE) states how economic agents use new and uncommercialised knowledge to create new ventures. The phenomenon is initially developed from investment in research and development (R&D) from incumbents, research institutions, companies, and the government (Cantù, 2017). The KSTE has been implemented to measure the economic growth in regions from the number of start-ups founded on countries and regions (Ghio, Guerini, E E Lehmann, et al., 2015). The theory enforces on the decision from individuals becoming entrepreneurs by identifying opportunities (Acs, Audretsch and Lehmann, 2013).

The theory further emphasises how knowledge-based and technological ventures can grow at a fast rate and eventually overtake incumbents (Ghio, Guerini, E E Lehmann, et al., 2015). The process nurtures the creation of new knowledge is generated endogenously. Once the system is set into place, start-ups decide to locate near sources of knowledge such as universities, research institutions, incumbents, small and medium enterprises (SMEs), and science and technology parks (STPs) (Shu et al., 2014; Colombelli, 2016). Economics research has been transitioning into understanding the so-called 'boundary paradox', on which companies would work in alliances based on trust, and knowledge is classified and shared (Norman, 2002; Shu et al., 2014). The KSTE has strongly emphasised that knowledge spillovers are unidirectionally transferred from organisations to start-ups and SMEs, which has been questioned by recent research (Koo, 2005; Kirchhoff et al., 2007; Ferenhof et al., 2016).

KSTE also centres its development on other factors and policies that further enforce the agglomeration of companies. Most recently, research has started to consider the mechanism, institutions and interactions that start-ups hold on entrepreneurial ecosystems that support the development of policies at the country level (Audretsch, Belitski and Desai, 2015). The transference and absorption of knowledge spillovers to entrepreneurs are expected to happen automatically from incumbents or institutions (Hayter, 2013). Research on SMEs started to uncover the importance of the allocation of R&D resources to increase companies' absorptive capacity and innovation (Nieto and Quevedo, 2005). The economic characteristics of a country such as unemployment rates, R&D investment, qualified human capital, cultural diversity, creation of patents and start-ups have been able to assess countries and regions (Audretsch and Lehmann, 2005;

Audretsch, Dohse and Niebuhr, 2010). This doctoral research emphasises the importance of uncovering the step-by-step process and approach taken by companies and individuals. This research provides more insights into the events and factors that affect start-ups survival during the first ten years of operation. This study also seeks to expand research on entrepreneurship by conducting an in-depth analysis of start-ups in the high-tech sector. The doctoral research aims to cover the gap in high-tech start-ups using technological tools unbounded by geographical proximity.

1.1. Current State of the Art

Research further extended to evaluate the effects that science and technology parks had on forming alliances that could lead to additional customer, supplier, and competitors knowledge spillovers (Montoro-Sánchez et al., 2011; Shu et al., 2014). All these research used regional surveys from entities such as the Organisation for Economic Co-operation and Development (OECD), and the European Commission through the AEGIS survey (Abubakar and Mitra, 2017; Amoroso, Audretsch and Link, 2017). This research led to the foundation of identifying potential sources of knowledge spillovers. Further attempts have been made to assess knowledge spillovers in the high-tech sector quantitatively (Stejskal and Hajek, 2015; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Hájek and Stejskal, 2018). On the other hand, qualitative research conducted case studies on start-ups and evaluated the influence of knowledge and incubators (Calcagnini et al., 2016; Cantù, 2017; Sedita et al., 2017).

Research at the current stage has missed addressing the most critical points: to identify knowledge spillovers mechanisms, taxonomy, and influence of incubators and accelerators on high-tech start-ups. Moreover, universities, research institutions and companies consider high-tech start-ups critical factors for supporting the development of technological breakthroughs and innovative solutions. Thus, the future of technology requires to evaluate the growth and success of R&D research supported by investment from universities and companies (Son, Chung and Hwang, 2019). The research on entrepreneurship seeks to distinguish between start-ups and Small Medium Enterprises (SMEs) in the high-technology based on the company's initial characteristics. High-tech start-ups have proven to be an intense and growing sector that promotes innovation and economic growth (Minola, Hahn and Cassia, 2019; Gimenez-Fernandez, Sandulli.

1.2. Theoretical Background of the Research Problem

1.2.1. The foundation of the Knowledge Spillover Theory of Entrepreneurship

The knowledge spillover theory of entrepreneurship (KSTE) has consistently proven the importance that generation and use of knowledge can have on creating new ventures (Audretsch, Dohse and Niebuhr, 2010). Research has continuously suggested how companies and institutions' geographical agglomeration and proximity open entrepreneurial opportunities to exploit uncommercialised knowledge (Audretsch and Lehmann, 2010). Hence, the initial location of a start-up leads to the exposure to entrepreneurial opportunities such as access to networks, support from the government, entrepreneurial infrastructure, and access to skilled human capital

Research into the KSTE has typically based its assumptions on the expected automatic transference and absorption of knowledge spillovers by entrepreneurs (Agrawal, Cockburn and Rosell, 2010; Audretsch and Lehmann, 2010; Audretsch, Dohse and Niebuhr, 2010; Ding, Liu and Song, 2013). Thus, the most commonly discussed mechanisms include access to knowledge through academic publications, the movement of human capital, entrepreneurial employee mindsets, and constant interaction with and between customers and suppliers (Nieto and Quevedo, 2005; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Fritsch and Changoluisa, 2017). This research approach is assessed through quantitative studies on economics and manufacture, which measure the effects of Research and Development (R&D) and the exchange of knowledge between companies in similar industries sharing supply chains (Blind and Mangelsdorf, 2013; Huang et al., 2014).

However, the exchange of knowledge spillovers in the engineering sector can be limited by budget or organisational performance, and the relative use of technology in physical and virtual environments (Petruzzelli et al., 2007; Nonaka, 2008). Therefore, it is critical to learning how current settings, collaborations, and alliances enable the maturity and creation of new prototypes through the product life cycle (Laursen and Salter, 2006; Avnimelech and Schwartz, 2009; Audretsch, Sanders and Zhang, 2017).

To date, the KSTE has demonstrated how the creation of new ventures influences economic growth in regions (Audretsch, Belitski and Desai, 2015). This phenomenon is caused due to influences from universities, financial institutions, and banks, that form entrepreneurial ecosystems around start-ups (Ghio, Guerini and Rossi-Lamastra, 2019). These sources of knowledge spillovers are seen as the main drivers for economic and technological impact on new ventures (Audretsch et al., 2018). However, recent studies have viewed the influence of entrepreneurial ecosystem on entrepreneurs as dependent on their capability to absorb knowledge spillovers, visualise opportunities, and use this to enhance performance and innovation capabilities (Link and Sarala, 2019).

1.2.2. The paradox of the Knowledge Spillovers definition

Knowledge spillovers term has unequivocally been used and extended to various research disciplines on management and engineering (Nieto and Quevedo, 2005; Cantù, 2017). The effects of knowledge spillovers on the creation of start-ups are highly dependent on the type of industry, current forms of collaboration, and the background of the company's initial founders (Connell et al., 2014; Shu et al., 2014; Ritala et al., 2015). Knowledge spillovers have explained the effects of human capital mobility on knowledge theories of entrepreneurship (Frederiksen, Wennberg and Balachandran, 2016). However, the definition of entrepreneurship itself offers vast flexibility, which has been used by various disciplines to assess knowledge accumulation and the creation of new ventures (Wiklund, Wright and Zahra, 2019). Research on KSTE has been determined to evaluate networks, suppliers, customers, and the market (Grewal et al., 2011; Musteen, Datta and Butts, 2014). All these research have proven to be essential for high-tech start-ups capability to respond to the market during a period of constant technological change on international markets (Prashantham and Young, 2011; Ferreras-Méndez et al., 2015; Zobel, 2017).

The main interrogator about knowledge spillovers has been to state the types of knowledge spillovers and the mechanism used for capturing it (Audretsch and Stephan, 2006). The reason is that knowledge spillovers research has to be connected to the real practices and stakeholders that have been defining entrepreneurship in the past decades (Wiklund, Wright and Zahra, 2019). Hence, it is essential to define knowledge spillovers as a measurable construct used to assess entrepreneurship at the individual level (Audretsch and Lehmann, 2010). The literature also mentions a gap on the KSTE research that needs to address how entrepreneurial management can affect the proper engagement of innovation to address the market's needs (Tzokas et al., 2015; Spender et al.

Research on knowledge spillovers towards innovation requires considering the start-ups type of industry (Hashi, 2013; Frederiksen, Wennberg and Balachandran, 2016). Empirical research has provided insights that internal and external knowledge accumulation can be assessed by evaluating a company's absorptive capacity (Forés and Camisón, 2016). The development of the new company can lead to the expansion of the franchise to national and international markets (Grewal et al., 2011; Kostopoulos et al., 2011). This research leads to establish a quantitative foundation to evaluate start-ups capability to absorb and implement knowledge spillovers.

1.2.3. The relevance of the study

This research focuses on assessing how entrepreneurs in the early stages are influenced when located near sources of knowledge which involve universities, companies, and research institutions (Audretsch and Lehmann, 2010; Lasch et al., 2013; Korosteleva and Belitski, 2017). The initial assessment focuses on the potential influence that competition can have on innovation and survival (E. Porter, 2000; Jacobs, 2016). Hence, the start-up would seek knowledge spillovers while preventing potential knowledge leakage by using knowledge management mechanisms (Romer, 1990; Ritala et al., 2015; Ferenhof et al., 2016). Hence, assessing how start-ups strategies and managerial decisions and processes influence the performance of new ventures. The doctoral research seeks to clarify definitions and effects of knowledge spillovers on entrepreneurship (Audretsch, Kuratko and Link, 2015).

The insights will provide evidence of the potential factors that, up to this points, set start-up companies to have only a 50 to 60 per cent of survival before the seventh year (Sedita et al., 2017; Stuetzer et al., 2017). The upcoming practices of entrepreneurs and mechanisms are tested through a developed model that measures the impact of knowledge spillovers on start-ups (Agarwal et al., 2010; Audretsch and Lehmann, 2010; Cantù, 2017).

1.3. Research aim and objectives

The introduction to the Knowledge Spillover Theory of Entrepreneurship (KSTE) has clearly stated the importance of proximity on the agglomeration of start-ups to sources of knowledge. This phenomenon illustrates how countries and regions can generate economic growth through investment in research and development that makes new knowledge. The KTSE fundamental core is centred on how the entrepreneur acts as a conduit that transforms uncommercialised new knowledge into new ventures. However, start-ups creation and growth are only evaluated after the company has established a strong foundation. Thus, the core of knowledge spillovers evaluation relies on indicators such as growth per capita, employment, R&D investment, knowledge from the number of graduates employed on start-ups, new ventures and patents created.

The doctoral thesis seeks to understand how and when knowledge spillovers affect start-ups development during the first ten years of operation. This project initially uses the entrepreneur's attendance to incubators and accelerators to identify high-tech start-ups that have formally founded the company, and that is currently under operation. The research expands on the definition and effects of knowledge spillovers at the individual level. The study would further seek to empirically develop a KSTE model for high-tech start-ups, developed in the discussion chapter that guides how knowledge spillovers are absorbed and used to enhance new ventures performance and survival.

Based on these points, the research aim of the research is:

> To analyse the effects of knowledge spillovers on high-tech start-ups, and to identify the mechanisms and technologies used in by entrepreneurs to implement knowledge that supports start-ups performance and survival, by developing a model that is validated and tested to evaluate start-ups capabilities and entrepreneurial decisions during the first ten years of operation.

The research aims to understand the nature of knowledge spillovers in the context of start-ups that attended an incubation or accelerator programme process and the exploration of the mechanisms that enable knowledge spillovers absorption at the individual level. The aim shreds the initial research limitations of KSTE research stating how knowledge spillovers are challenging to measure from just patents and investment through research and development. It leaves untraceable documents and involves transforming from tacit to explicit knowledge (Audretsch and Stephan, 2000a). The research seeks to uncover the actual mechanisms that start-ups use in the early stages to capture knowledge spillovers and evaluate its effects (Audretsch and Lehmann, 2005). The research objectives of the doctoral thesis are:

- **To explore the nature and effects of knowledge spillovers on high-tech start-ups that have attended incubators and accelerator programmes in Greater London.**
- **To empirically inform the development of a qualitative and quantitative model that defines the mechanisms and processes that high-tech start-ups undertake to use and implement knowledge spillovers during the first years of operation.**
- **To quantitatively validate a novel knowledge spillovers model that formally incorporates knowledge spillover constructs and evaluates start-ups performance.**
- **To clearly define a taxonomy of knowledge spillovers in the model that highlights the effects on start-ups, and the mechanisms used to transform entrepreneurial opportunities into the development of products or services and the incorporation of technologies.**

The objectives of the doctoral thesis are supported by the initial research statements based on the current state of the art theory that provided a guide to the research:

The Creation and Establishment of the Company

- Tacit Knowledge Spillovers gathered from industry and academia facilitate start-ups identifying an entrepreneurial opportunity that supports the business idea, performance and engagement towards innovation (Nielsen, 2015).
- Highly educated individuals are more prompt to recognise knowledge spillovers than entrepreneurs who do not hold an academic degree (Korosteleva and Belitski, 2017).

- The number of full-time employees in a start-up increases high-tech start-ups' performance (Rothaermel and Thursby, 2005; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Tufool and Gerard, 2016).
- The incubators and accelerator programme's location facilitate the identification and absorption of knowledge spillovers from universities, incumbents, and research organisations (Rothaermel and Thursby, 2005; Audretsch and Keilbach, 2007b; Cantù, 2017)
- The incubator and accelerator events facilitate the flow of knowledge spillovers and resources with third-party organisations and entrepreneurs (Nonaka, Toyama and Konno, 2000; Assenza, 2015; Bandera, Bartolacci and Passerini, 2016; Cantù, 2017; Eveleens, van Rijnsoever and Niesten, 2017; Nair et al., 2017).
- Incubators and accelerator programmes improve knowledge spillovers absorption and start-up's absorptive capacity (Clarysse et al., 2005; Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016).
- The incubator and accelerators geographical location to urban cities facilitate the identification and absorption of knowledge spillovers from universities, incumbents (Rothaermel and Thursby, 2005; Audretsch and Keilbach, 2007a; Cantù, 2017)

Establishment and Development of the Company

- Investment in research and development enables the capture and implementation of knowledge spillovers (Markovitch, O'Connor, & Harper, 2015).
- Start-ups seek to develop and use patents at the end of the first ten years of operation, and during the company's development (Qian & Jung, 2017).
- Human capital's cultural diversity and background working on high-tech start-ups facilitate product innovation (D. Audretsch et al., 2010; D Audretsch & Keilbach, 2008; Hardy & Rodriguez-Ponse, 2014; Zobel, 2017).

Scaling up and the Future of the Company

- Start-up's location in urban cities enables access to diverse types of knowledge spillovers (David B Audretsch, Belitski et al., 2015; Hardy & Rodriguez-Pose, 2014; Kirchhoff et al., 2007)
- Competition disrupts the flow of knowledge spillovers between start-ups, incumbents, and research institutions (David B. Audretsch et al., 2002; Ghio,

Guerini, Lehmann, & Rossi-Lamastra, 2015; Tothaermel & Thursby, 2005; Shu et al., 2014; Tsvetkova, Thill, & Strumsky, 2014).

- The location of start-ups in urban cities enhances the survival and growth companies (Renski, 2017; Tsvetkova et al., 2014)

The research aim and objectives of the research sought to uncover knowledge spillovers' effects on high-tech start-ups. For that matter, the development of an initial conceptual model identifies a set of overarching dimensions, first-order categories and second-order themes that enunciates start-ups processes through propositions (Audretsch and Lehmann, 2005; Curry, Nembhard and Bradley, 2009).

The ideal research methodology for this project justifies using a sequential exploratory mixed methods design. The use of a multimethod approach enables the researcher to provide qualitative and quantitative strands (Laborda, Guasch and Sotelsek, 2011; Venkatesh and Brown, 2013). The qualitative phase consists of using a multiple case study approach that uses incubators and accelerators as a context to gather data from founded high-tech start-ups. The researcher collected primary data from entrepreneurs operating in Greater London using a semi-structured interview guide. The insights and findings enabled identifying an initial propose set of knowledge spillover types, mechanisms used by entrepreneurs to gather knowledge, and the managerial decisions to remain competitive in the market.

A second quantitative phase developed from the qualitative insights supports the identification of constructs that statistically test the proposed conceptual model. Structured equation modelling (SEM) using factor analysis is recommended by collecting surveys from founders and co-founders of high-tech start-ups that founded the United Kingdom company. The quantitative analysis enables to empirically tests the generalise the application and validity of the model (Tashakkori and Teddlie, 2003). The established control variables enable to statistically distinguish the difference between types of companies based by industry, the background of the entrepreneurs and academic qualifications, human capital, diversity, and the effects of incubator and accelerator programmes.

The doctoral study seeks to formalise knowledge spillovers' evaluation through the definitions of constructs that evaluate sources of knowledge (Cassiman and Veugelers, 2002; Belderbos et al., 2004; Amoroso, Audretsch and Link, 2017). From one point, companies and institutions that at some end are connected to the chain of value of the new venture (Kaiser, 2002; Lhuillery, 2011; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Research has identified sources of explicit knowledge, such as academic publications and technical reports accessible to entrepreneurs (Sisodiya, Johnson and Grégoire, 2013; Stejskal and Hajek, 2015). The research evaluates if attendance to incubator or accelerator programmes does enable knowledge spillovers identification and use towards innovation (Rothaermel and Thursby, 2005; Squicciarini, 2009; Mrkajic, 2017). The assessment of the knowledge spillovers is conducted at the individual level of entrepreneurs. The model evaluation applies for companies on the high-tech, Knowledge Business intensive high-technology services (KIBS), and knowledge-intensive market services sectors (European Commision, 2008; Timmermans, 2009; Ii et al., 2014).

The research provides empirical evidence that supports the proposed framework that offers several contributions to the knowledge spillovers literature. The study bases the capture of knowledge spillovers through start-up's absorptive capacity and perception towards technological change (Nieto and Quevedo, 2005; Ferreras-Méndez et al., 2015; Limaj and Bernroider, 2017). The final evaluation of companies' performance is assessed through the capability to engage in product innovation (Enkel et al., 2017; Su and Yang, 2018). The findings proved that knowledge spillovers could only be beneficial during the stages of knowledge acquisition and assimilation (Flor, Cooper and Oltra, 2018). The process can be enhanced by attendance to incubator and accelerator programmes.

Evidence suggests that product diversification and technological turbulence can be influencers that enhance exploratory innovation (Zobel, 2017). Moreover, the processes of research and development carried out by project teams in the company enables knowledge spillovers to be transformed and exploited towards exploratory and exploitative product innovation.

1.4. Outline of the Doctoral Thesis

The thesis's development builds up from KSTE research that has provided insights on indicators at the regional level used to assess entrepreneurial activity in a region (Nieto and Quevedo, 2005; Nielsen, 2015; Hervas-Oliver, Lleo and Cervello, 2017). An evaluation of the company's characteristics and the entrepreneur to provide insights on how entrepreneurs use knowledge spillovers depending on the founder's background and experience to identify the business idea (Wennberg, Wiklund and Wright, 2011; Tsvetkova, Thill and Strumsky, 2014).

1.4.1. Chapter 1 - Introduction

The Knowledge Spillover Theory of Entrepreneurship (KSTE) background and main implications are enunciated in this section. An initial formal definition of the term knowledge spillovers is established, followed by evaluating its impact on the number of start-ups that are created and the country and regional level. The initial insights of the theory further emphasise the entrepreneur's importance as an economic agent that enables economic growth. The description emphasises how the KSTE considers geographical proximity to sources of knowledge as an indispensable requirement for collaboration and successful use of knowledge spillovers. The initial discussion mentions the role that incubators and accelerators, as well as the influence of the entrepreneur's background on the creation of the new venture. The chapter further highlights the gaps and contributions to knowledge that the research provides on assessing entrepreneurs at the individual level. The research problem is linked to the objectives and questions addressed on the development of the doctoral thesis.

1.4.2. Chapter 2 - Literature Review

The section starts with the state-of-the-art research conducted in the field of KSTE and entrepreneurship. The discussion of previous research leads a systematic literature review by following a review protocol that guides the literature's initial assessment based on the central questions of the thesis, objectives, and inclusion criteria. An initial quality appraisal enabled to identify the most influential authors in the field. The section continues by conducting a discussion of previous research based on academic papers. A second literature review approach enabled to expand the research from studies conducted at the regional level, to in-depth case studies of start-ups, and quantitative research using factor analysis which further evaluated the effects of knowledge on new ventures. The literature review's objective was to state the themes, concepts, construct, and variables used to guide the development of the model.

1.4.3. Chapter 3 – Conceptual Model

The conceptual model chapter centres all these efforts on developing initial themes and concepts used to provide support for the data collection and analysis of case studies on the qualitative phase. At this stage, the main objective was to develop a theoretical and sound conceptual model that informs the development of an interview guide. The literature review's main theories and concepts were used to identify a set of events and mechanisms to absorb the knowledge that determined entrepreneurial performance during the first ten years of operation. The qualitative analysis of the literature included the coding and development of memos using NVivo 12. The review of the literature uncovered how entrepreneurs perceive knowledge spillovers from the founders.

The chapter defines the measurements of the constructs, and the control variables used for the quantitative phase. The section establishes the potential and realised absorptive capacity constructs. The first-order constructs of exploratory innovation, exploitative innovation, and technological turbulence, as well as the control variables, evaluate the characteristics of the start-ups and the background of the entrepreneurs.

1.4.4. Chapter 4 – Research Methodology

This chapter aimed to justify the adequate research methodology for assessing the knowledge spillovers effects on high-tech start-ups. The research follows the pragmatic philosophical overview. The research approach facilitated the implementation of the most adequate qualitative and quantitative research methodologies. The research proposal based on the KSTE discussed to support the use of a sequential exploratory design. The study's proposed research design concludes with establishing an initial equal weight and adjusting the research methodologies and the data collection procedures.

The qualitative research informs the reader about the context taken for the development of single case studies. The sample was chosen as non-probabilistic based on the collection interviews through face to face, telephone and skype meetings. The unit of analysis determined was the founders of the high-tech start-ups, which compares entrepreneurial approaches between groups of companies. The entrepreneurs were involved with an incubator or accelerator programme held on a physical location in Greater London. The research methodology justifies the use of structural equation modelling using exploratory and confirmatory factor analysis and partial least squares to test the model's hypotheses. The data collection type for quantitative data was using online surveys.

1.4.5. Chapter 5 – Qualitative Analysis

The qualitative analysis chapter started with the deductive conceptual model that streamed the founder's initial alliances with universities and the industry. The analysis considers the start-ups initial human capital, characteristics and locations. Furthermore, the discussion identifies potential mechanisms used by entrepreneurs to absorb knowledge spillovers through start-ups absorptive capacity, the innovative approaches to develop products, the influence of accelerators and incubators services on the companies, and the entrepreneurs' goals. The qualitative analysis conducted case studies from a sample of 32 founders of start-ups that at some point, attended an incubator or accelerator programme in Greater London. The researcher conducted a first qualitative analysis identified overarching dimensions, first-order categories and second-order themes. The interviews were transcribed, coded and analysed using NVivo 12. The themes highlighted the main events, knowledge mechanisms, tools, and stakeholders that enabled start-ups performance.

A second qualitative analysis synthesised the most relevant findings into a qualitative model and propositions that informed the quantitative phase's selection of adequate constructs. The main results suggested the necessity to assess knowledge spillovers' effects depending on the start-up's type of industry. The main findings indicate the importance of developing alliances and collaborations with companies, research institutions, suppliers, and customers. The data also illustrates, depending on the company, how entrepreneurs would hire human capital to implement Information Technologies (IT) and Information and Communication Technologies (ICTs). The data stipulated that start-ups in the seed and growth stages would prioritise developing a product to enter the market and gain funding from investors.

1.4.6. Chapter 6 – Quantitative Analysis

The quantitative analysis chapter conducted a structural equation modelling using factor analysis to generalise the qualitative phase findings. The chapter begins taking reference on the second literature review do identify the most suitable constructs to measure knowledge spillovers absorption and use towards product innovation. The propositions led to the development of the initial quantitative model using the second-order constructs of potential and realised absorptive capacity and the first-order constructs of exploratory and exploitative innovation. The contribution to the KSTE for high-tech start-ups is the formal inclusion of the incoming and network knowledge spillovers formative constructs that evaluate the importance of sources of knowledge. The company's characteristics, type of industry, the founder's experience, the influence of incubators and accelerator programmes, and external factors are analysed through control variables.

The analysis was conducted from 594 valid surveys gathered from emails using the virtual platform JISC. The initial model proved a positive direct effect of knowledge spillovers during the acquisition and assimilation of knowledge. The model confirmed that entrepreneurs are focused on engaging in product innovation. The quantitative analysis findings highlight the statistical significance of the founder's academic qualifications, the contribution of incubator that accelerator programmes, and the constant technological change in the current industry. The statistical evidence suggests that the type of industry, technological turbulence, number of employees, diversification of products and services are factors that affect high-tech start-ups engagement on exploratory and exploitative innovation.

1.4.7. Chapter 7 - Discussion

This in-depth discussion of the qualitative and quantitative analysis is dedicated to critically discussing the findings and connecting the insights and statistical evidence. The chapter initially divides the insights into three main phases that highlight: 1) The creation and establishment of the company, 2) Establishment and Development and 3) Scaling up and Future of the company. The chapter includes data analysis and discussion of the qualitative and quantitative data to define a clear definition of a knowledge spillovers taxonomy and mechanisms used by entrepreneurs to obtain information and engage in product innovation.

The discussion leads to developing a final framework and propositions that support and generalise the findings and state the potential implications for high-tech entrepreneur founders. The section provides accurate statements and update of the propositions for the final knowledge spillovers effects on high-tech start-ups framework. The chapter concludes by enunciating the step by step process of the entrepreneurial journey and highlights the differences in applying the model based on the type of high-tech start-ups. The chapter ends with defining two base models that explain the effects of knowledge spillovers on start-ups based on high-technology and medium-high technology and knowledge-intensive start-ups.

1.4.8. Chapter 8 – Conclusions

This final chapter provides the closing remarks and recommendations for researchers on the implications and main insights of The Effects of Knowledge Spillovers, incubators and accelerator programmes on the Product Innovation of High-Tech Start-up's model (EKS-PI). The section states how the main objectives were achieved during the development of the doctoral thesis. The thesis's conclusions include a critical discussion of the enunciated research aims regarding the knowledge spillovers and innovation assessment, the characteristics of the company, the effects that incubators and accelerators on alliances, and the processes required to use knowledge spillovers to support start-up's product innovation and survival. The chapter ends by enunciating the limitations and future recommendations that researchers should consider to extend the research of knowledge spillovers and entrepreneurial domain. The thesis closes with advice to provide insights on how to implement qualitative and quantitative research accurately and use the proposed model to evaluate entrepreneurs at the individual level.

2. CHAPTER II LITERATURE REVIEW

2.1. Introduction

Chapter II describes the literature review conducted to select relevant literature linked to the KTSE and the objectives of the thesis. The papers, scope, and assessment of the academic articles and sources related to the research. The literature review offers a second review more directed to evaluate knowledge spillovers at the individual level of entrepreneurs and identify mechanisms and procedures undertaken by start-ups. The discussion includes potential implications for entrepreneurs' operations on entrepreneurial ecosystems, and strategical approaches are considered for engaging in innovation.

2.2. Literature Review Methodology

Bryman and Bell (2015) mention that the development of a literature review allows the development of arguments based on the clarity of the goal and the processes required to answer the established research question. An adequate literature review should discuss the project's statement while combining different theoretical ideas to expand the exploration and summarise previous studies (Blumberg, Cooper and Schindler, 2014). Its development can take on two main approaches: traditional literature review and systematic review. The narrative literature review guided the discussion of previous research, which may cause one-sided arguments or the development of biased statements (Jesson, Matherson and Lancey, 2011). On the other hand, a systematic review allows allocating different sources for synthesising and reporting while reducing bias (Buchanan and Bryman, 2009). The difference between a systematic and narrative approach is using scientific methods for reducing errors or bias during the collection of the literature review (Cook, Mulrow and Haynes, 1997).

The literature search had to start based upon the initial question, which was the evaluation of the effects of Knowledge Spillover on start-ups. The approach allowed the researcher to lead to the identification of the variables "Knowledge Spillover" as an intervention, "Lean-start up" as a mechanism, "new enterprises" as context, and "business value" as the outcome (Bryman and Bell, 2015). The researcher used an initial scoping review for identifying the fields involved in the study (Booth, Diana and Sutton, 2012); led to the identification of areas such as entrepreneurship and business management. The use of systematic review methodology used initially by the medical sciences can be applied for management research for increasing the legitimacy and authority of the evidence provided by research informs the development of policies established in the United Kingdom (UK) (Tranfield, Denyer and Smart, 2003). Similarly, studies conducted in entrepreneurial intentions tend to start anew without robustness and require to perform a systematic literature review approach to provide order and contribute to the creation of knowledge (Liñán and Fayolle, 2015).

The author decided to adopt systematic literature following the conceptualised research process proposed by Valentine, Hedges, and Cooper (2009). It is important to note that the step by step approach is covered by many with considerable similarities. The details of the systematic literature review are illustrated in table 2.1. The definition of the scope and quality assessment of the journal articles are detailed in Appendix A.

Table 2.1 - Adapted Systematic Literature Review Methodology (Okoli and Schabram, 2010; Booth, Diana and Sutton, 2012; Blumberg, Cooper and Schindler, 2014; Collis and Hussey, 2014; Bryman and Bell, 2015; Thomé, Scavarda and Scavarda, 2016).

Stage 1: Planning and initial definition of the problem.	Scope of the study identification.
	Review of the proposal
	Development of literature review protocol
Stage 2: Search process and the start of systematic literature review	Identification of Journals and selection of databases.
	Selection of keywords and search terms.
Stage 3: Appraisal and quality assessment of the data.	A search of sources and recording of relevant information of the literature.
	Review of abstracts, selection and evaluation of the content.
	Full review of the text and follow up of references.
Stage 4: Synthesis and interpretation of the data.	Data collection for the analysis.
	Extraction of the data from the literature review.
	Coding of leading theories, concepts, and relevant information from the literature and quality assessment.
Stage 5: Analysis and Reporting of the data.	Compilation and analysis of the data relevant to the doctoral research

2.3. Literature Review

2.3.1. Knowledge Spillovers foundation

2.3.1.1. Knowledge Spillovers Overview

The KSTE has unravelled how knowledge is generated from incumbents and universities' investment in research and technology (R&D) and public research organisations. The new knowledge is not always commercialised or appropriated and are a source of entrepreneurial opportunities (Audretsch and Lehmann, 2010; Audretsch, Dohse and Niebuhr, 2010). New knowledge increases the possibilities for economic agents to commercialise it into the market by creating a start-up. However, the evaluation of knowledge spillovers can be different, as it is asymmetric and depends and varies from case to case (Audretsch and Lehmann, 2010).

The access to this knowledge spillovers has been empirically proven to be bounded to the proximity to the sources of knowledge by showing how universities' generation of knowledge in regions with higher absorptive capacity can influence start-ups founding (Audretsch and Lehmann, 2010; Korosteleva and Belitski, 2017). One of the base research of the KSTE, backed up by the department of commerce in the United States, showed that employment changed new companies' performance with human capital with less than twenty employees and had a higher rate of employment (Audretsch, 2002). However, the impact of start-ups that transcend in small and medium-sized enterprises (SMEs) depends on their operational capacity.

The creation of new firms was analysed on modifying the knowledge production function, which enabled to correlate research and development (R&D) spending as a measure of innovation on the small and big firms. However, the research did not show statistical evidence for medium firms (Audretsch and Vivarelli, 1996; Abubakar and Mitra, 2017); this idea tranced to its replacement by university geographical proximity spillovers in Silicon Valley (Woodward, Figueiredo and Guimarães, 2006). In the case of university spillovers research, some knowledge mechanisms were introduced, such as students' mobility that graduate and start their new carrier on companies. However, knowledge in the form of publications and academic papers can be acquired through the internet, eliminating the need to stay close to the source of knowledge (Audretsch and Lehmann, 2010).

There are cases that the access to knowledge from outside the boundaries of an incumbent is not free of charge. It would only be possible to be absorbed if endogenous knowledge generated by the company allows entrepreneurs to understand and assimilate it (Nicolopoulou et al., 2016). However, a research case study in Spain illustrated how absorptive capacity on manufacturing industries requires a distinction on how knowledge spillovers could enhance technological knowledge, in which imitation of the product would not be possible, as other companies cannot implement it (Nieto and Quevedo, 2005). Moreover, it could be stated how absorptive capacity did not significantly impact innovation through knowledge spillovers (Nieto and Quevedo, 2005).

Companies tend to cluster in regions where universities conduct high research on technological innovations and science and technology parks. These directions cause companies from different industries such as public, manufactory, and knowledge-based services, enhancing competition and economic growth (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). The improvement of economic growth from knowledge spillovers is dependent on the density of the population in the region. In a sense, urban areas with a high population bring up more competition and knowledge flow, promoting development (Audretsch, Belitski and Desai, 2015).

The selection of the new firm's location by entrepreneurs is influenced by the market size and access to recourses from suppliers (Montoro-Sánchez et al., 2011). In the case of high tech companies, the advantages to be located in big cities would allow the company to have access to human capital and to present products to potential investors, and, be close to the users, and be able to precept knowledge for enhancing the products continuously (Narula and Santangelo, 2009; Renski, 2014, 2017). In manufacturing companies, it would be mandatory to be closer to suppliers and the recourses required to produce the products through the manufacturing process (Nieto and Quevedo, 2005; Amoroso, Audretsch and Link, 2017).

However, it is essential to note that a company's location will depend on evaluating the costs of transporting goods to the supplier and delivering the final product to the client (Ellison, Glaeser and Kerr, 2010). For example, the longitudinal study on twenty years in the United States on local conditions and entrepreneurship in terms of the spatial distribution showed that 75.9% of start-ups initiated with a maximum of five employees (Glaeser and Kerr, 2009). However, companies in the manufacturing such as the automobile and tobacco industries, turn their attention towards expansions, while high tech firms agglomerated in Silicon Valley (Acs, Audretsch and Lehmann, 2009; Glaeser and Kerr, 2009).

2.3.1.2. Technological Knowledge Spillovers and the interactions between industries

Companies engage in R&D activities to enhance the innovation process. Start-up's events are analysed through variables such as R&D budget variables, or the hours set to engage in such activities. Among the distinction, knowledge spillovers can be measured based on the levels of regions, countries, or established companies (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

R&D engagement measured through the generation of innovations and patents produced in the manufacturing industry, known as the Yale matrix; however, the transition of technological knowledge spillovers is lost when the knowledge transcends to services (Verspagen, 1997). It can also prove challenging to measure how the patents produced by an incumbent have links with other sectors (Verspagen, 1997). This research leads the foundation of assessing the combination of the employees' culture and synergistic knowledge, as the creation of new products and services.

The relation to the depth of knowledge is assessed with the Standard Industrial Classification (SIC), which links the classification products and homogeneous processes (Desrochers, 2001). Researchers found a correlation between the level two and level three-digit codes to assess knowledge spillovers, and the proximity between institutions (Woodward, Figueiredo and Guimarães, 2006; Ellison, Glaeser and Kerr, 2010; Greenstone, Hornbeck and Moretti, 2010; Helmers and Rogers, 2010).

In the case of high technology sectors, a company's location on counties in the United States depends on the costs of the land and taxes implemented. Still, it has not consistently proven the impact of R&D on universities (Woodward, Figueiredo and Guimarães, 2006). The simulation showed that an investment of one million US dollars had a marginal impact of less than one per cent on electronics, transporting equipment, industrial machinery, equipment, and chemicals (Woodward, Figueiredo and Guimarães, 2006). These findings suggest that companies may be obtaining more results based on case studies from universities (Woodward, Figueiredo and Guimarães, 2006).

The effects on technical knowledge spillovers are assessed through time-based changes on the total factor productivity in counties of US (TFP) (Greenstone, Hornbeck and Moretti, 2010; Greenstone et al., 2016). The location of a new plant has to consider many other factors aside from transporting goods, as the effects of agglomeration on firms influenced by the incentives of local governments offer incumbents or start-ups (Greenstone, Hornbeck and Moretti, 2010; Hervas-Oliver, Lleo and Cervello, 2017).

Technological knowledge spillovers are evaluated based on the statement that the impact on the processes in the incumbent is higher with external R&D in the sector (Verspagen, 1997). In the case of opening of Million Dollar Plants (MDP), manufactory incumbents increased their production rates in five years; caused by workers' mobility between companies that shared synergistic knowledge (Greenstone, Hornbeck and Moretti, 2010).

The phenomenon can also be replicated the other way around since manufacturing companies can face survival problems if the information is not managed correctly. The subsistence of a new firm depends on how innovative the market is., and the rates of unemployment in the country (Helmers and Rogers, 2010). The analysis conducted in the UK using the Oxford firm-level database IP (OFLIP) between 2001 and 2005 led to finding out that exit rates were reduced based on nullifying taxes for companies that had an income of ten thousand pounds (Helmers and Rogers, 2010). The analysis concluded that companies with an active intellectual property of companies, with a three-level SIC number, had a higher survival rate. Simultaneously, the increase in housing and employment cost negatively affects survival (Helmers and Rogers, 2010).

Start-ups operations can lead to companies' importance to have an innovation value chain model, especially in new technology-based firms (NTBFs), where the knowledge is transformed through the supply chain to create new products and improved processes (Ganotakis and Love, 2012). Overall, technology spillovers can be exploited depending on the company's location, the economic situation, the level of complexity of the knowledge, and the companies' adequate exposure to synergistic knowledge from different sources. Nonetheless, the effects of knowledge spillovers in each one on the stages continue to be difficult to assess (Hájek and Stejskal, 2016).

The measure of knowledge spillovers from technologies has continued to be elusive from its complexity. The similarity in types of industries such as leather, food or textiles, is challenging to assess. The interactions of knowledge generated by R&D are not be compiled since the data is collected from the business-unit level (Zvi Griliches, 1992). It is also difficult to ascertain how the SIC levels deal entirely on the process, as the technological knowledge spillovers may happen based on established relationships between companies (Verspagen, 1997). The problem can go even beyond when the interchange of ideas between workers is better when the companies located on a cluster, making it harder to measure knowledge spillovers at the individual level between workers (Ellison, Glaeser and Kerr, 2010).

2.3.1.3. Mechanisms of Knowledge Spillovers

The mechanisms used to obtain knowledge spillovers can vary on the form and the source. The absorption of knowledge depends on how a firm interacts between departments and can transform and use the knowledge generated outside of the firm (Nieto and Quevedo, 2005). The link to connect the further application of new information is absorptive capacity. Knowledge can be presented in different forms and can be different depending on the source it was created. One example is academia, where the firm can absorb knowledge spillovers through the collection of academic though published research obtained at a low cost as codified knowledge (Audretsch and Lehmann, 2005). Knowledge spillovers are presented as the number of graduates that enter the firms.

This mobility of human capital depends on the spatial proximity between the firms and universities and the type of knowledge generated in the research area. Furthermore, knowledge spillovers can occur when academics decide to start a new firm. Academics with a PhD degree can attempt to extend research; however, identifying the opportunities and its value has to surpass the benefits of a secure position and reputation attained by following an academic career (Nielsen, 2015). This observed process has high importance to the development of countries and nations. One example is the European Commission's initiatives, which has promoted the transference of technology and knowledge from the university to the industry through the Bayh-Dole Act, while fostering the implementation of patents on technological innovations (Rothaermel, Agung and Jiang, 2007).

It is essential to distinguish between knowledge transfer and knowledge spillovers to identify the mechanisms between each other. For instance, to evaluate how firms establish methods to access knowledge within the company and other organisations. The process goes through a dynamic process in innovation and is taken in place by interacting with customers, clients and competitors (Connell et al., 2014).

The process of knowledge transfer boost performance, as it reduces time on transactions, and enhances the quality of knowledge shared among organisations (Connell et al., 2014). Thus, the KSTE highlights the entrepreneur who works for a company that identifies commercialised knowledge and decides to penetrate the knowledge filter by creating a new company (Acs et al., 2005). Knowledge spillover stated as an overflow of knowledge unintentionally leaked by members outside the strategic alliance of organisations and absorbed by third party members (Ferenhof et al., 2016).

2.3.1.4. Absorptive capacity concerning companies

The new knowledge that is created endogenously by companies influences the economic growth in regions and countries. The relationship with these variables depends on how new knowledge is used to enhance the internal processes and how it affects economic growth (Qian and Jung, 2017). The effect on the industry in an increase in the absorption of technological knowledge. Absorptive capacity is of interest to entrepreneurship, enhancing its capability to absorb exogenous knowledge and transform it into the creation of new products and services through innovation (Qian and Jung, 2017). However, the process is not complete if the new firm members don't have the required base knowledge to absorb knowledge spillovers (Ferenhof et al., 2016).

The process of innovations on start-ups would be counter-productive if knowledge management implemented in the company. It has been discussed as the dynamic process to generate and share knowledge using knowledge management systems. It lacks the flexibility to adapt to the market needs (Nonaka and Takeuchi, 1995; Nonaka, Toyama and Konno, 2000; Bandera, Bartolacci and Passerini, 2016).

The illustration on figure 2.2. provides an overview of the processes undertaken by companies to absorb and implement knowledge.

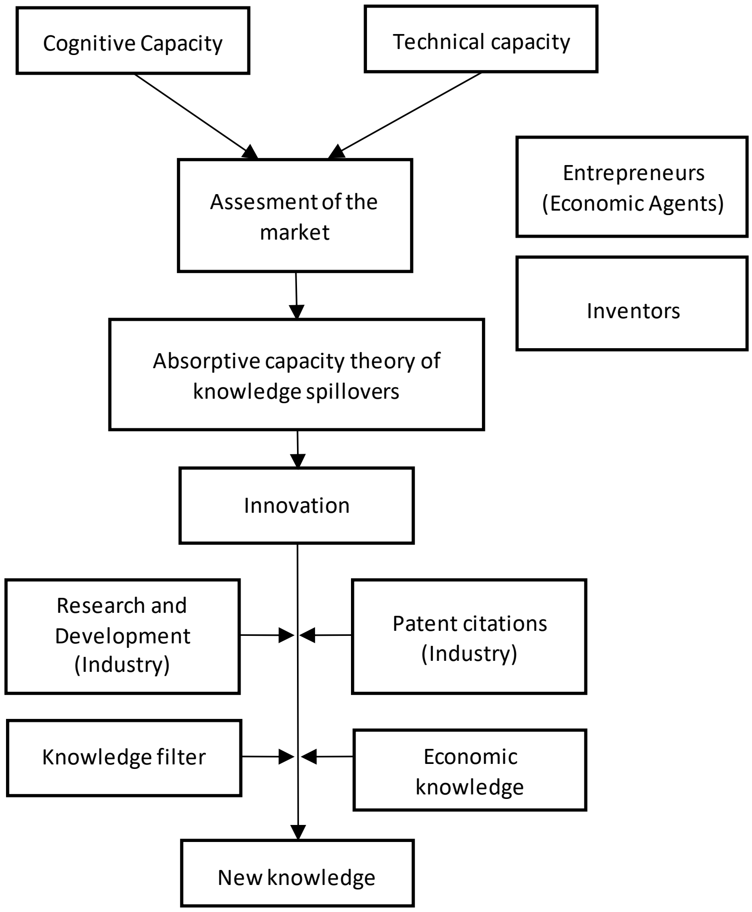


Figure 2.1 -Knowledge spillovers and Absorptive capacity general overview.

Absorptive capacity in the new growth theory is imperial. It mentions how new knowledge is transformed into commercial knowledge to generate growth in the region and penetrate the knowledge filter. However, the theory does not explain the mechanisms that enable the process (Qian and Jung, 2017). From the regional perspective, the mechanisms studied from the local or country perspective from indicators such as the number of companies created, growth per capita, unemployment, and students. This analysis assumes that knowledge spillovers happen when universities employ graduates, or when companies download academic research and apply it to the company (Audretsch and Lehmann, 2005). A case study in Germany highlighted that new companies locate close to universities, regardless of their reputation (Audretsch, Lehmann and Warning, 2005).

Knowledge is different between industries; the effect of knowledge spillovers increased in high tech and knowledge-based companies. The effects of knowledge spillovers are also affected by the country's regional innovation, and the policies set to enable research between academia and companies enabled knowledge spillovers (Audretsch and Lehmann, 2005).

From the industrial perspective, the studies conducted on knowledge spillovers focus their attention on how the agglomeration theory applies on how companies get closer on collaboration to conduct studies, especially in Science and Technology Parks (STP). By definition, science and technology parks are managed by professionals focused on increasing wealth in the region. The benefits of STPs and companies in them are bounded by space for knowledge absorption, core business, and required managerial function (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Although STPs have proven the evidence on economic growth and development in regions about R&D, proof of the effects on knowledge spillovers remains elusive on the mechanisms on how the knowledge flow occurs and continues to be tested (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

The flow of knowledge spillovers stated on the KSTE aligns with the generation of new knowledge to generate innovation to improve products and processes (Acs, Audretsch and Lehmann, 2009). The variables conducted to measure its effects are quite similar to the regional levels, such as expenditure in R&D, and the increase on innovation on processes, products, and services (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Among the input, the sources on knowledge spillovers had been identified based on the types of knowledge spillovers that are generated and can be absorbed by the companies such as competitor spillovers, customer spillovers, supplier spillovers, institutional Spillovers, and public Spillovers (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

The study conducted in Spain by Montoro-Sánchez et al., (2011) used data from the Technological innovation Panel from the Stanish Bureau of Statistics, which supports that knowledge spillovers enhance innovation on companies in STP, especially on the development of new products. The process of knowledge spillovers is linked to the chain value. The transformation from tacit knowledge to explicit knowledge occurs through the interaction of individuals in the chain value. The process is more noticeable on open knowledge clusters, where intermediaries can operate outside the companies boundaries acting as knowledge brokers, or workers that act as gatekeepers, embedded in the companies boundaries (Yang, Chen and Shyu, 2008).

2.3.1.5. Economic Agents and Appropriability

In KSTE, the catalyst for implementing knowledge spillovers is economic agents, which are responsible for identifying opportunities from knowledge generated from R & D's investment of R&D (Audretsch, Dohse and Niebuhr, 2010). Thus, research has expanded towards analysing the economic agents on start-ups, and its effects on diversity. The study conducted in Germany showed that the variety of industrial sectors negatively affects the creation of start-ups, while the diversity of culture and R&D has a positive impact on the creation of new business (Audretsch, Dohse and Niebuhr, 2010; Cheng and Li, 2012). Research conducted in the United Kingdom proves that the technical expertise and diversity of culture coming from immigrants led to more knowledge-based start-ups (Rodríguez-Pose and Hardy, 2015).

The individuals who possess endowments of knowledge can be part of an organisation, individuals, or in the processes taken in place to absorb knowledge (Hayter, 2013). The transition of an economic agent to start a new company and its performance may influence the funders' personal experience and motivations (Vivarelli, 2004). Research conducted in the United States highlighted that knowledge spillovers are accessible in cities from multiple sectors (Audretsch, 2002). The trend was observed in Germany, as the density of the population enables economic agents to generate more entrepreneurial opportunities, as knowledge flows occur faster, as are absorbed even from neighbour regions (Audretsch and Keilbach, 2007a).

The KSTE addresses economic agents that take advantage of knowledge spillovers and incubators, as high impact entrepreneurs (Acs, Audretsch and Lehmann, 2013). For instance, knowledge spillovers enable competitive advantage due to reduced costs for acquiring the knowledge necessary to generate a revolutionary product. The security measures set to prevent appropriability from making this type of knowledge more desirable for entrepreneurs, as there are no costs involved in transmitting knowledge (Arrow, 1972). Therefore, companies that operate in the market where knowledge is hard to appropriate influence accessible public knowledge from reports or patents (Nieto and Quevedo, 2005).

This situation affects the decision of the inventor to decide to create a start-up. Scientists in the biotechnology sector start their careers by earning a reputation that facilitates investment from academia. Afterwards, the entrepreneurs have to choose to start a company or maintaining a secure career in academia (Audretsch and Stephan, 1999).

2.3.1.6. Innovation and entrepreneurial environments

Current studies have extended on assessing academics and the success rate of new firms based on the funders' level of education and based on income and assets obtained. First, it has proven that an individual with a technical background can perform well in uncertain and profitable businesses. In contrast, academics from a business background only performed well on business to obtain profit (Nielsen, 2015).

The same behaviour has been evidenced as well on the number of innovations from entrepreneurial employees from 25 countries, including the ones in the OECD, from the Total Entrepreneurial Activity (TEA) rate, and the Entrepreneurial employee activity (EEA) (Stam, 2013). The study suggested that incumbents' staff can exploit knowledge from the incumbent and reduce opportunities from independent entrepreneurs (Stam, 2013).

Research studies conducted on networking and innovation on the mobile game and music industry emphasised the importance of validating the business idea (Castro Soeiro et al., 2016). In the case of technology and incubators on universities, the research evaluated how knowledge flows would enable and increase the incubator's performance based on backwards patent citation from universities. The study suggests that absorptive capacity is a concept that cannot be observed directly. However, it argues that no other indicators used to measure absorptive capacity, as the assumption presented, cannot be estimated directly (Rothaermel and Thursby, 2005).

The process of absorptive capacity on networks is affected by the location of start-ups. In the information and communications technology sector (ICT), choosing partners from social networks facilitates access to knowledge spillovers. Research conducted on R&D alliances on industrial firms in Europe suggests that ground rules and procedures are required to reduce opportunistic behaviour (Narula and Santangelo, 2009). In joint ventures, the presence of knowledge spillovers in the industry reduces companies' competitive advantage obtained from R&D investment (Ferenhof et al., 2016).

Networking is affected by the number of employees working on start-ups, and on the location to start a new company is directed to cities. For example, seventy per cent of the start-ups in the United States had an entry size between one and five employees (Glaeser and Kerr, 2009). However, in the case of the business survival in high tech industries, the propensity to exit depends on the minimum efficient scale of performance of the firm, competition, and the access to different forms of knowledge (Tsvetkova, Thill and Strumsky, 2014). Data analysed from the United States suggest that the start-up's survival may be negatively affected by an urban environment, and can cause to close the company for rechannelling recourses (Tsvetkova, Thill and Strumsky, 2014).

Research conducted on Sweden in the manufacturing industry has proven that the innovation on small firms with a size between one and ten employees depends on external financing and on multinationals' affiliation to access knowledge spillovers (Andersson and LooF, 2012). The process of innovation from knowledge spillovers enables creating new companies based on the entrepreneurial environment, not necessarily on urban settings for SMEs in the United States (Tsvetkova, 2015). These findings highlight that metropolitan cities with cultural diversity facilitate access to human capital with various knowledge but reduce the company's survival rate of start-ups due to competition. The study conducted based on the data provided by the Centre for European Economic Research (ZEW) in Germany regions showed that skilled employees affect start-ups' creation. It still depends on the population (Wyrwich, 2014).

2.3.1.7. Endogenous and Exogenous knowledge

Research had initially mentioned on the KSTE was that knowledge is endogenously created in regions and happens automatically (Audretsch and Lehmann, 2005). This statement's core stone developed through the knowledge production function (KPF), which proves how investment in R&D generates more innovation at the country level (Audretsch and Lehmann, 2005). However, when the observation unit is analysed at entrepreneurs on small firms or start-ups, the results turn ambiguous (Audretsch and Vivarelli, 1996; Audretsch and Lehmann, 2005).

The focus on the KSTE is to assess the spatial proximity, especially in industrial clusters (van Oort and Atzema, 2004). However, data collected from patents and R&D investment fail to highlight innovation when economic agents exploit knowledge without paying a monetary value (Verspagen, 1997). Also, R&D investment does not guarantee knowledge spillovers' transformation into economic knowledge or increased performance on companies (Qian and Jung, 2017).

The evaluation of knowledge spillovers has extended to understand the access to knowledge beyond geographical proximity. One such example is the evaluation of e-commerce, and the classification of information exchanged between the organizations (Kauffman, Ho and Liang, 2011). The key feature of using these technologies is that it enables them to break proximity barriers and is not limited to interactions with other countries (Kauffman, Ho and Liang, 2011). Nevertheless, the concept of the analysis of knowledge spillovers is evaluated as an industry (Audretsch, Huelsbeck and Lehmann, 2012). A vital aspect of the study focused on extending the endogenous growth model, which assesses the level of innovation based on the endogenous growth model (Audretsch, Huelsbeck and Lehmann, 2012).

This study's findings on data collected from initial public offerings (IPO) in Germany between 1997 and 2007 from 42 firms did not show robust statistical evidence of innovation based on e-commerce. However, the study conducted by Kauffman et al. (2011) focused on the impact of e-commerce between country-level as an exogenous factor from data of regulatory entities such as the OECD, dependent on the information communications and technology (ICT) structure of the countries. Although the study conducted briefly mentions knowledge spillovers sources through a conceptual model.

2.3.1.8. Absorptive Capacity and Knowledge Acquisition

One of the main obstacles that entrepreneurs and inventors face is how absorptive capacity can enable creating a start-up. It is essential to reflect that the process of absorbing knowledge depends on the type of knowledge spillovers. Knowledge is created from the continuous cycle between tacit knowledge and explicit knowledge (Bandera, Bartolacci and Passerini, 2016). Tacit knowledge is defined from Japanese managerial philosophy on how; 1) companies have contributed to the customer, 2) equality among individuals and 3) unity from the knowledge acquired from members of the organization (Nonaka and Takeuchi, 1995).

The absorption in the knowledge spillovers of this type depends on the repeated interactions and mobility between individuals and companies (Kirchhoff et al., 2007; Fritsch and Changoluisa, 2017). Research conducted on West German regions highlighted that competition influences new companies' performance (Fritsch and Changoluisa, 2017). These interactions are observed on a supportive network for start-ups. An objective of the study conducted on the United States on companies that issued IPOs found out that the proximity to law firms and venture capitalists on geographical clusters enabled the development of successful start-ups located in Silicon Valley, Boston and New York (Desrochers, 2005).

The transformation from tacit knowledge to explicit knowledge based on socialization, externalization, combination and internalization (SECI process) (Bandera, Bartolacci and Passerini, 2016). The process enables start-ups to attain competitive advantage, as the internal processes are standardized, and assets that will allow absorbing knowledge from external examinations. Research in this process developed a conceptual framework that links the process with knowledge spillovers, emphasises the identification of information through the usage of virtual or physical maps, as well as identifying a cyclical process from 1) promote awareness, 2) understanding the environment, 3) Mapping the core knowledge, 4) Perceive the environment and 5) manage the interactions. (Ferenhof et al., 2016).

The process is linked to other applications conducted by companies such as the importance of Business Process Modelling (BPM) or Value Stream Mapping (VSM) for managing flows of knowledge. It is important to note that the nature of tacit knowledge is difficult to assess, as it is shared through processes and daily routines of individuals (Nonaka, Toyama and Konno, 2000).

There are two types of absorptive capacity: cognitive capacity and technical capacity (Qian and Jung, 2017). The location (Ba) where knowledge can be shared, such as physical proximity on Technology Transfer Offices (TTOs) or through cognitive proximity through virtual platforms that can support the development of policies and operations of entrepreneurial ecosystems (Nonaka, 2008; Audretsch et al., 2018). The SECI process emphasises the importance of transforming tacit knowledge into codified knowledge through companies' ecosystems and the utilisation of assets that enhance online search and reviews with customers (Stough et al., 2013).

The KSTE given emphasises how endogenous knowledge is attained from the mobility of human capital from incumbents to third parties in spatial proximity to clusters (Acs et al., 2010; Hervas-Oliver, Lleo and Cervello, 2017). The case study of the Castellon ceramic industry on Spain highlighted the importance of networks and social capital enabled through the population's density, leading to the development of new firms in clusters from companies since 1990 (Hervas-Oliver, Lleo and Cervello, 2017).

It is essential to highlight that absorptive capacity evaluates its ability to innovate, which is directed towards products and processes (Rothaermel and Thursby, 2005). The process influences the absorption of knowledge spillovers, highlighting recent studies as a critical factor of transformation and transition of technological knowledge between firms (Nieto and Quevedo, 2005). However, research of knowledge spillovers from data 406 Spanish manufacturing companies pointed out that while absorptive capacity increases the level of innovation, there was no proven relationship with knowledge spillovers (Nieto and Quevedo, 2005). The study limitations mention that there are no standard ways to measure absorptive capacity.

KSTE research assessed the influence of networks and its influence on new firms (Audretsch, Belitski and Desai, 2015). One key finding of this research highlights that the evaluation of impact in innovation caused by new firms and entrepreneurs would take up several years for new ventures to exploit knowledge spillovers completely in cities (Audretsch, Belitski and Desai, 2015). Moreover, research conducted in Germany from 97 functional states that the impact of new firms maintains regardless of the market size and can be affected by knowledge diversity (Audretsch, Dohse and Niebuhr, 2010).

Research conducted on high tech companies in the United States highlighted the growth of start-ups caused due to their geographical proximity to venture capitalists, law firms, and bankers (Desrochers, Kenney and Patton, 2009). This scenario can be different in manufacturing (e.g., case of electric cars), where companies have the human capital required to gain a competitive advantage over entrepreneurs (Dyerson and Pilkington, 2005).

Research that translated the network, knowledge spillovers on incubators and start-ups case studies in Italy (Cantù, 2017). The study classified knowledge based on the market, technological, international knowledge, and evaluated incubator's influence on start-ups. One of the major highlights is that the benefits or change caused by an entrepreneurial network is assessed with questionnaires to entrepreneurs and individuals involved in the incubator (Cantù, 2017). The influence of networks on knowledge spillovers has to consider the previous connections that entrepreneurs have to incumbents to access to suppliers, customers, and obtaining assets for the start-up (De Figueiredo, Meyer-Doyle and Rawley, 2013). Thus, research has considered the entrepreneur's background, where individuals accept to enter companies with low salaries are the catalysts to absorb technological knowledge (Agarwal, D Audretsch and Sarkar, 2010). The discussion to assess how knowledge spillovers and networks combined are on the upmost importance for entrepreneurs to appropriate and commercialise new knowledge and innovate (Audretsch and Vivarelli, 1996; Hayter, 2013).

Start-ups with a horizontal organization are influenced by the entrepreneurs' personalities and their interactions and collaborations with the people involved during their operations on incubators (Bandera, Bartolacci and Passerini, 2016; Nicolopoulou et al., 2016).

2.3.1.9. Channels of knowledge absorption and knowledge filter

The importance of uncovering endogenous and exogenous knowledge is to distinguish the possible variables that start-ups are using to absorb knowledge spillovers. Endogenous knowledge is related to expanding the endogenous growth model through knowledge spillovers (Hervas-Oliver, Lleo and Cervello, 2017). Case studies showed the importance of networks, proximity and investment of research and development, enabling the innovation process (Verspagen, 1997). These variables also consider the interactions between industries through patents and investment in R&D (Qian and Jung, 2017).

On the other hand, exogenous knowledge started its development by analysing knowledge spillovers with the link Marshal, Arrow and Romer (MAR) externalities (Audretsch, Belitski and Desai, 2015). The model highlights the decision to locate a company on a particular location based on transportation costs of individuals, goods, and knowledge (Ellison, Glaeser and Kerr, 2010). An example of the agglomeration of industries and the locations of start-ups and entrepreneurs in Silicon Valley (Ellison, Glaeser and Kerr, 2010). Studies have evaluated demographics determinants to test entrepreneurial activity through the costs of transferring goods and information with suppliers and customers (Glaeser and Kerr, 2009).

The research conducted research highlighted that MAR depends on the type of industry in high technology sectors, with the trend to locate a company that would be on the proximity to the market (Glaeser and Kerr, 2009). The decision can influence additional costs such as taxes (Woodward, Figueiredo and Guimarães, 2006). However, the variables used for assessing the location of new forms are based on understanding the theories on regions or nations but cannot evaluate entrepreneurs directly (Fritsch and Changoluisa, 2017).

Starting the process is investigating new firms based on the finding that large companies don’t convert new knowledge into economic knowledge (Qian and Jung, 2017). The knowledge filter is all the limiting variables that prevent the transformation of new knowledge into economic knowledge (Acs et al., 2012). The link that enables the appropriation and conversion of knowledge into countries' economic growth is the economic agents, so-called entrepreneur (Acs et al., 2012; Ghio, Guerini, E E Lehmann, et al. Research of the knowledge filter in alliances from 219 partnerships in China highlighted that the level of protection that knowledge-protection processes prevented its exploitation into the market (Shu et al., 2014). The knowledge filter's effects became evident, as the implementations of joint venture regulations reduced the effects on knowledge spillovers (Shu et al., 2014).

2.3.2. Literature discussing knowledge spillovers implications at the individual level of start-ups

2.3.2.1. Knowledge Spillovers Characteristics

Knowledge spillover relates to the free capture of new knowledge obtained and used to commercialize a product or service in the market. Knowledge generated in a company or research institution left uncommercialised can be considered a source of further extra-entrepreneurial opportunity (Colombelli, 2016). This knowledge, which can relate to production processes, the implementation of new technologies, or the development of materials (Verspagen, 1997), can be subsequently captured through an entrepreneur’s absorptive capacity and exploited in a new market (Audretsch, Dohse and Niebuhr, 2010; Qian and Acs, 2013; Colombelli, 2016). Essential characteristics of knowledge spillovers are that they are challenging to measure and hard to determine their economic value as they do not typically directly benefit the creator of the knowledge (Arrow, 1972; Agarwal et al., 2010).

There are different types of knowledge spillover. For instance, tacit knowledge spillovers, which are often difficult to transmit and receive via face-to-face interactions, come from the previous experience and knowledge shared informally between individuals. Alternatively, explicit knowledge spillovers can be public or codified and can be present in published material, e.g., books, patents, industry reports (Acs et al., 2012; Lasch et al., 2013). Other types of knowledge spillovers relate to the geographical location and proximity to sources of knowledge, such as universities, companies, and governments (Nieto and Quevedo, 2005). These knowledge spillovers are generated from R&D and are accessible in the public domain and used in various industrial sectors (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Technological knowledge spillovers are the different types of information from the disciplines of technology and engineering that enable innovation (Nieto and Quevedo, 2005).

Other types of knowledge spillovers accessible to entrepreneurs are market knowledge, entrepreneurial knowledge and international knowledge (Verspagen, 1997; Cantù, 2017). Entrepreneurial knowledge spillovers can be attained from the direct exchange of knowledge between entrepreneurs and the market to develop a Minimum Viable Product (MVP), and the business knowledge necessary to obtain funding (Cantù, 2017). Here, entrepreneurs can access explicit knowledge in the public domain created from R&D investment from companies (Nieto and Quevedo, 2005; Qian and Acs, 2013). Lastly, tacit and explicit knowledge spillovers are examined from their various originators, including suppliers, customers, competitors and research institutions (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Spithoven and Teirlinck, 2015).

2.3.2.2. The relationship between entrepreneur background and the Start-up in knowledge spillovers

Entrepreneurs' experience and academic qualifications are proxies for the potential level of absorptive capacity that start-ups have in their early stages of operation (Fritsch and Changoluisa, 2017). As such, start-ups identify initial business ideas that influence the managerial and technical decision to engage in developing a new product (Nieto and Quevedo, 2005; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Based on unexploited knowledge spillovers, this initial decision leads to an initial financial evaluation that influences the decision to leave secure employment and to engage in the creation of a new company (Vivarelli, 2004; Santarelli and Vivarelli, 2007; Audretsch and

Lehmann, 2010).

Moreover, previous technical and managerial experiences can lead to the utilization of similar technological systems from the parent organization, which can cause the formation of spinoffs or influenced entrepreneurial endeavours (Narula and Santangelo, 2009). The network capital that CEOs have built during their industrial career and academic progression facilitate initial connections for future alliances that can secure access to resources and funding, increasing the survival chances of start-ups (Stam, 2013; Fritsch and Changoluisa, 2017).

Geographical proximity to sources of knowledge is also a factor that has been shown to influence decisions, primarily regarding locating a company in a specific region (Audretsch, 2006; Amoroso, Audretsch and Link, 2017). As start-ups develop and gain market experience, companies progress in the start-up cycle, which includes the stages of seed, venture growth, business stabilization, product diversification, and a potential final decline or creative destruction (Agarwal et al., 2010; Cantù, 2017). Hence, an entrepreneur's commitment to developing a new start-up depends on their decision to identify entrepreneurial opportunities (Nascent entrepreneurship) or to pursue the creation of a new business (Stam, 2013). The characteristics of CEOs and the company employees are indicators of the potential to engage in innovative endeavours (Tsvetkova, 2015). Although studies have recognized the influence of entrepreneur background, there is still a need to understand its effects on knowledge spillovers at the entrepreneur's level.

2.3.2.3. Accelerator Programmes and Networking

New physical locations, provided through incubators, open spaces, and accelerators, have been shown to influence entrepreneurial ecosystems' creation and facilitate access to financial investment from angel investors and venture capitalists (Audretsch and Belitski, 2017; Hausberg and Korreck, 2017). This research shows the positive influence that science and technology parks have on start-up development (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Cantù, 2017). In particular, accelerator programmes provide short term training, access to industry experts, and the opportunity to access a network of companies. These feature predominantly in cities that present high economic growth (Lasch et al., 2013; Mrkajic, 2017). Attendance of an accelerator or open-ended incubator program provides the opportunity to use facilities that reduce operational costs and provide access to necessary assets to run a company in the early stages (Nicolopoulou et al., 2016).

The capacity and services provided in such programmes act as mechanisms that enable access to knowledge spillovers outside the boundaries of a geographical location (Ho et al., 2011; Qian and Acs, 2013). Hence, accelerator programmes and incubators can influence start-ups' development by providing strategic advice and technical knowledge to achieve short and long-term goals (Nicolopoulou et al., 2016). Sources of knowledge in these start-up support systems include entrepreneurial events exploited to increase business ideas' exposure to investors and to engage with potential partners to develop collaborations (Audretsch and Belitski, 2017; Hausberg and Korreck, 2017). By uncovering the mechanisms used by CEOs and entrepreneurs as part of these situations, we can start to understand how knowledge spillovers are used to develop alliances and engage with product and process innovation (Amoroso, Audretsch and Link, 2017).

The exchange of informal knowledge between individuals and companies is disrupted by the perceived adverse effects of knowledge leakage and competition and can be considered a source of future hazards (E. Porter, 2000; Bouncken and Kraus, 2013; Jacobs, 2016). Nonetheless, when start-ups face adversity, it can be a source of motivation that incentivises entrepreneurs to promote the implementation and development of technological knowledge and to engage in alliances that boost the possibility of survival. The KSTE has provided research on how the formation of collaborations between companies stimulate R&D on the creation of new patents and new technologies (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Thus, the nature of formal alliances and establishing joint projects leads to product innovation by sharing resources, facilities, and human capital (Bouncken and Kraus, 2013; Hayter, 2013).

2.3.2.4. *Absorptive Capacity and Knowledge Implementation*

Absorptive capacity represents the capability of a company to recognize knowledge generated outside the firm's boundaries and the amount of the knowledge that is absorbed and implemented to create products or enhance processes (Nieto and Quevedo, 2005). To increase the absorptive capacity of a company, firms must invest in R&D through the acquisition of highly skilled human capital and the utilization of Information and Communication Technologies (ICTs) that enable exploration of the market and competitors (Qian and Acs, 2013).

Start-ups are dependent on their level of absorptive capacity to be able to identify technological knowledge spillovers and the level of involvement of innovation by using knowledge spillovers as input (Nieto and Quevedo, 2005; Agarwal et al., 2010). The implementation of new technologies is dependent on the availability of a budget to conduct market research and hire or subcontract human capital to develop products, services, and conduct competitor assessment (Fritsch and Changoluisa, 2017). Hence, accelerator programmes can act as intermediaries that provide the ICT and technological tools to capture explicit knowledge spillovers (Spithovenm and Knockaert, 2012; Lasch et al., 2013). However, such programmes can be indirectly affected by economic factors, such as taxes, infrastructure and unemployment (Lasch et al., 2013).

High-tech start-ups, initially developed by highly skilled human capital, provide opportunities to establish constant engagement with product innovation. Thus, if start-ups want to engage actively in developing technology products and services, the decision to hire or train human capital depends on the level of technical complexity (Stam, 2013). Hence, start-ups can decide to engage with universities and research organizations to cover the gaps in skilled human capital by, e.g., receiving students as interns.

2.3.2.5. *Implications on entrepreneurial Ecosystems and Clusters of Innovation*

In countries with high economic growth rates, such as the United Kingdom, evidence suggests that most companies create cities with a population above 250,000 inhabitants (Audretsch, Belitski and Desai, 2015). Institutions, companies, universities, and socio-economic factors lead to indicators of entrepreneurial ecosystems' presence (Ghio, Guerini and Rossi-Lamastra, 2019). However, this area of research has not been widely defined. It currently lacks a clear understanding of what should be considered a set of boundary conditions to conduct consistent research (Audretsch et al., 2018). Studies have determined various classifications, such as business ecosystems, innovation ecosystems, entrepreneurial ecosystems, or even financial ecosystems (Audretsch and Belitski, 2017). The research focuses on defining entrepreneurial ecosystems and innovation activity within the boundary of urban cities, focusing on the influencing results accelerator and incubator programs, start-up companies, and governments, which all act as sources of knowledge (Audretsch and Belitski, 2017; Autio et al., 2018).

Incubator and accelerator programmes enable access to networking events to help develop alliances or partnerships with companies in close proximity (Desrochers, Kenney and Patton, 2009; Montoro-Sánchez et al., 2011; Shu et al., 2014). Furthermore, they offer mentoring programs and training that provide technical and business knowledge to the founders (Bandera, Bartolacci and Passerini, 2016). However, the main driver for being part of such programs is the potential to gain access to investors (Narula and Santangelo, 2009). Therefore, the effect of such programs on high-tech start-ups depends on the capability and services provided by an established curriculum and the activities partaken by the entrepreneurs (Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016). The initial effects of incubators and accelerators can involve access to explicit knowledge spillovers through shared platforms.

Similarly, tacit knowledge spillovers fostered by informal meetings between entrepreneurs and customers, suppliers, competitors, and institutions. Access to open spaces can also lead to obtaining rent knowledge spillovers form inventory, materials, and machining operations (Kaiser, 2002; Koo, 2005). The impact of gathering data from similar industries can lead to enhanced product innovation. An incubator or accelerator program's perceived influence has been assessed on the moderating effect, and comparison between companies that have attended programs in the United Kingdom (Rothaermel and Thursby, 2005; Jia et al., 2018).

This study considers the involvement of entrepreneurial ecosystems focused on start-ups with companies and mentors, forming alliances or collaborations, and maintaining a group that shares knowledge between individuals. It is also essential to question incumbents' influence on high-tech start-ups' creation and performance (Szerb et al., 2018). The research can explore the systems that enable access to knowledge spillovers from universities, customers, suppliers, and competitors (Montoro-Sánchez et al., 2011; Link and Sarala, 2019). The research evaluates entrepreneurial ecosystems surrounding incubator and accelerator programs and how they would illustrate ICT mechanisms to gather access to knowledge spillovers in geographical and virtual platforms from local and international customers (Acs et al., 2017; Autio et al., 2018).

2.3.2.6. Product Innovation and Scaling

The initial capability to identify knowledge spillovers as an entrepreneurial opportunity depends on the start-up's human capital and the background of the company's founder (Audretsch and Belitski, 2017; Cantù, 2017). The business idea depends on the entrepreneur's experience while identifying the business and technological resources in the seed stage leads to developing a prototype (Nieto and Quevedo, 2005). Hence, entrepreneurs can use various knowledge spillover mechanisms that facilitate access to free data and information that support the product's life cycle.

Entrepreneurs operating in the high-tech sector have emphasized that the innovation process is an important dimension that leads to start-up success. A new venture that focuses on improving existing products or services depends on the company's absorptive capacity to engage in technical innovation through the utilization of resources and networks to transform knowledge spillovers into economic spillovers (Qian and Acs, 2013; Srivastava, Gnyawali and Hatfield, 2015). Research suggests that early-stage entrepreneurs tend to focus on the innovation of products rather than process innovation (Wong, Lee and Foo, 2008; Kostopoulos et al., 2011). Furthermore, the understanding of change from entrepreneurs not focused on disruptive, but on revolutionary innovation that seeks to exploit existing technological knowledge to satisfy the market by capturing knowledge spillovers (Yan, Khoo and Chen, 2005; Bouncken and Kraus, 2013).

Product innovation is often initially supported by direct investment from investors or business angels. Start-ups gather resources by establishing alliances and collaborations through former networks or pitching events (Zedtwitz, 2003; Cohen et al., 2017). The decision to develop a product focuses on a type of innovation that enables market entry through constant interaction between a team and the customers (Nieto and Quevedo, 2005; Wang and Wang, 2012). Start-ups can consider that starting with the development of the product that is affected by perceived competition levels in the market establishes an openness to sharing knowledge (Bouncken and Kraus, 2013). In this regard, involvement in accelerator programs and facilities' creation provides access to new networks, resources, and entrepreneurial knowledge that facilitate discovery (Markovitch, O'Connor and Harper, 2015; Cantù, 2017).

2.4. Conclusions

The knowledge spillover theory of entrepreneurship (KSTE) has consistently proven the importance that generation and use of knowledge can have on creating new ventures (Audretsch, Dohse and Niebuhr, 2010). Research has continuously suggested how companies and institutions' agglomeration in geographical proximity open entrepreneurial opportunities to exploit uncommercialised knowledge (Audretsch and Lehmann, 2010). For instance, a start-up's initial location leads to exposure to local characteristics such as access to networks, support from the government, entrepreneurial infrastructure, and access to skilled human capital (Audretsch, Belitski and Desai, 2015). The extended evaluation of knowledge spillovers has extended to evaluating companies near universities, science and technology parks, and incubator programmes(Montoro-Sánchez, Ortiz-de-Urbina-Criado. All endeavours seek to point the importance that access to sources of knowledge represents on their survival and competitive edge of new ventures (Audretsch, Belitski and Desai, 2015).

Knowledge spillovers have unequivocally used as a term that's has been extended to research to disciplines of management and engineering (Nieto and Quevedo, 2005; Cantù, 2017). These effects are highly dependent on the type of industry, current forms of collaboration, and the background of the company's initial founders (Connell et al., 2014; Shu et al., 2014; Ritala et al., 2015). Hence, similarly to KSTE, research has been determined to evaluate networks, suppliers, customers, and the market (Grewal et al., 2011; Musteen, Datta and Butts, 2014). All these factors have proven to be essential for high-tech start-up's capability to respond to the market during a period of constant technological change on international markets (Prashantham and Young, 2011; Ferreras-Méndez et al., 2015; Zobel, 2017).

The literature presented some issues in the research of knowledge spillovers, start-ups, and innovation. Research on knowledge created by research institutions such as universities does not develop homogeneous knowledge among them. Moreover, the literature states that studies have not identified the knowledge spillovers mechanism used by entrepreneurs aside from access to publications and graduated students (Audretsch and Lehmann, 2010).

There is no doubt that economic conditions, the presence of universities and adequate policies purpose access to knowledge spillovers. However, the phenomenon continues to become a mystery as researchers continue to evaluate economic indicators, the presence of universities, investment in R&D, and economic indicators and regions' characteristics to evaluate knowledge spillovers indirectly. The core problem has been stated for a long time, as the argument raised that knowledge spillovers are hard to measure and leave no trails to be evaluated (Audretsch and Vivarelli, 1996; Audretsch and Stephan, 2000a).

Research in economics at the regional level started to consider the diversity and different characteristics of people cause the creation of new ventures and evaluate business ideas (Audretsch, Dohse and Niebuhr, 2010). In addition, knowledge spillovers from the chain of value are considered an essential source of knowledge towards innovation (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). However, initial attempts to prove the moderating effects of knowledge spillovers from R&D missed demonstrating the statistical significance of innovation on manufacturing companies (Nieto and Quevedo, 2005). Thus, it remains to question if patents' creation does support the development of start-ups (Helmers and Rogers, 2010).

The evaluation of innovation also presents problems, as the evaluation of R&D investment does not portray the company's full processes. The literature has stated the necessity to identify the influence of the entrepreneur's education and the impact of universities or specific sectors for start-ups at the individual level (Lasch et al., 2013).

Moreover, research needs to identify knowledge spillovers and knowledge transfer processes and management processes specifically for start-ups (Agarwal et al., 2010; Bandera, Bartolacci and Passerini, 2016). Research began to assess knowledge transfer on industrial clusters and has proven that the agglomeration of companies and geographical proximity does not guarantee innovation and the evaluation of the company’s networks (Hayter, 2013; Connell, Kriz and Thorpe, 2014). Research has attempted to evaluate these problems by conducting case studies in incubators. This research suggests evaluating the networks and access to knowledge effects and technology through surveys (Cantù, 2017).

The common conclusion among previous knowledge spillovers research continued to emphasise the necessity to implement an in-depth analysis (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). A recent study has assessed regionally the regulations that support regulations, causes of society, and interactions between organisations on entrepreneurship without providing direct empirical evidence to directly assess the phenomenon (Korosteleva and Belitski, 2017).

Recent research on knowledge spillovers has tackled the importance of tacit knowledge spillovers from employees' experience in start-ups (Naldi, Criaco and Patel, 2020). However, the research mentions that knowledge spillover effects on product innovation and internalisation require to analyse the processes needed to undertake it. Studies also considered assessing technological knowledge spillovers on start-ups performance (Minola, Hahn and Cassia, 2019). The assessment on the number of employees and human capital proved to influence access to funding. Research has also proved that unemployed entrepreneurs run the risk to establish a start-up with limited entrepreneurial experience, network and human capital, and limitations to innovate (Caliendo, Künn and Weissenberger, 2020). On the other hand, the assessment graduated entrepreneurs from Science, Technology, Engineering and Mathematics (STEM) background of entrepreneurs has proven that specialisation on engineering, economics and management increases the chances of finding a new venture within three years of graduation from masters programmes (Colombo and Piva, 2020).

This brief review proves that most of the current research continues to evaluate only successful start-ups progression and developing assumption based on start-ups' characteristics and financial progression of successful start-ups. Thus, the same research gaps enunciated from previous research continues to be present by conducting a direct assessment of processes required to implement knowledge. Most research in this domain has focused on proving the existence and effects of knowledge spillovers. Still, it has not provided primary data to clearly state the mechanisms and processes used by start-ups to use and implement them.

3. CHAPTER III CONCEPTUAL MODEL CHAPTER

3.1. Introduction

Chapter III focuses on developing a qualitative model that supports the development of knowledge spillovers on high-tech start-ups. Chapter III's objective is to develop a conceptual model and propositions to provide theoretical support to develop an interview guide and offer insights to conduct the qualitative analysis. The proposed model is explained based on proposed theoretical dimensions and initial propositions to expand and discuss Chapter V.

Overall, the chapter categorises start-ups development from the initial absorptive capacity of the company. The possible sources of knowledge spillovers and the effects of incubators and accelerators lead to knowledge spillover events. The process leads start-ups to transport tacit and explicit knowledge that results in creative destruction and construction. The development of the model led to setting the project's scope by considering alliances, absorptive capacity, and product innovation as the primary processes undertaken by entrepreneurs.

3.2. Theories, justifications and initial discussion

A conceptual model linking the concepts from the KSTE (Hennink, Hutter and Bailey, 2011) is required. This conceptual model informed the first phase of the research methodology, the qualitative case study. This Chapter aims to set a boundary to guide the research and set the limit of the literature and sample required to cover the research questions (Bazeley, 2014). The formulation of the research questions and a conceptual model is an interactive process, where the initial deductive concepts developed expands to an inductive model (Hennink, Hutter and Bailey, 2011). The research followed the cyclical process of the formation of the model and is illustrated in figure 3.1.

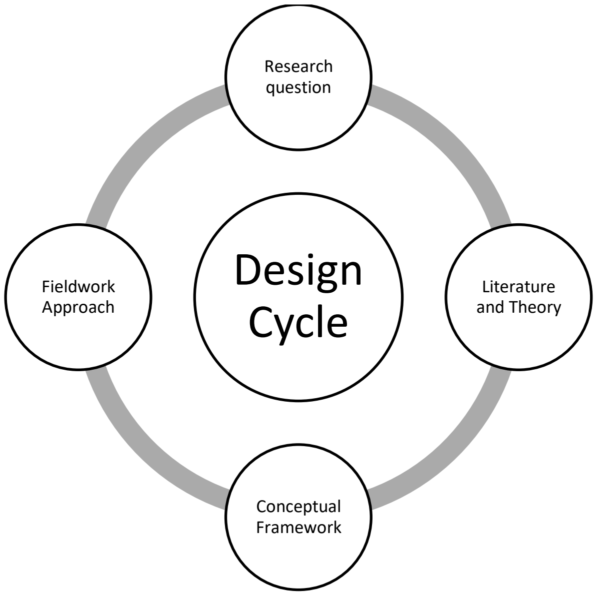


Figure 3.1 - Qualitative research cycle based on Hennink et al. (2011)

The model requires to include the components that link the research methods, the validity of the research, the purposes, and the research questions established (Maxwell and Loomis, 2003). The connection of these components is intertwined and has to consider the research's limitations (Maxwell and Loomis, 2003). Thus, the model's development has to focus on identifying the actions and processes that enable early entrepreneurs to exploit knowledge spillovers (See figure 3.2).

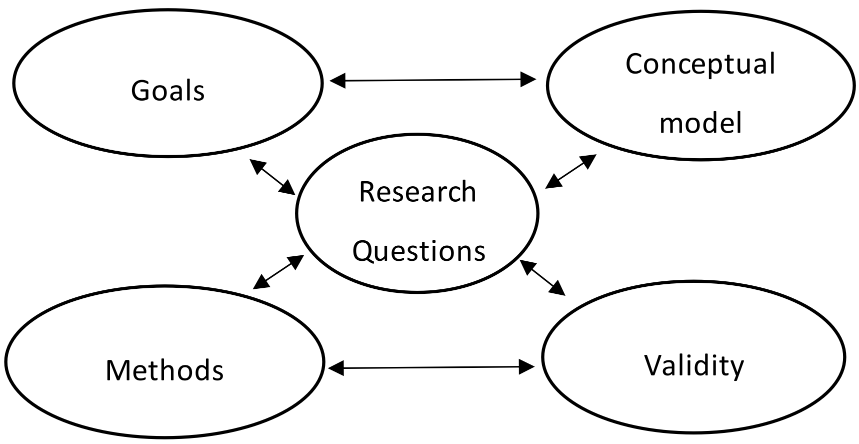


Figure 3.2 – Interactive model of the research design, based on Maxwell et al. (2003)

The conceptual model established from the literature enables the researcher to have a foundation and a starting point for understanding the effects of knowledge spillovers on start-ups (Bazeley, 2014). The first two specs to structure together a qualitative research design are to set the process to set the initial connection of the research question. The link to relevant theories links to the research to develop an interview guide (Hennink, Hutter and Bailey, 2011).

From the perspective of the pragmatic philosophical overview, research questions are stipulated in propositions (Strang, 2015). In particular, the setting of research questions can direct data collection, which is a similar approach in the case of grounded theory (Yin, 2006). The main theories that mention the flow to knowledge spillovers to entrepreneurs are:

- The Knowledge Spillover Theory of Entrepreneurship (KSTE)
- The absorptive capacity theory of knowledge spillover
- Schumpeter's theory
- Agglomeration theory
- Economic Growth Models

3.2.1. Absorptive Capacity Implications

The KSTE posits that it is required to understand how entrepreneurs transform new knowledge into economic knowledge (Nieto and Quevedo, 2005; Qian and Jung, 2017). On the other end, the entrepreneur requires to break the knowledge filter that prevents the process of knowledge spilling over from one organization to another (Audretsch and Lehmann, 2017). In this case, entrepreneurs working for a company have to break through the barriers and the decision-making process, which in cases involves individuals with a background on engineering, scientific researcher, or another type of experience that supports technological knowledge absorption (Audretsch and Lehmann, 2005; Hayter, 2013).

The Absorptive Capacity Theory of Knowledge Spillover denotes the importance of entrepreneurs' ability to absorb and implement knowledge (Acs ed., 2010). It is first introduced as the entrepreneurial absorptive capacity, which indicates the creation of exogenous and endogenous new knowledge from entrepreneurs and other organisations (Acs et al., 2009). This theory mentions the expansion and speed of new knowledge creation is not enough to enforce the economic growth of regions. Previous research provided insights to consider the influence of the country's characteristics on the development of start-ups and patents; is mainly linked to the geographical proximity between the sources of knowledge.

Thus, the research aims to uncover and evaluate the actual process and mechanisms that entrepreneurs take to assess new knowledge creation and collect knowledge spillovers (Nieto and Quevedo, 2005; Audretsch and Lehmann, 2006). The literature has provided sufficient evidence to support the evaluation and identification of entrepreneurs' mechanisms to collect information through knowledge spillovers (Audretsch and Lehmann, 2010). Thus, this research seeks to extend the understanding of the initiatives that entrepreneurs take in collaboration measures and the kind of behaviour necessary to enhance their performance (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

The entrepreneurs at the beginning have to decide to start a company. The choice involves considering leaving the safety of a job position; In some instances, the initiative is prevented by companies by offering benefits or an increase in salaries (Wong, Lee and Foo, 2008). Thus, to complete the transformation of knowledge, it is required to consider the cognitive and technical capabilities of the founders of the company (Qian and Jung, 2017). On top of the capability, entrepreneurs need to establish the mechanisms used to establish the connections between departments to support financing, identify knowledge from academic publications, movement of human capital (Audretsch and Lehmann, 2005; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

In the long term, entrepreneurs' evaluation may involve entrepreneurial activities when the company has transcended from the initial stages from start-up to incumbent (Stam, 2013). From the perspective of space location, the start-ups may consider remaining using the incubator facilities, which facilitates access to resources, reduced taxes, and cost of the installations (Woodward, Figueiredo and Guimarães, 2006). On the other hand, high-tech start-ups may have the possibility of growing exponentially in exchange to be exposed to competition and a higher rate of failure in urban cities (Santarelli and Vivarelli, 2007).

3.2.2. Knowledge Transformation and Implementation

In the case of geographical proximity, it assumes that knowledge spillovers automatically transfer on geographic proximity to companies' sources of knowledge, which may not be the case, as the start-ups require to establish a robust set of networks between individuals (Cantù, 2017). Furthermore, Europe differs from the United States regarding the terrain, diversity, culture, the rapid expansion of cities, and the transference of data between cities (Audretsch, Belitski and Desai, 2015).

The process of innovation passing the twentieth century has been transforming individuals' capabilities into the structured processes set by companies (Dyerson and Pilkington, 2005). As this knowledge management processes become more formal, companies require to share a physical space to develop the exchange of tacit knowledge (Connell, Kriz and Thorpe, 2014). It is necessary to expand on the understanding of previous institutions' effects on the operational capabilities of newly funded start-ups (De Figueiredo, Meyer-Doyle and Rawley, 2013). The problem from KSTE research is that authors do not directly assess the characteristics and effects of knowledge spillovers and fail to analyse it on a specific type of industry (Hayter, 2013).

The transformation between tacit and explicit knowledge spillovers is conducted in physical or virtual spaces supported by absorptive capacity (Nonaka, Toyama and Konno, 2000; Qian and Jung, 2017). Thus, companies can use knowledge spillovers to explore products to enter the market, explore the competition, and sell products in local and international markets (Fritsch and Changoluisa, 2017). Thus, research is evaluated on the development of collaboration with other companies and using networks based on agglomeration effects (Hervas-Oliver, Lleo and Cervello, 2017). These events cause the process of creative construction and destruction, where incumbents have to compete by hiring human capital and using adequate technologies to compete in the market (Narula, 2014).

Thus, companies invest in R&D and human capital, which falls absorptive capacity capabilities (Spithovenm and Knockaert, 2012). However, the resources required to implement knowledge spillovers can also cause entrepreneurs to reduce interactions or collaboration initiatives with other companies (Spithovenm and Knockaert, 2012). Furthermore, KSTE research has extended from different angles, such as evaluating its effect from academia, transfer and technology offices, incubators, accelerator programmes, and Science and Technology Parks (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

These locations serve as a context to identify an organization was entrepreneurs benefit from an organization that enables the creation of new knowledge to implement it in the market (Acs et al., 2012). For instance, interactions between entrepreneurs depend on incubators' capabilities to facilitate R&D processes and on the start-up's capabilities (Markovitch, O'Connor and Harper, 2015). Incubators and accelerators receive start-ups with high impact entrepreneurs, which act as economic agents and have the capacity to transform new knowledge into economic knowledge (Acs et al., 2012). Incubators and accelerators are considered hybrid organisations that enable start-ups to innovate on open spaces. Companies receive advice on setting a strategy and monitoring their progress during the program (Nicolopoulou et al., 2016).

The entrepreneurs' development also depends upon maintaining collaboration with companies and institutions for gaining access to resources. However, to maintain a thriving flow of knowledge, it is required to have a trust level that enables companies and employees to exchange information without concerns (Connell, Kriz and Thorpe, 2014). Furthermore, the exchange of information doesn't guarantee that the start-ups will be absorbing knowledge spillovers. The process requires start-ups to have the necessary absorptive capacity to identify entrepreneurial opportunities (De Figueiredo, Meyer-Doyle and Rawley, 2013).

Entrepreneur's choices occur in the period of five to seven years, where start-ups have crossed the so-called "valley of the dead" and were able to be involved in the process of growth and establishing their trademark in the market (Helmers and Rogers, 2010). This change of strategy can be directed at a process where the company can change from investments of R&D towards increasing revenue or to enhance innovation processes start to lead from innovation from products and services into the improvement of processes (Bandera, Bartolacci and Passerini, 2016). These transformations included discussing what kind of human capital and what effects it has on absorptive capacity and the capture and implementation of knowledge spillovers (Kirchhoff et al., 2007).

An indicator that the start-ups have managed to implement knowledge spillovers can be the number of products and patents produced before the five to the seven-year mark of the companies development (Audretsch and Vivarelli, 1996; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). During the process, the perception of high-tech start-ups on the number of employees required to capture opportunity and the necessity to locate on the incubator's installations reduces (Audretsch and Vivarelli, 1996; Nicolopoulou et al., 2016).

3.2.3. Sources of Knowledge Spillovers

The questions on creating knowledge spillovers and start-ups depend on the types of industry (Audretsch and Stephan, 2000a). The knowledge spillover effects have triggered the assessment of entrepreneurial networks to share knowledge in a cognitive and spatial space (Hayter, 2013). This part of the research is critical to evaluate the constant transformation between tacit and explicit knowledge from endogenous and exogenous sources of knowledge (Nonaka, Toyama and Konno, 2000; Ho, Kauffman and Liang, 2011).

Start-ups need to link and connect to incumbents to exploit the advantages of absorbing knowledge spillovers in entrepreneurial cities such as London (Greenstone, Hornbeck and Moretti, 2010). Second, the exploitation of different types of knowledge spillovers requires that start-ups have models that involve tangible recourses for the products, the facilities and human capital needed to absorb and implement knowledge, and the networks and closeness to other companies to manage the chain of value (Cantù, 2017). However, the different type of knowledge transformation between different types of high-tech start-ups depends on the types of industries where the companies decided to enter to develop their new company (Santarelli and Vivarelli, 2007).

From one perspective, companies involved in the process of entrepreneurship are more directed towards hiring high skilled human capital if they are involved in a cluster of start-ups. On the other hand, isolated companies will prefer to limit the number of contracts to start research and development (Santarelli and Vivarelli, 2007). Secondly, companies involved in the innovation of disruptive technologies formed outside of the boundaries of companies tend to have a different level of technological knowledge flow (Santarelli and Vivarelli, 2007). This distinction depends on the level of the product developed. For example, companies in the advanced and communications and technology are more predominant to share information than the so-called traditional sectors where the technologies developed depend on basic science (Markman et al., 2005).

Third, knowledge spillovers can come from academia by the influence of Higher Education Institutions (HEIs). Business knowledge is promoted to students through learning content towards entrepreneurship on the development and requirements to start a new company (Korosteleva and Belitski, 2017). Other sources in the industry of biotechnology come from academic researchers' effort towards increasing the expansion of knowledge through the development of publications and the reputation of the company that facilitates the funding acquisition process (Audretsch and Stephan, 1999; Nielsen, 2015).

For such importance on the influence of human capital on start-ups, there should be, at first, an initial strategy set by entrepreneurs on startups to hire highly skilled individuals with a balanced skill set of experience and competences (Santarelli and Vivarelli, 2007). On the other hand, incumbents employ professional human capital to identify unexploited knowledge and may decide to start a new company (Audretsch, Dohse and Niebuhr, 2008; Cantù, 2017).

Research of knowledge spillovers remains a mystery is because it is analysed through many different lenses and perspectives that the concept needs refinement (Verspagen, 1997; Acs, Audretsch and Feldman, 2008). If knowledge spillovers are not managed or handled accordingly, it can cause harm to the organization; whereas, if controlled, it can lead to identifying opportunities to innovate on products, services, or the performance of start-ups (Wong, Lee and Foo, 2008; Ferenhof et al., 2016).

3.2.4. Creative Construction and Destruction

Even though the KSTE considers one of the leading indicators for measuring the economic growth in countries and regions caused by investment in R&D that generated new exploitable knowledge, it may prove to be a misleading choice on early starters (Audretsch and Lehmann, 2010; Cantù, 2017). In a sense, start-ups entering the high-technology market. In one aspect, start-ups with a revolutionary product most likely would choose to develop the organisation to a point where the startup enters a process of creative destruction (Santarelli and Vivarelli, 2007; Schendel and Hitt, 2010). Such directions follow and investment in Research and Development (R&D) that boosts the absorptive capacity process and enable the implementations of knowledge spillovers towards the handing over the premise to joint ventures or incumbents (Cockburn, 2004; Kauffman, Ho and Liang, 2011).

On the other hand, start-ups that fall on the process discussed under Schumpeter's theory were entrepreneurs identify opportunities generated by incumbents that led them to implement in a new company (Stam, 2013). However, due to such identification, the formation of small groups of leading innovators that generate new companies and trends to follow creation (Santarelli and Vivarelli, 2007); However, these companies tend to replicate existing business. Under the entrepreneur's perception, the company may end up falling in the process of creative construction, where the companies decide to continue operating after their development process or join an incumbent towards developing the product or services (Santarelli and Vivarelli, 2007).

The identification of knowledge spillovers depends on the type of industry. For example, 35% of companies between 1986 and 1991 that survived after five years of their establishment in the United Kingdom belonged to companies that had more employees than the competition (Helmers and Rogers, 2010). Nevertheless, the situation changes when we deal with companies that work in the IT or R&D sector. These companies had an initial surviving rate of 85 % in the first year and ended up with a probability of survival of 60 % at the end of the fifth year (Helmers and Rogers, 2010). On the other hand, companies that are part of R&D started with a survival rate of 95% in the first year and ended up in an 85% of survivors at the end of year five (Helmers and Rogers, 2010).

The main variables to be added to the survival of start-ups in IT and R&D are their proximity to universities, and their ability to have at least one patent or a form of Intellectual Property (IP) and patents (Helmers and Rogers, 2010). This back up the effects of knowledge spillovers when companies decide to locate in regions with higher indicators on R&D on technology and high-skilled human capital improve the probability of identifying technological opportunities (Audretsch, Dohse and Niebuhr, 2008). This effect caused by knowledge spillovers flows between individuals on companies or between companies, resulting from hiring human capital (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

The direction of this research focuses on analysing the development of start-ups and the identification of knowledge spillovers. Such a process requires knowledge absorption that facilitates progress through networks and information that promote the access of knowledge spillovers (Hayter, 2013). For instance, the incubator's geographical location to sources of knowledge and high-tech start-ups companies should support the development of new companies and the identification of opportunities (Audretsch, Dohse and Niebuhr, 2010). This process depends on the approaches taken by the entrepreneur to create a start-up. The three main start points of a company can originate from academia, incumbents, or companies (Cantù, 2017). Companies have to continue innovation and survive on a period of around five to seven years to achieve stability and start growing on human capital and economically (Audretsch, Belitski and Desai, 2015).

3.3. Conceptual model aims and justification

The first step is to set an adequate theoretical model for elaborating the qualitative phase's research tool (Tashakkori and Teddlie, 2003; Bryman and Bell, 2015). The creation consists of maintaining a constant interaction between the data collected in the filed while comparing and analysing previous research (Bentahar and Cameron, 2015). Until the end of the qualitative analysis phase, the use of this tool is to capture the point of view of Chief Executive Officers (CEOs) that went through an incubator or accelerator program. Identifying the responses aims to seek for fears, emotions, perceptions, and points of view of starting a company in London (Dey, 2016).

The qualitative phase of the research enables us to uncover the results from entrepreneurs on the development of star-ups and evaluate the quality of the resources, procedures, and effects caused by knowledge spillovers. Thus, the initial objective is to obtain responses and events that reflect the entrepreneur's thinking process about starting a company (Dey, 2016). The evaluation of start-ups, depending on their years of operation, enables us to distinguish the differences of perceptions through time (see figure 3.3).

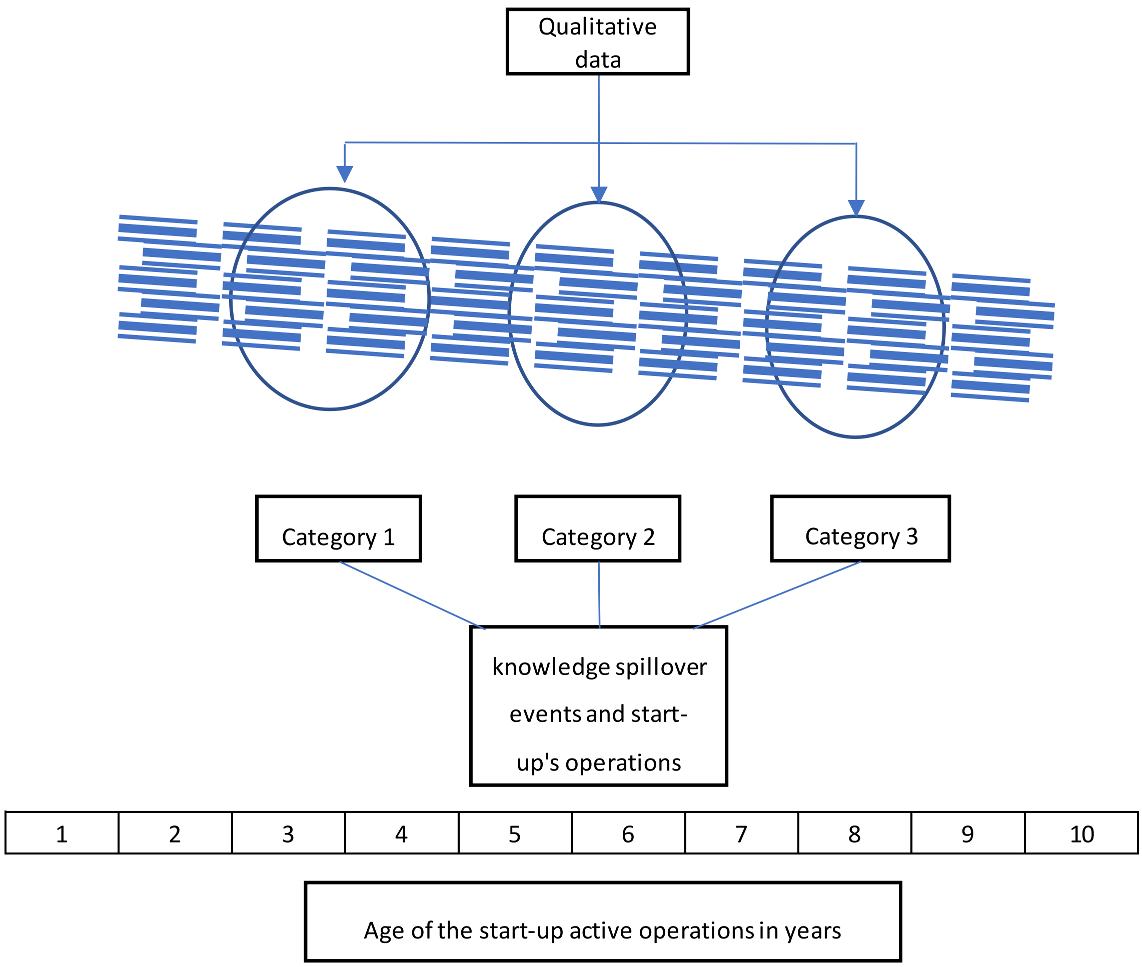


Figure 3.3 - Evaluation of qualitative data example, based on Dey et al., (2016)

3.4. Conceptual Model Development

The assessment of knowledge spillovers considers previous theories, models, propositions, dependent, and independent variables identified on the topic shown on a visual representation based on constructed theory (Hennink, Hutter and Bailey, 2011; J A Maxwell, 2013). Such a conceptual model aims to demonstrate how the concepts and constructs are linked (Bickman and Rog, 2009). The initial guidance to structure the conceptual model follows the sequence illustrated in figure 3.4.

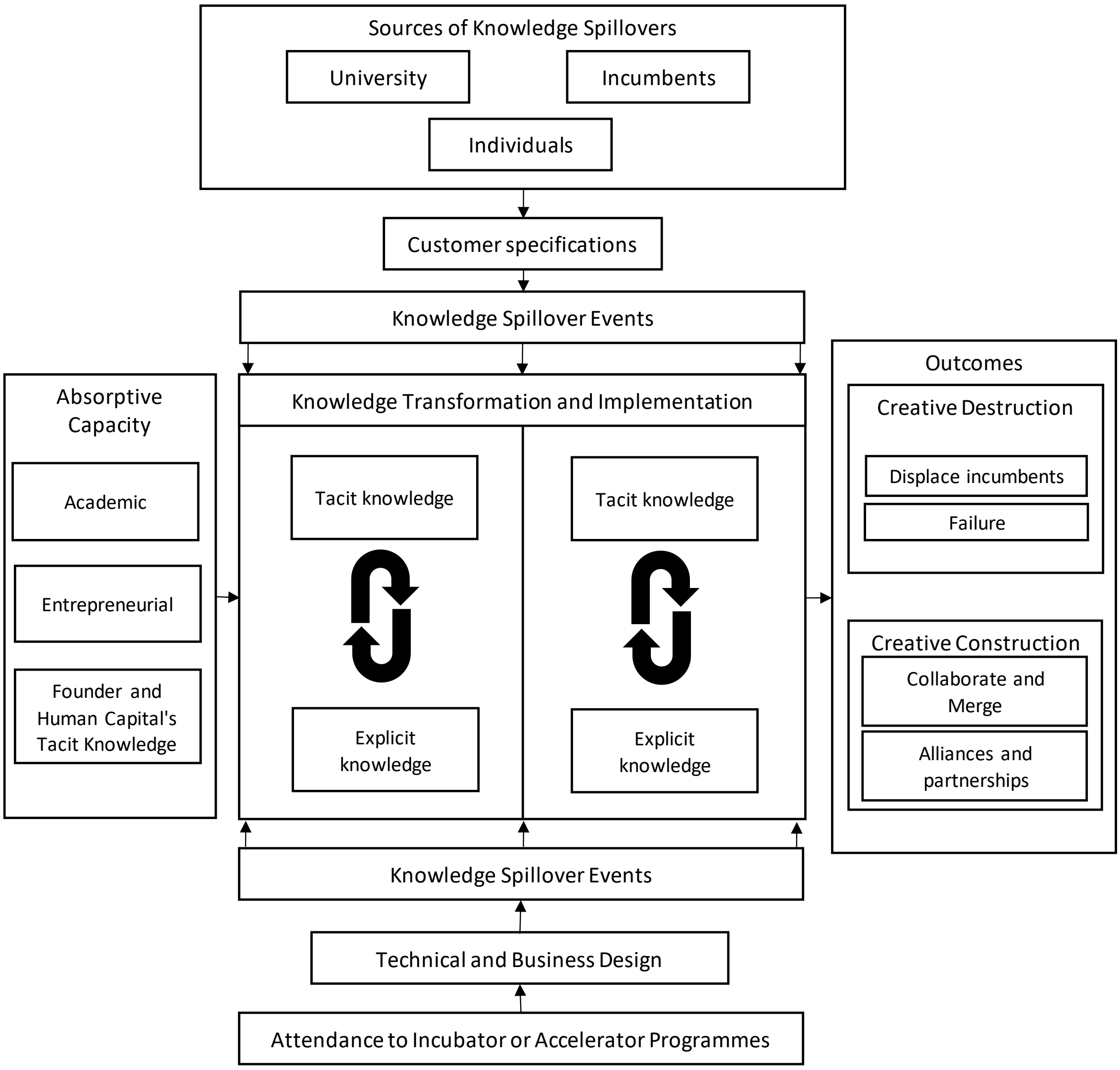


Figure 3.4 - Initial illustration of the sequence of the flow of knowledge spillovers. Extended model on knowledge spillovers and strategic entrepreneurship (Agarwal et al., 2010).

The initial structure of the conceptual map to develop the propositions starts with a broad description of knowledge spillovers flow, as illustrated in Figure 3.4. In the context of the research, the attendance and entry requirements to incubator and accelerator programmes assess start-ups in their business model, characteristics of the team, and the products or service that the company is using to enter the market regardless of the type of attended program (Vanderstraeten, Matthyssens and Campus, 2004).

During the incubation and accelerator programmes, the process involves the absorptive capacity linked to human capital and mechanisms of platforms used to capture knowledge and identify technological opportunities (Nieto and Quevedo, 2005; Huang et al., 2012). The process contains a constant transformation of tacit and explicit knowledge spillovers and mostly generated from no-cost and incentivised by R&D investment (Nonaka, Toyama and Konno, 2000; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Korosteleva and Belitski, 2017). These conversions facilitated exposure to knowledge spillovers through a series of events from networking and interactions with individuals internal and external to the organisation (Nonaka, Toyama and Konno, 2000; Audretsch, Belitski and Desai, 2015; Cantù, 2017). The base directions for identifying the model are illustrated in figure 3.5. This illustration provides a visual representation of the expected contexts to consider during the qualitative data analysis. Thus, the analysis considers identifying the effects of incubators or accelerators, the knowledge spillover events that promoter entrepreneurial intentions, and the required processes and mechanisms needed to undertake them.

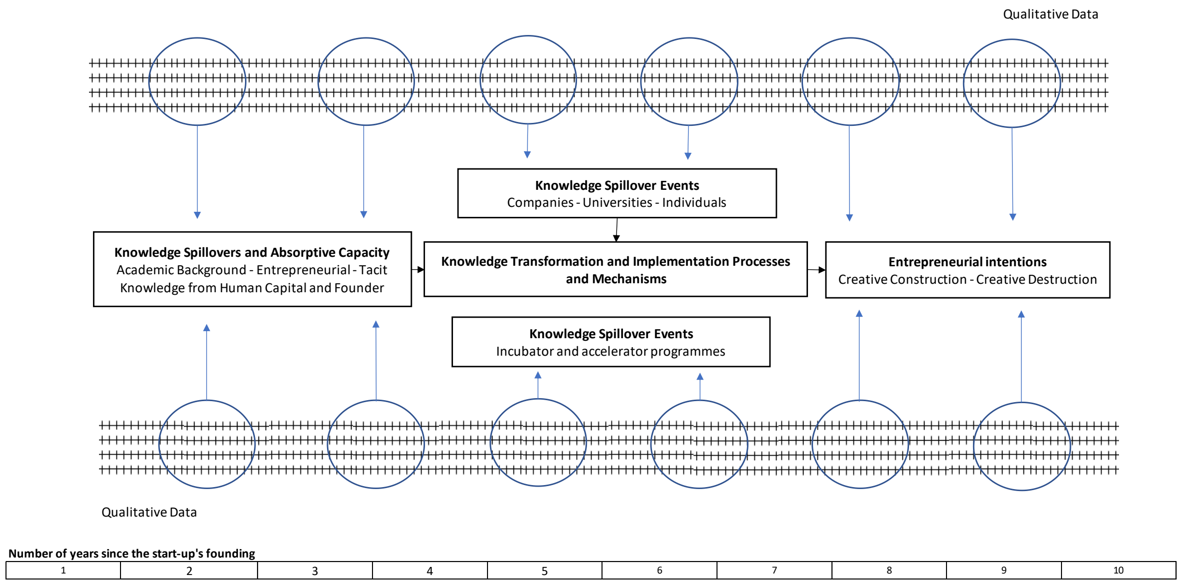


Figure 3.5 - Qualitative aspects of the model considered for qualitative analysis, Adapted from Yin et al., (2018).

Most of the effects of knowledge spillovers assessed on the number of patterns created, the growth and survival on companies after five years, and generation of new jobs in a region with a high flow of knowledge (Audretsch, Dohse and Niebuhr, 2010; Ellison, Glaeser and Kerr, 2010; Rodríguez-Pose and Hardy, 2015). However, these indicators fail to recognise the true nature of knowledge spillovers, which is not linked to documents and continuously assessed from economic indicators (Audretsch and Stephan, 1999; Hayter, 2013).

The possible outcomes from creative destruction are to continue the company's growth, which aims to create a displacement of incumbents (Audretsch and Lehmann, 2005). The second option involves entering the market and failing to continue growing, which generates knowledge spillovers to third parties or to sell the company to an incumbent (Dyerson and Pilkington, 2005). Alternatively, start-ups may start developing a process of creative destruction by deciding to collaborate and merge with a prominent company to continue developing (Agarwal, Audretsch and Sarkar, 2007; Shu et al., 2014). Another option for start-ups in this path is to establish partnerships and alliances with incumbents and SMEs.

The answers collected from CEOs seek to cover three main aspects of the qualitative analysis phase: contexts, intentions, and processes (Yin, 2003). In this case, incubator and accelerator programs act as the spatial context, was the entrepreneurs are interacting with each other (Yin, 2003). These conditions seek to identify the events were knowledge spillovers are absorbed and impact the company's operations. These interactions are linked to external and internal requirements to operate in Greater London (Audretsch and Lehmann, 2005; Bouncken and Kraus, 2013). Entrepreneurs might mention sets of events that present fears or signs of conflict caused by knowledge spillovers from start-ups to third party members (Ritala et al., 2015). In this case, these types of knowledge spillovers to third parties and between alliances, leading to knowledge leakage (Ferenhof, 2016).

The most highlighted tools that the KSTE have identified are the entrepreneur that identifies an opportunity and decides to start a new venture identified as an “economic agent” (Audretsch and Lehmann, 2005; Audretsch and Stephan, 2006; Audretsch, Dohse and Niebuhr, 2010). However, knowledge spillovers are obtained from human capital employed from universities and the industry locally or internationally (Audretsch, Dohse and Niebuhr, 2010; Cantù, 2017). Furthermore, networking events facilitate exposure to the market, competitors, future collaborations, and funding for start-ups (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Audretsch and Belitski, 2017). Mechanisms include access to knowledge spillovers that are not bounded to human interaction such as virtual communities and programs supported by Information Technologies (IT) and engineering methodologies (Huang et al., 2012; Schmidt, 2015). The conceptual model used to guide the discussion in this chapter is illustrated in figure 3.6.

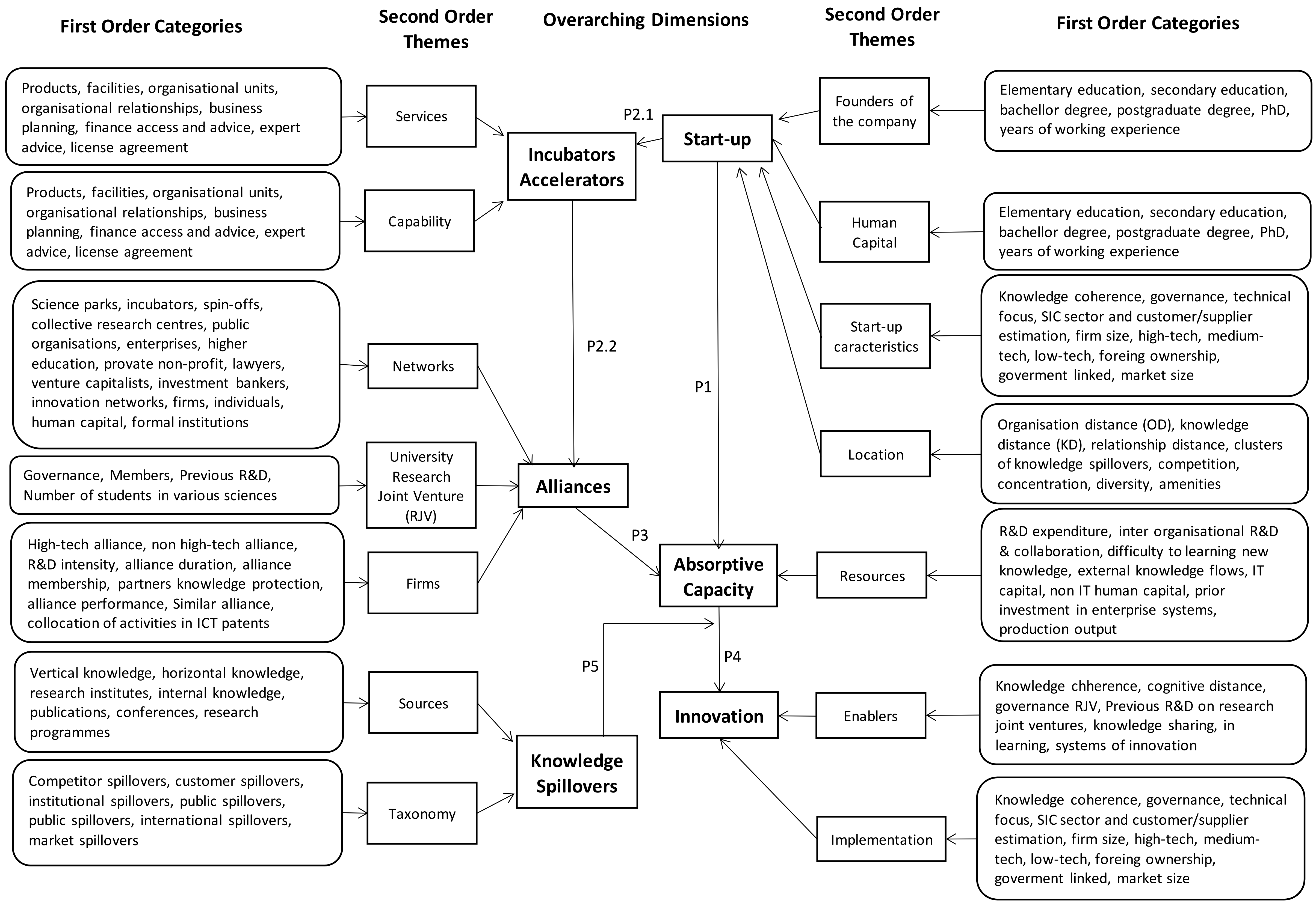


Figure 3.6 - Knowledge Spillover Effects on Start-ups – qualitative conceptual model (KST-QLCM).

3.5. Discussion of main themes

3.5.1. Start-ups

3.5.1.1. Start-ups Characteristics

The first point is to consider the years evaluating firms, and start-up's survival is linked to their fundamental characteristics when the company was created (Tsvetkova, Thill and Strumsky, 2014). In entrepreneurship, the initial idea comes from the perspective that start-ups developed with the primary intention to implement new unexploited new knowledge or to imitate existing organisations (Audretsch and Lehmann, 2005; Santarelli and Vivarelli, 2007). The analysis of the survival of new firms in the United Kingdom focused on evaluating how competition, unemployment, prices, and living expenses in the city (Helmers and Rogers, 2010). Furthermore, the entrepreneur's number of years is considered an initial indicator of tacit knowledge from the entrepreneur's past experiences (Bouncken and Kraus, 2013).

However, the increase in the number of years of operation since the foundation can reduce companies' chances to be exposed to knowledge spillovers (Amoroso, Audretsch and Link, 2017). The number of sales not asked directly since start-ups just started its development and may not have actual sales (Shu et al., 2014).

The causes of competences and improvement can also depend on the levels of competition and the entrepreneurial culture in European cities with more than 250,000 residents and incumbents currently operating (Audretsch, Belitski and Desai, 2015). The evaluation of knowledge spillovers and firms' survival depends on the agglomeration effects that cities cause on the creation of new start-ups (Greenstone et al., 2016). These are interrelated to the access to investment and capital, the effects of competition on high technology companies, and access to individuals with an entrepreneurial culture that enables ICT access and collaboration un an urban location (Narula and Santangelo, 2009; Renski, 2009; Wyrwich, 2014; Greenstone et al., 2016).

The development of the startup's life cycle focuses on the first two initial stages of the company's development. This cycle is compromised by its initial product conceptualisation and start-up activities, all as the seed state, the growth of the venture, the stabilisation of the business, diversification of the product, renewal, and final decline (Cantù, 2017).

The firm's size also enables the opportunity to survive and involve in patents if the start-ups have more than three employees who also depend on the type of industry and the product lifecycle (Tsvetkova, 2015). However, to exploit this process, it is necessary to highlight that the founders and co-founders' background can also influence the start-up's strategies that lead to success or failure. The intensity of capital investment from venture capitalists and the industrial life cycle enables innovation and increases survival chances (Tsvetkova, 2015). Thus, start-ups in the early stages have a higher opportunity to innovate and create and disrupt the market (Beugelsdijk, 2007).

The number of employees also enables companies to boost alliances and enhance creative construction (Shu et al., 2014). However, the number of employees doesn’t necessarily influence on R&D activities. Moreover, the diversity of individuals allows the combination of knowledge that, with cooperation, leads to innovation (Nieto and Quevedo, 2005).

The type of industry and the perception of the entrepreneur on the market enables to evaluate the potential on expanding on the capital intensity and the interactions that the company has with other sectors, companies, institutions, and their approach to the market (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Tsvetkova, Thill and Strumsky, 2014). The type of industry can also provide insights into possible patents' use or implementation (Helmers and Rogers, 2010). This section seeks to uncover the level of technological knowledge used from the company and if it is linked to spinoff development from previous companies (De Figueiredo, Meyer-Doyle and Rawley, 2013). The sector also further influences the company's capabilities regarding its number of employees incorporated into the company (see figure 3.7) (Audretsch, Belitski and Desai, 2015).

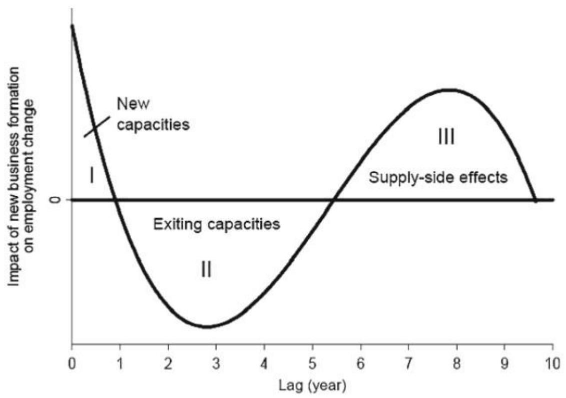


Figure 3.7 - Creation of job opportunities form new companies based on Audretsch & Belitski et al., (2018).

The aim is to determine the type of industry the company is involved in, categorised by the Standard Industrial Classification (SIC) (Helmers and Rogers, 2010). The assessment is relevant since entrepreneurs may interact with other individuals, universities, start-ups, or companies (Woodward, Figueiredo and Guimarães, 2006; Narula and Santangelo, 2009).

3.5.1.2. Founders of the Company

These conditions influence the creation of a new firm and depend on their first team or collaborator to start a new business and allocate in regions that are heavy on the nature of knowledge (Audretsch and Lehmann, 2005; Audretsch, Dohse and Niebuhr, 2010). The academic and technical experience dictates if the entrepreneur will perform in markets that are profitable or uncertain (Nielsen, 2015). Also, the entrepreneur's background and the characteristics of the initial spinout would most likely focus on exploiting knowledge spillovers and access to resources through networks from academia or the industry (O’Gorman, Byrne and Pandya, 2008; Cantù, 2017).

For example, academics are most likely willing to start a company to continue publications, expand knowledge, and obtain funding universities. Collaboration with University-based technology transfer offices (TTOs) would lead entrepreneurs to enter a less profitable industry (Rothaermel, Agung and Jiang, 2007; O’Gorman, Byrne and Pandya, 2008). On the other hand, the founders with more years of entrepreneurial experience are more likely to be part of highly profitable industries with a lower level of uncertainty about the market (Nielsen, 2015).

The nationality of CEOs and the localisation of the company are fundamental for the companies' selection process that will be part of this research study. This process's selection focuses on access to diverse type of knowledge and resources, such as human capital (Desrochers, 2001). It is essential to consider the background of the initial founder and the possible effects or highlights of the background and initial experience of the company's initial founders (Amoroso, Audretsch and Link, 2017).

Age and nationality are considered subjective indicators and used as pushing factors to evaluate companies' creation and economic growth on quantitative analysis (Vivarelli, 2004). However, these indicators can highlight what preferred sources of knowledge chosen from the CEOs, and most importantly, determine when the entrepreneur decided to start a new company (Audretsch and Stephan, 2006; Amoroso, Audretsch and Link, 2017). Also, the entrepreneurial and cultural diversity of knowledge can negatively affect the development of new companies. However, start-up’s creation is enhanced by individuals' cultural diversity, which depends on their traditions and habits (Audretsch and Keilbach, 2007a; Audretsch, Dohse and Niebuhr, 2010).

3.5.1.3. Location

The development of entrepreneurship started in the United States and caused growth and trend of sustained start-ups raised in the United Kingdom even after the recession (Stuetzer et al., 2017). In particular, London is considered one of the entrepreneurial systems that facilitate opportunity recognition, which is bounded by geographical boundaries and is highly diverse regarding the city's population (Rodríguez-Pose and Hardy, 2015; Audretsch and Belitski, 2017).

The location enables the creation of start-ups through spinoffs from different companies and academia, sharing knowledge with other organizations towards product and process enhancement (O’Gorman, Byrne and Pandya, 2008; Wennberg, Wiklund and Wright, 2011; Hervas-Oliver, Lleo and Cervello, 2017). Therefore, it is expected that high-tech start-ups locating in big cities enable them to have closer access to customers, enhances the growth opportunity, but also increases failure due to competition. The company's location also boosts access to tacit knowledge from cultural diversity from the mobility of human capital (Audretsch, Dohse and Niebuhr, 2010; Helmers and Rogers, 2010).

The literature states how the growth of high-tech start-ups in an urban location such as London can have an initial impact on start-ups' success or fall in the process of creative destruction (Santarelli and Vivarelli, 2007; Renski, 2017). Thus, entrepreneurs need to have the start-up's ability to continue innovating while being able to survive with limited economic resources and intense competition (Arrow, 1972; Santarelli and Vivarelli, 2007; Lasch et al., 2013). Overall, start-ups decide to locate in the urban core to have access to investment from Venture Capitalists and the capital intensity in the market (Tsvetkova, Thill and Strumsky, 2014). The new companies can also seek to imitate current products or services, which use knowledge spillovers to create a business from a previously started business or alliances (Santarelli and Vivarelli, 2007; Shu et al., 2014).

A company's location also enables the start-up to be close to a variety of knowledge spillovers from other companies (Colombelli, 2016). Such access to knowledge should enable the company to engage with customers and human capital depending upon the entrepreneurial absorptive capacity (Nieto and Quevedo, 2005). Proximity allows obtaining free resources such as students from universities and academic research generated from universities and institutions (Kirchhoff et al., 2007).

Choosing the company's location can be influenced by socio-economic characteristics that can either facilitate or reduce the capture of knowledge spillovers. For instance, economic indicators such as unemployment in the location, the Growth per Capita, and social diversity can indirectly affect start-ups (Lasch et al., 2013; Colombelli, 2016). For instance, unemployment and low development of a city can influence new companies' creation and the establishment of innovative start-ups. The access to capital and other support networks such as investment bankers and lawyers can be considered a cluster of knowledge spillovers accessible through incubator and accelerator programmes (Desrochers, Kenney and Patton, 2009).

Thus, start-ups are exposed to high-growth potential, increased chances of failure, and chances of survival based on the company’s site's distance to the core centre of the city (Renski, 2017). The differences for start-ups to locate are illustrated in table 3.1.

Table 3.1 - Areas for the location of start-ups, based on Renski et al., (2018)

	Urbanised area	Urban clusters	Rural
Central city	**Urban Core**	**Small city**	**Rural metropolitan**
Outside Central city	**Suburban**	Small city	Rural metropolitan
Nonmetropolitan	**Small city**	Small city	Rural nonmetropolitan

The parent company or institution was the entrepreneur working acts as an initial indicator that companies in high-tech decide are created from these companies' spinoff or from the possibilities to access these resources (Lasch et al., 2013; van Oort and Bosma, 2013). The decision to locate in the urban core is different from manufacturing companies, which establish their headquarters in areas that reduce transportation costs on the supply chain and develop patented knowledge to protect from competitors (Helmers and Rogers, 2010; Audretsch, Huelsbeck and Lehmann, 2012).

The research in this area must consider the context of the type of industry and start-ups' location to develop an initial evaluation. Thus, companies and R&D activity agglomerations conducted among similar or different types of industries (Beugelsdijk, 2007; Ellison, Glaeser and Kerr, 2010). The location is essential as it sets the founding to access human capital and facilitates proximity to knowledge sources (Korosteleva and Belitski, 2017). This initial evaluation involves the date of attendance to accelerator programmes, and the number of directors and employees (Nieto and Quevedo, 2005).

3.5.1.4. Human Capital

Knowledge spillovers are generated from new or existing knowledge from the entrepreneur for academic, a company or previous experience, enabling the creation of start-ups and economic knowledge. The conjunction of organisations in an urban area facilitate access to skilled human capital, access to a broader market, and the access to knowledge spillovers at a lower cost (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Audretsch, Belitski and Desai, 2015; Hervas-Oliver, Lleo and Cervello, 2017). enables the creation of information that facilitates economic growth caused by R&D conducted by incumbents (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011).

In the case of the level of education of members of the start-up, the literature suggests that it may not affect the development of regions and is not dependent on the market size (Audretsch, Belitski and Desai, 2015). It even raises de discussion to assess if the academic qualifications of entrepreneurs in high-tech start-ups operating in an urban area have the same on a different level of performance than non-academic entrepreneurs (Nielsen, 2015). The company must invest in R&D facilitates to enhance innovation processes and capture knowledge spillovers from the team members. These operations have to consider possible time in commuting to the location, which can be viewed as a restricting variable (Beugelsdijk, 2007).

It is important to note that how knowledge is captured depends on the absorptive capacity of the team. For instance, the skillset and human capital allocated to solve technical and systems processes (Stam, 2013; Qian and Jung, 2017). The hiring of skilled human capital may change the effects on team development to the start-up (Audretsch, Dohse and Niebuhr, 2010). This assessment will develop further to understand how knowledge is shared in start-ups (Qian and Jung, 2017).

The main implications to be taken into consideration are if CEOs consider cultural and sectoral diversity on the company's surroundings as a positive or negative effect their company (Audretsch, Dohse and Niebuhr, 2010). The number of employees can change depending on the competition level that the company faces in the first years of operation (Fritsch and Changoluisa, 2017). Thus, the research must evaluate if entrepreneurs consider hiring members from other start-ups or engaging in potential alliances to share knowledge and resources to innovate to overcome obstacles (Ellison, Glaeser and Kerr, 2010; Bouncken and Kraus, 2013).

The discussion on the founder of the company, initial characteristics of the start-ups, human capital and location of the company enabled to state the following propositions:

Proposition 1. Start-ups' initial number of employees, type of industry and background of the founding members influence its absorptive capacity. The initial foundation establishes the competence to exploit new knowledge and implement strategies and technology to conceptualise profitable products and develop patents.

Proposition 2.1. Start-ups can choose to attend incubator and accelerator programmes in urban cities located in entrepreneurial ecosystems. Start-ups face competition and high operational costs to access resources from universities and companies. The company's development depends upon obtaining funding from investors and financial institutions and engagement with the market.

3.5.2. Incubators and Accelerators

3.5.2.1. Services

New companies created outside of academia can be influenced by the number of high-tech companies located in Greater London, creating a similarity of high-tech services oriented to satisfy the needs of that market and to use complementary technological knowledge (Lasch et al., 2013; Colombelli, 2016). This formation also supports incubator and accelerator programmes in the area that facilitate access to experts in the field and platforms to share knowledge (Colombelli, 2016).

Incubator and accelerator programmes offer an initial step stone for the companies' development and validate their business models and confirm that the start-up has a Minimum Viable Product (MVP) (Bandera, Bartolacci and Passerini, 2016; Cohen et al., 2017). The substantial research on the effects of technology and university incubators in highly developed cities and being presumably considered an entrepreneurial ecosystem (Rothaermel and Thursby, 2005; Audretsch and Belitski, 2017; Malecki, 2018).

It is essential to mention the difference between incubators and acceleration programmes. An accelerator is a time-bounded programme, were entrepreneurs attend and structured in cohorts to receive training and mentorship, which culminates on a presentation to obtain funding (Cohen et al., 2017). On the other hand, business incubators on new firms are focused on helping new firms to survive, were companies share an open space to receive training, support, and a provision of networks (Vanderstraeten, Matthyssens and Campus, 2004).

3.5.2.2. Capability

Incubator and accelerator programmes promote events serve as a shared space where knowledge spillovers and resources can be captured and exploited (Nonaka, 2008; Bandera, Bartolacci and Passerini, 2016). This location sets them to distinguish to what extend knowledge spillovers can differ from knowledge management (Bandera, Bartolacci and Passerini, 2016). This discussion considers evaluating how incubator and accelerator programmes affect the start-up’s performance, such as survival, growth, and profitability (Vanderstraeten, Matthyssens and Campus, 2004).

These processes also include how these programmes enable the achievement of short and long-term goals for the company, and the support received from venture capitalists and angel investors (Audretsch and Belitski, 2017; Hausberg and Korreck, 2017). Knowledge spillovers measurement is different for university incubators' research, as the development of start-ups and motivations aligns with research and academic publications and reputation (O’Gorman, Byrne and Pandya, 2008). Knowledge spillovers transfer include mechanisms such as the movement of human capital, contact with universities, and the use of research papers (Rothaermel and Thursby, 2005; Amoroso, Audretsch and Link, 2017).

Knowledge spillovers generated from start-ups can attract incumbents or customers from foreign companies to form alliances or obtain financial resources (Clarysse et al., 2005; Fritsch and Changoluisa, 2017). These processes have a different effect on expanding knowledge sharing with other organisations outside the country by exporting products or providing services (Fritsch and Changoluisa, 2017).

Additional resources obtained in incubator and accelerator programmes are tangible products, facilities to enable the start-up's operation, organisational units and the corporate relationships (Cantù, 2017). Thus, entrepreneurs should identify the most critical contacts with organisations that enabled access to knowledge and inputs that dramatically affected the innovation for start-ups (Lockett and Wright, 2005). The discussion on the services and capacity of incubator and accelerator programmes led to the development of the following proposition:

Proposition 2.2. Incubators and accelerator programmes facilitated access to experts in the field and shared platforms to develop and validate a minimum viable product. Entrepreneurs should attain financial stability and growth through entrepreneurial opportunities to engage in local and international markets. The shared spaces facilitate the flow of knowledge spillovers that enables start-ups to form alliances companies and corporations.

3.5.3. Alliances

3.5.3.1. Networks

The CEOs' previous job position initially influences the possible identification of knowledge spillovers before starting the company. If the entrepreneur came from academia, the motivation to create the company is supported by increasing reputation from the research by obtaining funding for expanding current academic knowledge. Alternatively, the entrepreneur's goals can be centred to attain an economic return (Audretsch and Stephan, 2000a). These spinoffs are applicable if the researcher has been operating under a post-doctoral position or academic research role that enabled identifying exploitable new knowledge. For that matter, the economic agent that decides to venture on creating a new company will consider if the identified idea has the potential to exceed the monetary value compared to working from the industry (Vivarelli, 2004).

The spinoff that occurs in the same region come from incumbents, located in London (Fritsch and Changoluisa, 2017). This process enables start-ups to exploit knowledge and networks from these organisations to remain competitive and enter the market. It may explain the potential access to knowledge absorption their performance in the following years of operation (De Figueiredo, Meyer-Doyle and Rawley, 2013). Spinoffs connect as an initial identification of knowledge spillovers capture mechanisms, as the company could be expanded from a previously tools and methodologies used by incumbents and the opportunity to engage in joint ventures to engage in continuous co-operation (Hervas-Oliver, Lleo and Cervello, 2017).

Investment in R&D is directed for hiring human capital with an adequate skill set and capability to adapt technological features on products and services to continue innovating (Nieto and Quevedo, 2005). These depend on the number of employees, the intensity and the R&D resources devoted to focusing on the product development, and possible exportation to other markets (Beugelsdijk, 2007; Fritsch and Changoluisa, 2017). Furthermore, employees' background and qualifications depend on the start-ups focused on technology, development of services, or entirely high-tech (Audretsch, Dohse and Niebuhr, 2010). The difference between the two first scenarios and high-tech and the other types is directing to hire employees focused on R&D. Still, companies on services do not perceive positive outcomes from recruiting highly qualified employees.

Thus, companies with a direction of Total Entrepreneurship Activity (TEA) may be companies in the early stages have a negative relationship towards education and degrees. In contrast, owner-managers of a new business older than three years have a definite relation to universities (Stam, 2013). The types of entrepreneurial activity are illustrated in table 3.2.

Table 3.2 - Types of entrepreneurial activity, based on Stam et al. (2013).

	Phases in the entrepreneurial process	
	Recognition of an entrepreneurial opportunity	**The pursuit of an entrepreneurial opportunity**
With an independent business	TEA: Nascent entrepreneurship	TEA: Owner-manager of new business
Within an established organisation	EEA: Employee leading idea development for new business activities	EEA: Employee leading the exploitation of new business activities

Start-ups can expand their connections through networking events and establish alliances with companies (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Schmidt, 2015; Sedita et al., 2017). The evaluation of knowledge spillovers in alliances comes from identifying possible traces of competition that can act as a catalyst from maintaining the survival of start-ups towards incumbents (Acs., 2010; Bouncken and Kraus, 2013).

Entrepreneurs maintain previous networks, and to focus on the potential identification of human capital and suppliers that lead to knowledge spillovers (Woodward, Figueiredo and Guimarães, 2006). Therefore, entrepreneurs' previous training and experience can lead to exploit access to knowledge spillovers through open innovation, information technologies, and access to international knowledge through the use of virtual platforms (Huang et al., 2012; Del Giudice, Carayannis and Maggioni, 2017).

3.5.3.2. University Research Joint Venture

The KSTE emphasises how joint ventures from academia to stimulate R&D in start-ups (Audretsch and Link, 2017). Start-ups can innovative by engaging in alliances between companies to create patents and explore the marker (Backman and Loof, 2015). Research has examined though case studies to identify the flow of knowledge spillovers. In addition, entrepreneurs exploit previous networks from contacting members from the industry (Connell, Kriz and Thorpe, 2014; Hervas-Oliver, Lleo and Cervello, 2017). Now, knowledge spillovers research explores actors involved start-ups that shared knowledge while attending incubator programmes (Cantù, 2017).

Start-ups may be interacting with local entrepreneurs and companies from the same or different industries (Hervas-Oliver, Lleo and Cervello, 2017). These can extend to connections that can come from the industry and academia, which would enable to capture a different form of knowledge collection (Cantù, 2017). Thus, start-ups establish connections with potential suppliers, customers, and members from the government that can provide insights and knowledge that supports the development of the company (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Finally, the exchange of knowledge from human capital in collaboration with universities is conducted by recruiting students willing to work on start-ups without monetary value (Baptista and Mendonça, 2010).

3.5.3.3. Firms

Knowledge spillovers can be obtained from various layers depending on the networks. The first layer contained in the context of the research is the incubator and accelerator programmes. The second layer comes from networking events conducted in Greater London, or other entrepreneurial ecosystems perceived by the entrepreneurs. A final third layer occurs on virtual platforms and engagement with international organisations (Audretsch and Belitski, 2017; Cantù, 2017). Hence, knowledge spillovers capture involve processes in start-ups were employees and CEOs decide to engage in continuous innovation by maintaining interactions that start networking events (Wong, Lee and Foo, 2008).

Entrepreneurs seek to stipulate an initial value of the business idea by conducting research in the market and asking experts (O'Gorman, Byrne and Pandya, 2008; Ko and Liu, 2019). Such evaluation can be supported by incubator or accelerator programmes through access to IT and ICTs (Nicolopoulou et al., 2016). Thus, networking events can prove to be an invaluable source of knowledge for start-ups (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Hayter, 2013). Also, entrepreneurs seek information from third parties such as actors regarding regulations from lawyers and financial institutions (Desrochers, Kenney and Patton, 2009).

This initial perception of competition can start with the entrepreneur by identifying what technologies have been developed by incumbents that created spinoffs (Wong, Lee and Foo, 2008). The absorptive capacity of the start-ups involved in the process and the extent of knowledge protection in alliances and involvement in Equity Joint Ventures (EJV) (Shu et al., 2014). The process will identify if competition forces entrepreneurs to engage in radical innovation (Bouncken and Kraus, 2013).

Start-ups aims for establishing potential alliances and extend to processes of knowledge sharing with other businesses. The first characteristic is identifying if the companies in the partnership are from a similar or different type of industry (Narula and Santangelo, 2009). Such collaborations nurtured with entrepreneurs within the accelerator programme, or outside of it (Wong, Lee and Foo, 2008; Cantù, 2017). These alliances reflect on an increased performance of the start-up by sharing and protecting technological knowledge spillovers (Narula and Santangelo, 2009; Shu et al., 2014). The process is constrained to a single point which is the entrepreneur's ability to engage in networking events (Audretsch and Lehmann, 2017).

However, knowledge spillovers can be harmful as an appropriation of information from another company is considered a form of knowledge leakage (Hayter, 2013; Ferenhof et al., 2016). Identifying this potential threat, motivates start-ups to secure knowledge through the application of technological tools (Acs., 2010). On the other hand, knowledge sharing limitations could be nullified by the entrepreneurial ecosystem culture (Audretsch and Belitski, 2017).

The discussion of the start-up's engagement with networks and the development of alliances and partnerships led to state the following:

Proposition 3. The founders established network capital leads to alliances with universities and companies to enhance start-ups absorptive capacity. The engagement with academia leads to research joint ventures to develop patents, engage with the government, and develop research with students' support. Alliances with companies and third parties aim to share and protect technological knowledge and tools through equity joint ventures to compete in the market.

3.5.4. Absorptive Capacity

3.5.4.1. Resources

The development of the initial ideas to start a new company depends on the experience CEOs to support the new company's development. At one point, the entrepreneur can use previous knowledge of innovation to implement learning by evaluating outcomes and developing new products (Nieto and Quevedo, 2005). This application involves companies' practices to allocating a budget or some employee hours spent on R&D (Nieto and Quevedo, 2005).

The development of start-ups depends on the innovation activities and the technological environment that promotes research and innovation (Nieto and Quevedo, 2005; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). This exposure to the process and identifying the idea leads the entrepreneur to start the new venture and locate in the proximity to universities, incubators, accelerators, and STPs (Audretsch and Lehmann, 2010). However, these actions depend on the type of industry and company that the entrepreneur used to work. Previous experience also influences the high-tech start-up's decision to locate in an urban location (Lasch et al., 2013).

Entrepreneurs also interact with each other and to glance if the perceived competition or reduced absorptive capacity prevents the sharing of knowledge spillover capture (Schmidt, 2015). These processes would consider expanding on geographical and cognitive proximity mechanisms between the entrepreneurs to capture opportunities (Nonaka, 2008; Backman and Loof, 2015; Bandera, Bartolacci and Passerini, 2016).

Start-ups can also acknowledge that innovation is conducted by integrating similar sets of knowledge (Desrochers, 2001). First, diversity initially on the development of the KSTE as the difference between companies and industries (Colombelli, 2016). This approach states how start-ups engage in innovative endeavour caused by collecting different kinds of knowledge tested by patent citations (Markovitch, O'Connor and Harper, 2015; Colombelli, 2016).

Start-ups have considered that cultural diversity in cities enables start-ups to employ human capital from different backgrounds (Rodríguez-Pose and Hardy, 2015; Stuetzer et al., 2017). Such resources facilitate the exchange of knowledge with professionals internationally and form possible alliances that can overlap sets of expertise to support product innovation (Bouncken and Kraus, 2013). However, if a location were companies have agglomerated have a very diverse type of knowledge, it can cause an overall negative or neutral effects on start-ups creation and innovation process (Lasch et al., 2013; Ghio, Guerini, E E Lehmann, et al., 2015).

Start-ups also interact with other organisations through face-to-face or virtual meetings, leading to an adverse effect of knowledge spillovers (Qian and Jung, 2017). This query can evaluate if face-to-face interactions can evolve capture international knowledge from foreign countries using ICTs (Petruzzelli, Albino and Carbonara, 2008; Acs., 2010; Ho, Kauffman and Liang, 2011; Cantù, 2017). Thus, the firm's human capital will dictate its absorptive capacity capabilities and its probability to continue staying in business (Tsvetkova, Thill and Strumsky, 2014).

The discussion of absorptive capacity on access to resources and effects on innovation is stated as follows:

Proposition 4. Start-ups invest R&D budged and resources to hire highly skilled human capital and carry on projects with companies in alliances and share knowledge to increase the company's performance. Entrepreneurs seek to integrate diversified technological and cultural knowledge to implement innovation initiatives using information technologies. The processes involve the development of patents and products for customers.

3.5.5. Knowledge Spillovers

3.5.5.1. Sources

The capture of knowledge spillovers is driven by the focus on setting up regions' technological progress through the improvement of products and processes (Acs et al., 2012). The formation of a cluster of companies, universities, and other organisations acts as a provider of knowledge for start-ups that can be dependant to a geographical or a cognitive distance (Connell et al., 2014). Thus, the different sets of individuals, stakeholders, and companies spillover technological knowledge, marketing knowledge, and international knowledge (Cantù, 2017).

The process of knowledge spillovers absorption evaluation and implementation is evaluated from the motivation that the entrepreneur is developing to start a new company. The previous setting enables economic agents to develop as a conduit to use unexploited knowledge and enter the market (Korosteleva and Belitski, 2017). Thus, innovation depends on the technological environment's level and legal regulations to support start-ups and the social values and norms that allow companies to share knowledge (Nieto and Quevedo, 2005; Korosteleva and Belitski, 2017).

These conditions should enable companies to capture new business ideas, and the amount of knowledge present would push the company to engage on attracting opportunities or participating in a more active R&D process (Nieto and Quevedo, 2005). This initial question and knowledge identification of the product will enable identifying if the company has established innovation processes.

The identification of knowledge can show from other resources and the previous organisation where the entrepreneur is involved. For instance, the drive to identify a business idea can cover the market's needs portrayed in the public domain and knowledge spillovers from suppliers, customers, institutions or competitors (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). This process would help entrepreneurs identify the business idea as it continues progressing through the endogenous creation of knowledge generated from the start-ups (Stam, 2013).

The number of employees that the company has in the company's initial stages can be considered a source of knowledge spillovers (Rothaermel and Thursby, 2005). The idea is to identify the staff's background and how it links to the process of determining the team required in the company to make the company survive while developing an MVP (Rothaermel and Thursby, 2005; Hayter, 2013). This process requires the company to have access to a diverse type of knowledge from the employees and their exposure to the market (Glaeser and Kerr, 2009; Hayter, 2013; Rasmussen and Tanev, 2015).

Tacit knowledge from entrepreneurs can also support the decision to locate in an incubator and accelerator programme that facilitates innovations processes and knowledge exchange between start-ups (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Nicolopoulou et al., 2016).

The continuous development of the business idea falls into the valuation of the company and the business idea. This process is supported by teams on incubator or accelerator programmes and human capital capable of exploiting knowledge from the industry and the market (Markovitch, O'Connor and Harper, 2015). This process would consider the direct engagement with the customers to capture knowledge spillovers that enable to adapt the product to generate value to the customer and transforms into technological knowledge (Yan, Khoo and Chen, 2005; Markovitch, O'Connor and Harper, 2015).

The development of the product or service is facilitated by creating a business plan and establishing connections with customers (O'Gorman, Byrne and Pandya, 2008). CEOs' experiences lead to decide if the business idea has enough value to leave a secure job position or to leave unemployment and to identify if the timing to enter the market is right (Audretsch and Keilbach, 2007a; Audretsch, Dohse and Niebuhr, 2010).

This choice is highly dependent on the high-tech industry's life cycle, which is, in most cases, has a high innovation pace (Audretsch and Keilbach, 2007a). Such evaluation has been considered on contrasting companies created from academia and the industry. However, the focus on knowledge spillovers' effects on this research focused on the high-tech sector (Wennberg, Wiklund and Wright, 2011).

3.5.5.2. Taxonomy

This section focuses on identifying initially a taxonomy of knowledge spillovers definitions collected from the literature. The literature discussion enables to support the research objective to explore the nature of knowledge spillovers (Agarwal, D B Audretsch and Sarkar, 2010). The primary characteristics that make knowledge spillovers are:

- **It is an informal transference of knowledge between the members involved in the process.**
- **The knowledge creator does not obtain a direct value or benefit from the knowledge created.**
- **Knowledge spillovers are under-compensated and are don't have a monetary value paid to the creator of knowledge to capture it.**

Knowledge can come on *tacit* or *explicit* form and continuously transforms through the interactions between companies or individuals on a geographical or virtual environment (Nonaka, Toyama and Konno, 2000; Bandera, Bartolacci and Passerini, 2016). Explicit knowledge is considered *codified* and is present in sets of published material, papers, books and excludable knowledge (Acs., 2010).

Tacit knowledge comes from previous experiences and information exchange that entrepreneurs capture and implement (Acs., 2010). This form has roughly expressed as *geographical spillovers* bounded to proximity and *R&D Spillovers.* The later and has given further definitions such as *intersectoral knowledge spillovers* (Zvi Griliches, 1992; Verspagen, 1997; Nieto and Quevedo, 2005). For research and development, two main types are *pure knowledge spillovers* which are research ideas borrowed from the industry (Zvi Griliches, 1992; Verspagen, 1997).

In particular, patented information considered as a form of *public spillovers*, which captured from patents and databases (Belderbos et al., 2004; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). This definition further extends to the understanding of *local knowledge spillovers,* including innovative high technology measurements that generate *agglomeration spillovers* of knowledge in locations with the same development of technology (Woodward, Figueiredo and Guimarães, 2006; Greenstone et al., 2016).

The definitions of knowledge spillovers have expanded aside from geographical proximity. The transfer of *technological knowledge spillovers* between companies carried through patents (Verspagen, 1997). This type of information relevant innovation activity in the market. The capture of technological knowledge spillovers depends on the innovative effort and absorptive start-ups' capacity (Nieto and Quevedo, 2005).

University or institutional knowledge spillovers are captured at a reduced cost from academia from the movement of students or graduates to companies, published academic papers or research (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Amoroso, Audretsch and Link, 2017). Knowledge is accessible from the chain of value, which is the contact that start-ups have with stakeholders in their supply chain. Thus, interactions between companies led to identifying other taxonomy defined as *competitors, customer, institutional, and supplier knowledge spillovers* (Belderbos et al., 2004; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Stejskal and Hajek, 2015). These knowledge flows can also include the transportation of products or materials that fall under the category of *intellectual spillovers* or *rent spillovers* (Glaeser and Kerr, 2009; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). The sources of knowledge spillovers illustrated in table 3.3.

Table 3.3 – Sources of knowledge spillovers, reference from Amoroso et al., (2017).

Sources of knowledge spillovers	**Category**
Clients or customers	Vertical
Suppliers	Vertical
Competitors	Horizontal
Public research institutes	Research institutes
Universities	Research institutes
External commercial labs/R&D firms/technical institutes	Research institutes
In-house know-how	Internal
Trade fairs, conferences, and exhibitions	Publications
Scientific journals	Publications
Funded research programmes	Research programmes

A final classification based on interactions in companies is defined as vertical knowledge spillovers, which is all information from a different industry and *horizontal knowledge spillovers* obtained from companies in the same industry. Suppose the information proceeds from a source that is part of a similar initiative for a start-up and focused on innovating products and processes (Wong, Lee and Foo, 2008; Narula and Santangelo, 2009; Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). knowledge can include the know-how information on developing the company or supporting data from other institutions such as law firms (Desrochers, Kenney and Patton, 2009; Amoroso, Audretsch and Link, 2017).

Research on information and software have extended the understanding of the capture of knowledge spillovers through the internet. These affirmations include university knowledge spillovers obtained through digital publications in journals (Rothaermel and Thursby, 2005). More specific technical knowledge involved in the process that information technologies and the mechanisms used to capture it is *IT knowledge spillovers,* which include the identification of data and the implementation of ICTs (Ho, Kauffman and Liang, 2011; Huang et al., 2012; Lasch et al., 2013; Castro Soeiro, Santos and Alves, 2016).

The knowledge that is technical or managerial from outside the regional boundaries is considered international spillovers, which is exogenously developed and depends on international openness to information (Ho, Kauffman and Liang, 2011; Cantù, 2017). The cultural diversity of human capital facilitates access to knowledge spillovers, which can influence the decision of a start-up to collocate in a reduced distance from the leading companies (Audretsch, Dohse and Niebuhr, 2010; Ellison, Glaeser and Kerr, 2010; Amoroso, Audretsch and Link, 2017). Finally, knowledge defined from later qualitative research on incubators perspective has been classified as *technological, marketing spillovers,* which falls under *entrepreneurial knowledge spillovers* (Cantù, 2017).

The discussion on the sources and taxonomy of knowledge spillovers led to the development of the following:

Proposition 5. Start-up's absorptive capacity enables entrepreneurs to evaluate knowledge spillovers and decide to establish the company and conduct a valuation of the business idea. Entrepreneurs engage with companies in the supply chain to determine the most appropriate processes required to innovate.

3.5.6. Innovation

3.5.6.1. Enables

The interaction between companies and entrepreneurs establishes entrepreneurial ecosystems' development in cities and communities (Audretsch and Belitski, 2017). Such agglomerations would expose start-ups to a diverse set of human capital that can be hired for commercial purposes and combine knowledge from professionals working in foreign countries (Stuetzer et al., 2017).

Sharing knowledge and collaborating or form alliances on joint R&D projects with other organisations enable to influence the innovation process (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). These processes would be allowed in the actors are located in geographical proximity or if the companies form part of technological core business in a particular high-tech sector (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). It is important to evaluate an environment such as an open space, incubator, or accelerator programme and an additive impact on start-ups and involve a higher level of R&D (Markovitch, O'Connor and Harper, 2015).

The cause expected to enhance exploitative discovery of knowledge spillovers based on the assumption that accelerator programmes promote this behaviour. Thus high-tech start-ups focus more on exploiting existing products on Business to Customer (B2C) (Markovitch, O'Connor and Harper, 2015). This process can also be more predominant depending not entirely on the number of employees or positive sharing of *knowledge spillovers* on a tacit form, but on the incentive that a competitive environment enables to the start-ups (Beugelsdijk and Mudambi, 2013).

3.5.6.2. Implementation

The investment and operations on R&D affect start-ups recognition of technological opportunities by using knowledge spillovers as an input (Nieto and Quevedo, 2005). These endeavours are directed by engaging with customers through surveys, subcontracting human capital, acting as a supplier for other high-tech companies, and assessing how competitors are operating in the market (Nieto and Quevedo, 2005). The innovative effort and absorptive capacity enforce innovation. However, the effects of knowledge spillovers have to be tested in this relationship, as it depends on the ability of the entrepreneur to exploit knowledge spillovers the high-tech sector (Fritsch and Changoluisa, 2017). The endeavours can lead to possible exposure to new knowledge created from developing new emergent research and technological breakthroughs (Audretsch and Lehmann, 2005).

The allocation of R&D budget and resources in the early stages can differ and be misleading. In a sense, accelerators, incubators, STPs, universities and other intermediates are actors that can facilitate viable mechanisms to collect knowledge spillovers (Spithovenm and Knockaert, 2012). These institutions can act as an intermediator to provide such tools to start-ups. Thus, business-oriented companies use ICTs that enable the sale of products locally (van Oort and Atzema, 2004; Lasch et al., 2013). Companies' agglomeration enables start-ups to use technological tools acquired from companies, joint ventures and subcontracting to integrate information (Schmidt, 2015; Hervas-Oliver, Lleo and Cervello, 2017).

Start-ups consider the presence of large companies to access the market, entrepreneurial expertise, and knowledge spillovers (Lasch et al., 2013). This perception can go one step beyond to indicate that entrepreneurs may not be aware of the other advantages and disadvantages that the city core has on their company such as unemployment, taxes, or the city's infrastructure (Lasch et al., 2013).

Business-related knowledge consists of the know-how on how to market products and services, manage companies, or improve manufacturing processes (Agarwal, D B Audretsch and Sarkar, 2010). Organisations briefly consider this notion of knowledge spillovers as a conduit of innovation can have different effects on product and process innovation (Nieto and Quevedo, 2005; Greenstone, Hornbeck and Moretti, 2010).

All knowledge flows of knowledge exploited on the presence of industrial clusters and entrepreneurial ecosystems located in geographical proximity (Desrochers, Kenney and Patton, 2009; Audretsch and Belitski, 2017). Thus, identifying types of knowledge spillovers has been extending in the area of start-ups, incubators, and sources of knowledge (Amoroso, Audretsch and Link, 2017; Cantù, 2017).

R&D activity considers the intensity that the company has on innovation and new patents' creations (Beugelsdijk, 2007; Shu et al., 2014). The use of these indicators had an initial problem that can mislead the identification of knowledge spillovers. Its nature is sticky and doesn’t always reveal the effects or innovative efforts (Arrow, 1972; Zvi Griliches, 1992). Also, the creation of patents mostly occurs in companies with previous years of experience and interact with other organisations such as STPs, while patents get reduced when start-ups are developed with universities (Petruzzelli, Albino and Carbonara, 2008; Squicciarini, 2009).

3.6. Conclusions

Chapter III focused on developing the knowledge spillovers effects on start-ups qualitative conceptual model (KST-QLC). An initial description of the research design enabled to discuss the main theories linked to the flow of knowledge spillovers on entrepreneurship. Absorptive capacity highlights the importance of developing and implementing new knowledge by implementing technological tools and mechanisms that must be uncovered (Nieto and Quevedo, 2005; Ghio, Guerini, E E Lehmann, et al., 2015; Qian and Jung, 2017). The process involves entrepreneurial decisions to leave a stable job. The founder of the company also must decide to locate the start-up in a setting that facilitates the access to resources and reduces risks such as incubators or accelerators (Woodward, Figueiredo and Guimarães, 2006; Santarelli and Vivarelli, 2007; Wong, Lee and Foo, 2008; Nicolopoulou et al., 2016).

The theory also stipulates the importance of geographical proximity to gain access to sources of knowledge and networks (Cantù, 2017). However, the literature provided insights that entrepreneurs also need to establish processes to transform tacit and explicit knowledge spillovers (Nonaka, Toyama and Konno, 2000; Qian and Jung, 2017). Hence, start-ups have to engage in physical and virtual spaces to share the knowledge necessary to explore the market and develop alliances (Fritsch and Changoluisa, 2017; Hervas-Oliver, Lleo and Cervello, 2017). Thus, entrepreneurs must invest in R&D in human capital and technology on a period of five to seven years to survive and innovate (Helmers and Rogers, 2010; Bandera, Bartolacci and Passerini, 2016). Most importantly, the theory posits the importance of identifying the events and processes required to implement knowledge spillovers (Hayter, 2013; Cantù, 2017).

Chapter III provided support to evaluate data from start-ups during the first ten years of operation using qualitative data (Dey, 2016). The model enables to identify the initial start-ups absorptive capacity. The process involves the previous experience and networks from entrepreneurial activities, academia, and tacit knowledge of the founder. Afterwards, knowledge spillover events occurring during the attendance to incubators and accelerator programmes, and the engagement with universities, incubators and individuals enable identifying technical designs and customers specifications. The absorption and implementation of tacit and explicit knowledge lead to processes of creative destruction and construction.

The chapter continues with the development of the overarching dimensions and second-order themes of the model. Start-ups start their foundation by identifying unexploited new knowledge that can be used to conceptualise a product or service and enter the market. The founders and initial teams' background, and the type of start-up establish where the company locates, the initial strategies are taken to raise funding, and the engagement with the market. Incubators and accelerator programmes facilitate entrepreneurs to access experts in the filed and virtual platforms dedicated to start-ups. The programmes provide facilities with all the required amenities and reduce operating costs. Also, entrepreneurs can validate a minimum viable product and should be able to access customers and venture capitalists.

The whole process enables start-ups to establish alliances with incumbents and universities. The objective of entrepreneurs is to identify the necessary resources, human capital, tools and methodologies to engage with suppliers, customers, and governmental organisations. Thus, start-ups regularly share knowledge with partners to integrate knowledge spillovers through meetings and use ICTs to develop products and patents in joint projects. The company's operations may have direct or indirect knowledge spillover effects in tacit and explicit form companies in the chain of value or other sources.

The conceptual model Chapter has provided a sound model that guides the development of an interview guide in Chapter IV and discusses the statements of the literature with the collected data from interviews in the analysis of the qualitative analysis conducted in Chapter V.

4. CHAPTER IV RESEARCH METHODOLOGY

4.1. Introduction

Chapter IV provides a discussion of the research methodologies used in this project. The section addresses provide insights to follow a pragmatic philosophical overview and mixed methods approach that support a sequential exploratory approach. For the qualitative phase, the case study research methodology collects interviews from CEOs and founders of companies. The quantitative phase describes the sample of entrepreneurs collected with surveys. The section follows up with the tests and indicators that guide the exploratory and confirmatory factor analysis. The chapter includes a description and measurements of the constructs used in the quantitative model.

4.2. Philosophical Overview

The philosophical overviews guide the researcher to elaborate on the research design, which alights the inclination towards a quantitative, qualitative, or a mixed-methods approach (Creswell, 2014). By definition, philosophical overviews are models that have been developed through time to support researchers, and that has been universally recognised (Kuhn, 1962). The positivism and interpretivism considered as extreme philosophical overviews established through time (Collis and Hussey, 2014).

Positivism ⟷ Interpretivism

Figure 4.1 - A continuum of paradigms, based on Collis et al. (2014)

Positivism is based on defining the effects that cause the change on outcomes; al tends to follow a reductionist approach. Ideas are reduced into variables tested through hypothesis and research questions (Creswell, 2014). Hence, the research comes from a set from a foundation of pre-existing theories and variables (Bryman and Bell, 2015). Is focused on the understanding that absolute truth is impossible to be found, but can be tested through the rejection to fail an established hypothesis by the researcher and backed from an accepted theory (Creswell, 2014).

Interpretivism focuses on understanding social reality, which is subjective and seeks to analyse perceptions. It directs the study to an explorative state of the complexity that leads the researcher to understand the social phenomena (Jesson, Matherson and Lancey, 2011). Fundamental theories cannot be used for understanding the activities undergoing on the transfer of knowledge (Blumberg, Cooper and Schindler, 2014). The paradigm focuses on discussing concepts from the literature and uncovering them through the interaction of the research in social reality (Schwartz-Shea and Yanow, 2012). Thus, interpretivism often leads to the development of new theories based on the researcher's interpretation from the data(Blumberg, Cooper and Schindler, 2014). Table 4.1 shows the main approach of the two paradigms.

Table 4.1 - Approaches and features of the two main paradigms, based on Collis et al. (2014)

Positivism	Interpretivism
Approaches	
Quantitative	Qualitative
Objective	Subjective
Scientific	Humanistic
Traditionalist	Phenomenological
Features	
Use large samples	Use small samples
Have an artificial location	Have a natural location
Be concerned with hypothesis testing	Be concerned with generalizing theories
Productive, precise, objective, quantitative data	Produce ‘rich,' subjective, quantitative data
Produce results with high reliability but the low validity	Produce findings with low reliability but the high validity
Allow results to be generalised from the sample of the population	Allow conclusions to be generalized from one setting to another similar setting.

Both paradigms share approaches that are similar to each other. For instance, the qualitative and quantitative researchers seek to understand the social phenomena through empirical data and build the argument based on them (Sechrest and Sidani, 1995). These approaches and their advantages allow them to understand the concepts of theories at a different level and implement objectivity to test them through hypothesis and propositions.

Pragmatism offers mixed research approaches from positivism and interpretivism (Hoshmand and Lisa, 2003). This philosophical overview uses mixed methods approaches to focus on understanding the research problem (Ivankova, Creswell and Stick, 2006; Creswell, 2014). The principle behind it is to understand the concepts and ideas and their effects on the subject.

A pragmatic philosophical overview is a fitting approach to the nature of the research. It enables us to assess how entrepreneurs perceive knowledge spillovers and concepts, and then teste hypotheses through quantitative techniques. However, the incremental change between research hypotheses instead of an may be considered one weakness of pragmatism that needs to be overcome in the research (Ivankova, Creswell and Stick, 2006). The development of the research design on this chapter follows a developed process model explained as a top-down model, used as a guideline to identify the adequate strategies to implement on the research (see Figure 4.2) (Strang, 2009).

The orientation of research based on the philosophical overview are determined by the selection of **philological assumptions** (Johnson and Onwuegbuzie, 2004; Collis and Hussey, 2014), and leads on how it influences the design strategy and execution, as well as the understanding of terminology (Strang, 2015). The assumptions are of utmost importance, as it allows to clarify the goals, strategies used and the level of analysis (Strang, 2009), The categories of philosophical assumption business and management are Ontology, Epistemology, and Axiology (Strang, 2009) (Strang, 2015). The mixed-methods methodology applies the ontological and epistemological assumptions support assumptions.

Epistemology focuses on the authentication of both qualitative and quantitative knowledge through validation processes for each of the research questions (Collis and Hussey, 2014); which emphasises the construction of the leading research question through understanding acceptance knowledge (Wahyuni, 2012). The epistemology factors enable the connection of terminology between the qualitative and quantitative approaches (Strang, 2015). The epistemology bases are to assess how the knowledge generated by the research can be considered valid and acceptable (Wahyuni, 2012).

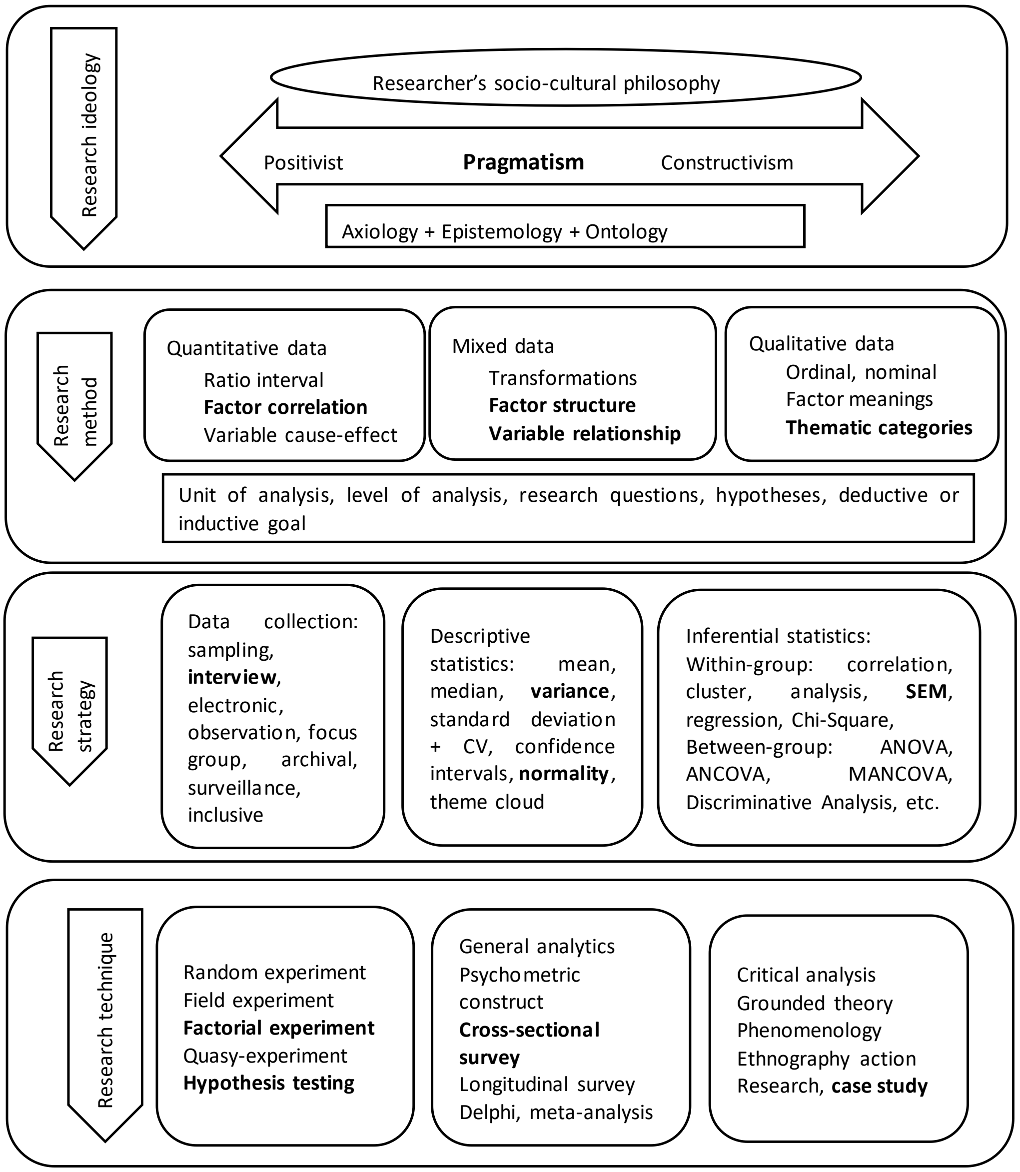


Figure 4.2 - Research design model based on Strang et al., (2015).

Considering that in the process of knowledge generation, in mixed-method research, it focuses on establishing which assumptions would allow the researcher to justify the research (Tashakkori and Teddlie, 2010). Studies depend on data collected and analysed from the participants (Wahyuni, 2012). From an interpretivism paradigm, the focus is to understand the reality and subjective meanings and actions involved in the data collected (Wahyuni, 2012). The two typologies' influence is that mixed methods consider a single philosophical pragmatic stance, while the multi-methods aspect can use multiple philosophical overviews (Venkatesh and Brown, 2013).

The epistemology view under a pragmatic philosophical overview is to acknowledge that observable phenomena are subjective. Hence, the collection of meanings and perceptions from the data can be considered acceptable to generate knowledge through different techniques depending on the research question (Wahyuni, 2012).

Ontological assumptions are focused on the perception and nature of reality. From a positivist perspective, understanding the truth is the same for all the people, allowing to state that the case studied is independent of the researcher; allowing the researcher to conduct the study outside the boundaries of the phenomenon (Collis and Hussey, 2014). Understanding the research is done through the evaluation of data, focused on analysing the cause and effect of variables (Wahyuni, 2012).

The interpretative perspective requires to reduce contact between the researcher from the environment and subjects studied. The analysis acknowledges that the perception of knowledge based on multiple realities (Collis and Hussey, 2014). Hence, the environment studied depends on the individuals that are part of the social phenomena (Wahyuni, 2012). Ontology focuses on understanding the interactions between tacit against explicit, in which the people's socio-cultural values (Strang, 2015). Under the pragmatic philosophical overview, the ontological factor views research as an understanding of multiple points of view, required to answer the research question (Wahyuni, 2012).

The pragmatic philosophical overview does not distinguish the difference between what is objective or subjective, since different pieces of knowledge may transform during the research process (Tashakkori and Teddlie, 2010). The approach is quite adaptable for the research, as the nature of knowledge spillovers, is heterogeneous and undefinable, in which the interaction between tacit and explicit occurs in cycles (Nonaka, Toyama and Konno, 2000). The analysis depends on the identified sources of knowledge, and the discipline and the form evaluated in academic research (Audretsch and Lehmann, 2005).

4.3. Research Design

The research design sets the pace to identify the adequate research strategies, the time horizon to consider for the project, design and the techniques used for the analysis (Saunders, Lewis and Thornhill, 2016). The selection of this design enables the researcher to has the freedom to select the adequate methods to address the research problem (Strang, 2009). The evaluation of the data gathered while moving through the continuum between positivism and interpretivism using mixed-method enables the implementation of qualitative and quantitative research methods (Collis and Hussey, 2014; Creswell, 2014). An overview of the focus of the research shown in figure 4.3.

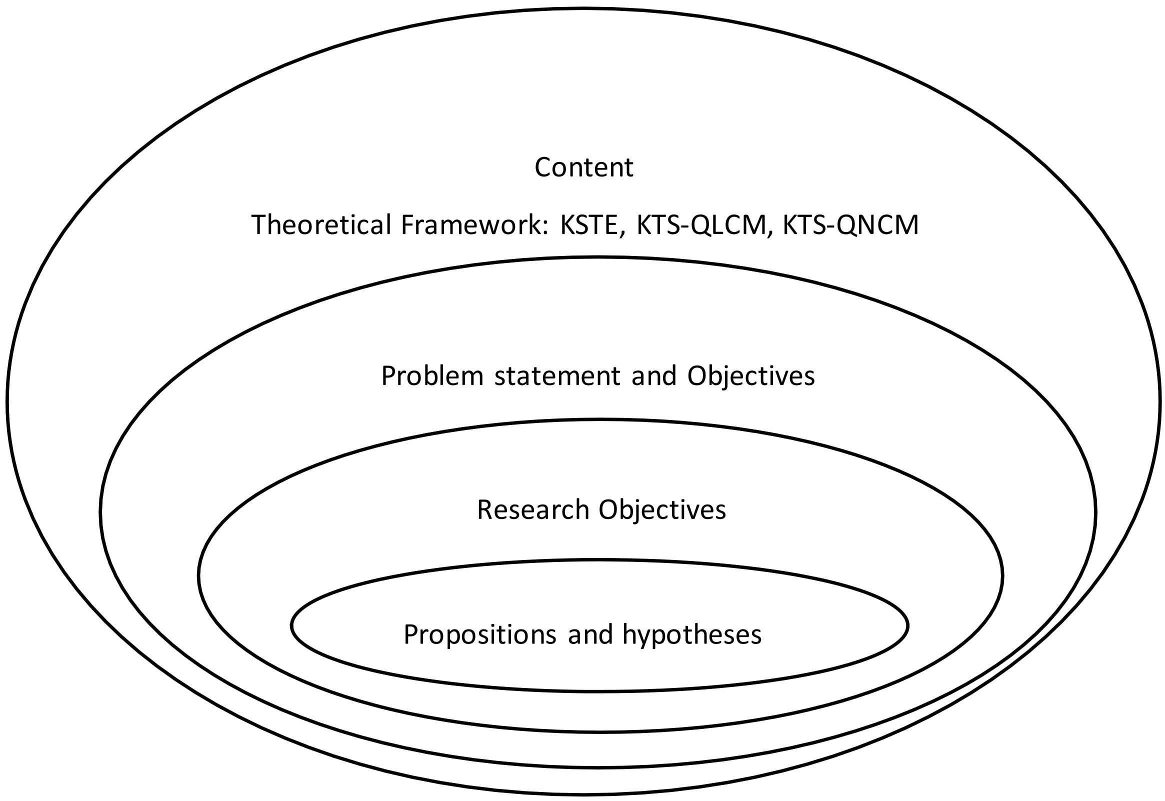


Figure 4.3 - The focus of the research from research questions, based on Saunders et al., (2012).

To have a clear understanding of the identification of the adequate research methodologies, the selection discussion of the adequate research design follows the description proposed by Saunders et al. (2012) illustrated in figure 4.4 (Saunders, Lewis and Thornhill, 2016).

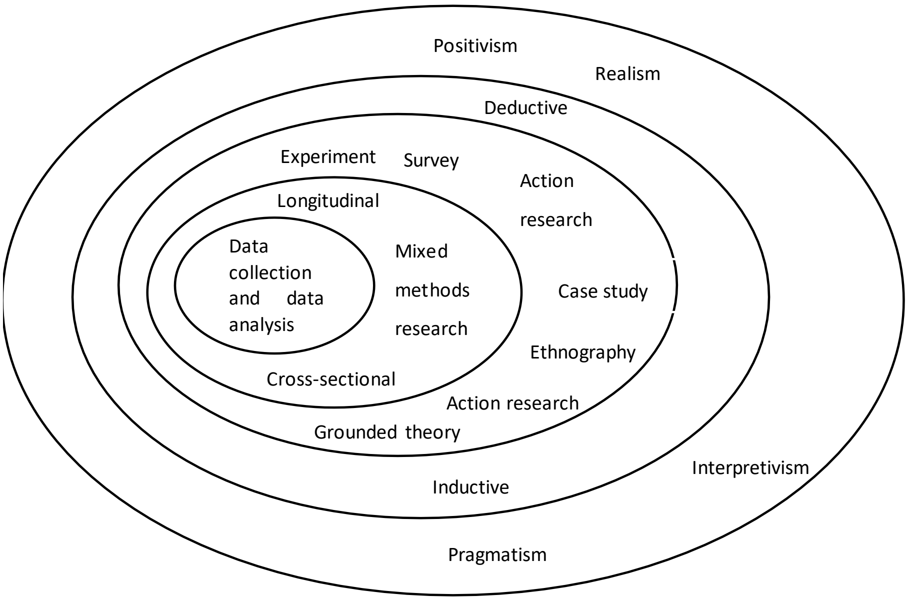


Figure 4.4 - The Research Onion, Based on Saunders et al., (2012).

The development of the literature review led to conclude that the KSTE enabled to define a qualitative model (KST-QLCM) created in Chapter III, which supports the development of the quantitative model. The research focuses on explaining the effects that knowledge spillovers have on the increase of productivity and innovation of new products and services (Fritsch and Changoluisa, 2017). The research questions and objectives established from the literature review methodology enabled research questions and hypotheses. The KSTE provides an initial foundation for identifying the main theories and concepts aligned with innovation and creating start-ups in countries and regions among the transfer of technological opportunities (See figure 4.5) (Audretsch and Caiazza, 2016).

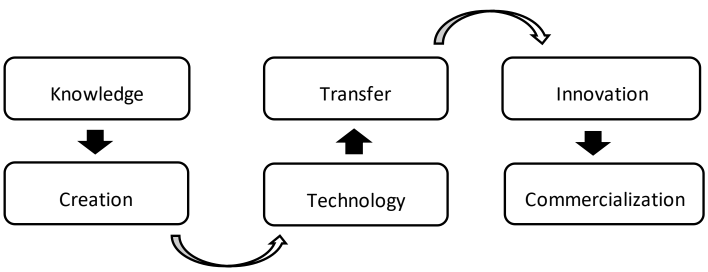


Figure 4.5 - The transfer of knowledge and technology from incumbents and academia based on Audretsch et al., (2015).

It is essential to recognise that an initial deductive framework is necessary to analyse the phenomena in reality and consider the importance of the qualitative themes (Hennink, Hutter and Bailey, 2011). The initial definition of the research questions and possible hypothesis also highlight if the research would be conducted starting from a deductive stance (Tranfield, Denyer and Smart, 2003; Coxon, Matthew; Kelly, Nathan; Page, 2016).

In this research, the qualitative phase's inductive approach is conducted to identify the paths and themes, dimensions, and to develop propositions from the data (Tashakkori, foundations of the mixed methods research; Mc Gregor, paradigm, methodology and method). The inductive analysis projects to develop a theory from the data collected and analysed (Coxon, Matthew; Kelly, Nathan; Page, 2016). On the other hand, the deductive approach is considered for testing a developed model and test established hypotheses (Taskajori). In this research, the pragmatic philosophical overview emphasises on the importance of using an inductive approach in the qualitative phase to develop a model from the data (Kenethy strang). Once obtained, the deductive approach is used in the quantitative phase to use statistical analysis to test the established hypotheses (foundations of mixed methods research).

The focus of using a qualitative method for the initial stage is to capture definitions and the perception of knowledge spillovers from entrepreneurs (Booth, Diana and Sutton, 2012). The data collected's evaluation and validity would focus on highlighting evens portrayed by knowledge spillovers; a set a measurement against the increase on the absorptive capacity (Booth, Diana and Sutton, 2012). As the analytical process unfolds, the initial deductive model would change the development of an inductive model (Creswell, 2014). The transition to developing a proposition based on analytic induction through coding of the material. As the ongoing circle continues to go through, the model and propositions would be formulated until theoretical saturation is reached (Hennink, Hutter and Bailey, 2011; Booth, Diana and Sutton, 2012).

In mixed methods research, the researcher can use multiple strategies and unit of analysis and the type of data collected. Qualitative data can be considered ordinal, nominal, images, mixed or content that is intangible such as meanings or feelings (Strang, 2015; Saunders, Lewis and Thornhill, 2016). On the other hand, If the data collected is categorical of nominal, including codes, words or different types, it would require analysis through interpretative methods such as grounded theory or case studies by assessing themes and keywords (Strang, 2015). On the other hand, quantitative data appears in numbers on an interval or continuous data.

This research's most suitable methodology is mixed methods because it enables to validate and generalise empirical models. Based on the aims, the identification of the phenomena of knowledge spillovers at the individual level. The final objective is to develop an empirical model that can measure the established variables using triangulation (Tashakkori and Teddlie, 2010).

The design's nature suggests that the research can be an exploratory study, descriptive studies, or an explanatory study (Saunders, Lewis and Thornhill, 2016). The first one fits the research aim and focuses on uncovering and understanding the phenomenon and the concepts through the use of open-ended questions (Saunders, Lewis and Thornhill, 2016). Thus, the initial collection data can use interviews with experts or individuals and focus groups (Tashakkori and Teddlie, 2010).

The adequate strategy that supports to obtain the aims of the research is the Pragmatism-of-the-middle paradigm (Tashakkori and Teddlie, 2010; Creswell, 2014). This approach focuses that uncovering the research on social and behavioural research uncovers that the type of research can be a concurrent, mixed or multi stand research design. The adequate selection of the research suggests selecting a sequential exploratory mixed method that covers the selected nature of the research design (Creswell, 2014; Saunders, Lewis and Thornhill, 2016).

The sequential exploratory design has the priority to conduct a collection and analysis of the qualitative data in the first phase, aligning with the research aims of Chapter I. The research approach strategy aligns with the research objective: (1) Further explore the nature of knowledge spillovers on high-tech start-ups that have attended incubator and accelerator programmes and, (2) Inform the development of a conceptual model that defines high-tech start-ups mechanisms and processes.

The quantitative phase of this design focused on generalising the conclusions' results (Creswell and Plano Clark, 2018). This second phase supports the research objective (3) Conduct validation of the proposed model with data collected from surveys on start-ups that incorporate knowledge spillover constructs and (4) define a taxonomy of knowledge spillovers and mechanism. The importance of selecting this type of design is developing a developed model in the qualitative phase and testing in the quantitative phase (Doyle, Brady and Byrne, 2009).

The difference in fully mixed-methods between the concurrent or crossover research design and the main distinction is caused by the timing of the qualitative and quantitative phase. On the other hand, partially mixed-methods conduct both qualitative and quantitative phases independently were the data is integrated into the integration phase (Doyle, Brady and Byrne, 2009).

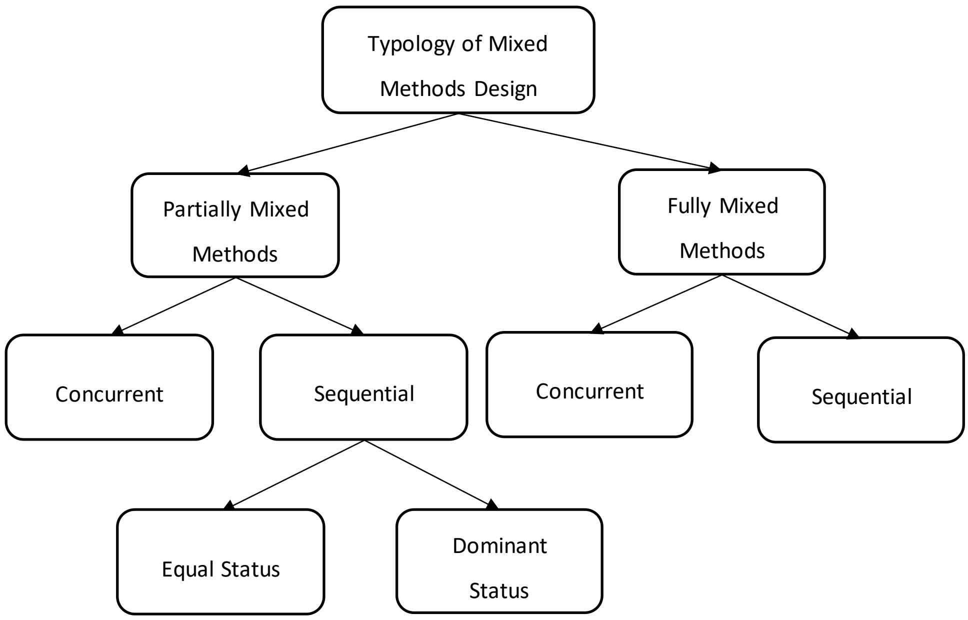


Figure 4.6 - Typology of mixed methods, based on Leech et al. (2009).

The fully mixed methods design has mixed in either one or all of the following: the research objective(s), the types of data, analysis, and inference. Figure 4.6 outlines the typology of mixed methods design (Leech and Onwuegbuzie, 2009). The first layer differentiates the studies into either partially or fully mixed designs. The second decides on the timing of the different phases of data collection and whether each methodology is given equal status within the chosen design.

The classification of the mixed methods research and the selection of an adequate design depends on four factors. First, the combination of qualitative and quantitative data that is used. Second, the sequence or order in which the methods and strategies are used. Third, the Implementation or absence of a framework required for the study (Bentahar and Cameron, 2015; Saunders, Lewis and Thornhill, 2016).

The exploratory design must be used since non-existent measurements or instruments of knowledge spillovers the individual level. The existence of variables is inexistent for identifying and evaluating the flows of knowledge at this level. (Saunders, Lewis and Thornhill, 2016). However, the KSTE has held research on countries and regions and test factors that affect entrepreneurs (Audretsch and Lehmann, 2005; Johnson, Onwuegbuzie and Turner, 2007; Saunders, Lewis and Thornhill, 2016).

In the case of previously conducted research developed on KSTE, the most common model used by the leading researchers in implementing quantitative research through econometric models. The focus on this type of research has been directed towards expanding the Knowledge Production Function (KPF) and the Agglomeration Theory to evaluate economic growth (Ghio, Guerini, E Lehmann, et al., 2015). Since these procedures do not align with this research, it is necessary to establish the study's fittest implementations. The mixed-methods paradigms, assumptions and strategies are shown in Appendix B.1.

The development using a partially mixed design enables creating research tools such as a survey and allows generalising the hypotheses of the qualitative phase in a larger population (Bryman and Bell, 2015). The characteristic of the sequential designs in this research is its evolution of the methods used, and the selection of adequate variables change over time (Tashakkori and Teddlie, 2010). Such an assertion on defining the proper boundaries from the qualitative and the quantitative research. From this perspective, qualitative research is exploratory, which is subjective and descriptive (Tashakkori and Teddlie, 2010; Merriam, 2016). On the other hand, quantitative research is objective, confirmative, and seeks to generalise theories and models by testing hypothesis through statistical methods (Ivankova, Creswell and Stick, 2006; Tashakkori and Teddlie, 2010).

The research exploratory design selection has the characteristic of the fact that one type of data is collected at once. This approach suggests that the first part of the qualitative phase has a higher priority (Creswell, 2014). The main challenges linked are that it requires time to develop and use multiple research methods requiring time and participation from entrepreneurs (Creswell and Plano Clark, 2018).

The quantitative phase takes a higher priority (Bryman and Bell, 2015). However, the mixed methods methodology following a pragmatic philosophical overview can consider allocating an equal status to qualitative and quantitative research design (Schoonenboom and Johnson, 2017). The sequential equal status of QUAL –> QUAN is used in this research.

The classification of mixed methods designs is illustrated in figure 4.7.

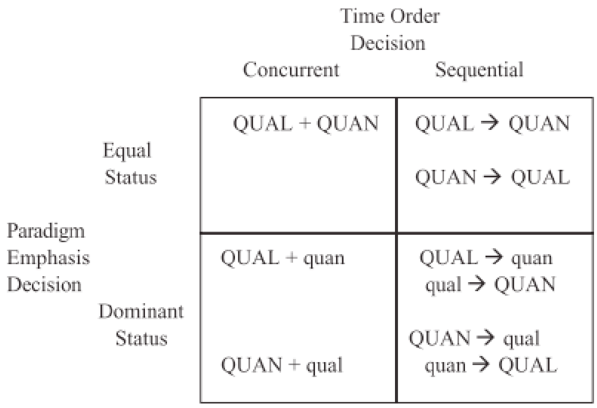


Figure 4.7 - Mixed methods research design, based on Johnson et al. (2004)

The sequential design options enable to conduct the qualitative phase first and continue with the quantitative phase (Johnson and Onwuegbuzie, 2004). The aim is to give a higher weight on the quantitative phase to generalise the qualitative phase findings in a more general population (Creswell and Plano Clark, 2018).

The research starts with initial inductive questions that depend on the interpretation of the entrepreneur's understanding of knowledge spillovers in the qualitative phase (Tashakkori and Teddlie, 2010). The remaining research question that seeks to link the relationships on constructs depends on the quantitative stance (Tashakkori and Teddlie, 2010). This stand requires considering theories and models related to the research goals and objectives to explore the variables and constructs linked to absorptive capacity (Tashakkori and Teddlie, 2010; Creswell, 2014). The sequential exploratory research design is illustrated in figure 4.8.

Step 1 - Chapter III and IV

Design and Implement the Qualitative Strand.
- State qualitative research questions and determine the qualitative approach.
- Obtain permissions.
- Identify the qualitative sample.
- Collect open-ended data with protocols.
- Analyse the qualitative data using procedures or theme development and those specific to the qualitative approach to answer the qualitative research questions and identify the information needed to inform the second phase.

Step 2 - Chapter V

Use strategy to build on the qualitative results (Developed KTS-QLCM).
- Refine quantitative research questions or hypotheses and the mixed methods questions.
- Determine how participants will be selected for the quantitative sample.
- Design and pilot test a quantitative data collection instrument based on the qualitative results.

Step 3 - Chapter VI

Design and implement the Quantitative Strand (Testing KTS-QNCM and expanding).
- State quantitative research questions or hypotheses and build on the qualitative results and determine the qualitative approach.
- Obtain permissions.
- Select a quantitative sample that will generalize or test the qualitative results.
- Collect closes-ended data with the instrument designed from quantitative results.
- Analyse the quantitative data using descriptive statistics, inferential statistics, and effect sizes to answer the quantitative and mixed methods research questions.

Step 4 - Chapter VII

Interpret the Connected Results.
- Summarize and interpret the qualitative results.
- Summarize and interpret the quantitative results.
- Discuss to what extent and in what ways the quantitative results generalise or test the qualitative results.

Figure 4.8 - Sequential exploratory research design, based on Creswell et al., (2000)

4.4. Research Strategy

The research strategy sets the researcher's plan to obtain archive the research aims and objectives (Saunders, Lewis and Thornhill, 2016). According to Tashakkori et al. (2010), the sample size has to cover both research methodologies' requirements. In the qualitative phase, the size has to enable the researcher to attain theoretical saturation. In the quantitative phase, a reduced response rate with a sample of less of one hundred surveys could reduce the statistically significant relationship between the model's variables and validity (Bryman, 2006; Tashakkori and Teddlie, 2010).

This section discusses the adequate research design and methods to implement for the sequential exploratory phase illustrated in figure 4.9.

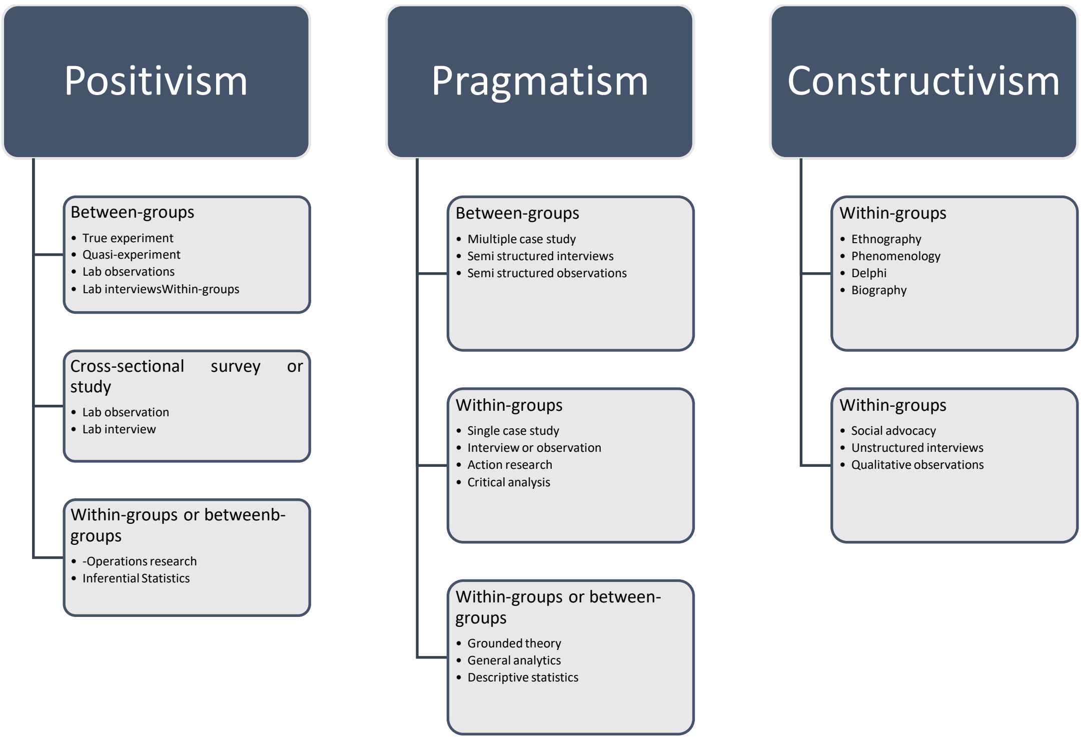


Figure 4.9 - Research strategies used based on the philosophical overview, based on Kenneth et al. (2016)

4.4.1. Characteristics of the Exploratory Design

The sequential exploratory design takes into consideration data collection decisions that must be made. First, data collected in the qualitative phase does not have to be the same for the quantitative phase (Creswell and Plano Clark, 2018). This process enables the generalization of the model and covers the validity issues (Blessing and Chakrabarti, 2009; Leech and Onwuegbuzie, 2009). The selection of adequate research strategies is also selected from the orientation. The three approaches are on the case-orientation variable orientation, and process/experience oriented analyses (Tashakkori and Teddlie, 2010).

Case oriented focuses on studying the phenomena, previous experiences that focus their attention in a particular small range of cases; variable oriented techniques are set to identify the connection between variables. Each one of these approaches has research methods that enable the process of collection and analysis of data.

The characteristics of the qualitative research design are to understand the behaviours and identify the processes and individuals' experiences (Hennink, Hutter and Bailey, 2011). On the other hand, the quantitative phase focuses on measuring the variables and the hypothesis collected from the previous phase (Burke and Onwuegbuzie, 2004; Creswell, 2014). From this perspective, data collection in the qualitative and quantitative analysis is managed independently (Table 4.2).

Table 4.2 - Types of designs, based on Creswell et al., (2014)

	Research Problems/Data Questions	**Data Collection/Method**	**Data Analysis/Procedure**	**Data Interpretation**
Quantitative	Confirmatory. Outcome-based	Instruments Observations Documents Score Oriented Closed-ended process Predetermined hypotheses	Descriptive statistics. **Inferential statistics**	Generalization, prediction based Interpretation of theory
Qualitative	Exploratory Process-based Descriptive Phenomenon of interest	**Interviews,** documents Observations, audio-visual Participant-determined process. Open-ended process, text/image-oriented	Identify themes/categories Look for interconnectedness among categories/themes (vertically and horizontally)	Particularization (contextualizing) Larger sense-making. Personal. Interpretation. Asking questions

The decision to incorporate the strategy has to support the exploratory process in the qualitative phase; and the implementation of the theory's confirmation followed by the quantitative phase (Tashakkori and Teddlie, 2003). The research type methodologies are also associated with positivism and Interpretivism paradigms (Collis and Hussey, 2014).

4.5. Qualitative phase

The qualitative research approaches and strategies' role enables the researcher to use specific methods to collect empirical data (Hadzilias, 2011). The type of research conducted in business is for an interpretative study (Merriam, 2016). The pragmatic philosophical overview includes formal research methods to discuss the strategies mentioned in 4.9. The main qualitative strategies are illustrated in figure 4.10.

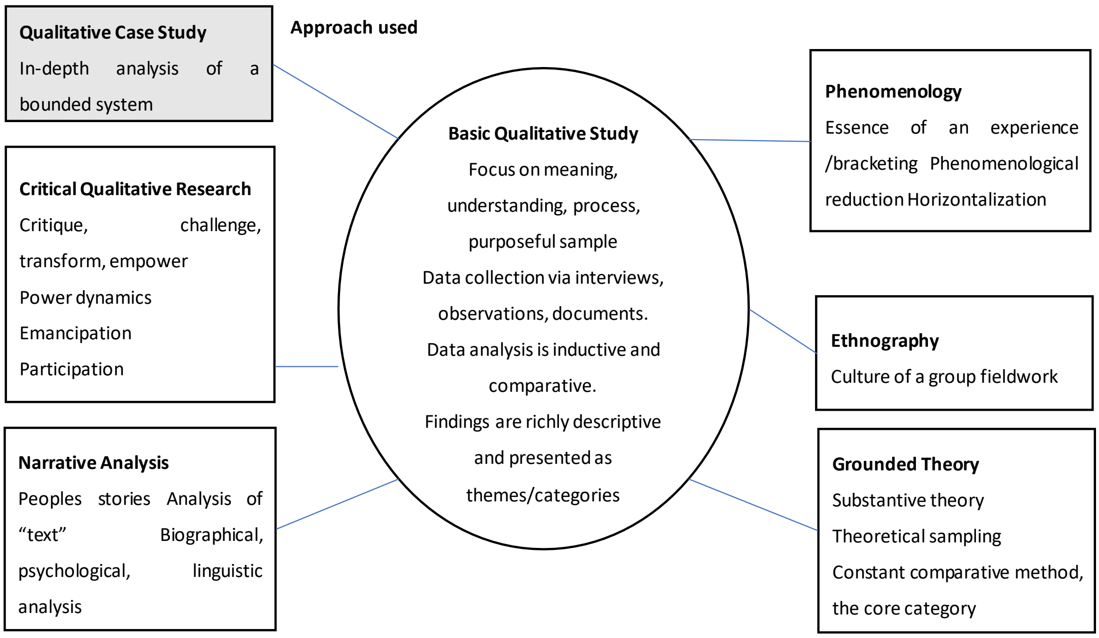


Figure 4. 10 - Types of qualitative research based on Merriam et al. (2016)

- ***Critical analysis*** focuses on identifying themes, topics, and factors, and assesses the credibility of previously conducted research. The approach focuses on comparing and contrasting the different studies and determine the most credible interpretation of each one of the mainly deductive factors (Strang, 2015). This research focuses on understanding society and seeks to research change it (Merriam, 2016). Research is directed toward the evaluation of the dynamics of power. This research strategy is not suited for assessing knowledge spillovers on start-ups as critical research focuses on the analysis of content and is not centred on individuals (Merriam, 2016).

- ***Grounded theory*** falls in the interpretivist ideology and pragmatist ideology; and has been extended to the constructivism ideology named as constructed grounded theory (Strang, 2015). This approach focuses on the creation of theory from data collected (Hadzilias, 2011). For that matter, data collection and analysis are developed at the same time that the theory developed. The focus is to identify the relationship between all the types of interactions and processes that occur in individuals' interactions in businesses (Saunders, Lewis and Thornhill, 2016). The key difference with other forms of research methodologies is that it centres on theories that refer to specific everyday situations (Merriam, 2016). For that matter, the unit of analysis that is considered is the developed theory does not fit entrepreneurs' evaluation during an incubator programme (Strang, 2015).
- ***Content or Narrative analysis*** follows a similar ideal from grounded theory, except that qualitative data is collected from the narratives from participants the study (Strang, 2015). The analysis of data is covered with the analysis of keywords and the frequency of words. The Qualitative narrative analysis methodology expands the analysis with the use of the rate of words. The analysis includes the assessment of linguistic properties to build taxonomies (Strang, 2015). This approach is not the most appropriate for this research, as it is focused on the assessment of documents, while knowledge spillovers can also be tacit.
- ***Ethnography*** focuses on analysing the experiences of the individual exposed to a type of phenomenon (Creswell, research design). The focus on this type of strategy design focuses on understanding human society and culture (Merriam, 2016). For that matter, the researcher immerses himself in cultural groups and collects data through interviews, focus groups and observation (Hadzilias, 2011). Although the discussion on knowledge spillovers considers the influence of cultural background on the types of knowledge, the focus of the research is to evaluate the absorption and implementation of knowledge spillovers (Audretsch, Dohse and Niebuhr, 2010).
- ***Phenomenology*** focuses on individuals' experience that later on transform into the conscience of the person (Merriam, 2016). It is grounded on the analysis of past events of individuals related to a phenomenon (Creswell, 2014). Phenomenology aims to undermine the individual's belief systems to uncover the insights of the conscious side of individuals (Merriam, 2016). The uncovering of the meaning of

research reveals the awareness of the phenomena (Connell et al., 2014). This approach does not apply for knowledge spillovers, as re the research also considers start-up's interactions with other third parties and companies.

- ***Case study*** research is considered one of the leading research methodologies used with different research methodologies that fit for use under pragmatism (Strang, 2015). The approach enables to explore the phenomenon within a context, which allows setting a boundary or limit to the area of analysis (Saunders, Lewis and Thornhill, 2016). This analysis's on a bounded system can be individuals, groups, institutions or communities (Merriam, 2016). Case studies are different from the survey strategy, as it does not limit the survey to a set number of variables (Saunders, Lewis and Thornhill, 2016). Case studies are consistent, as it enables the researcher to obtain information from multiple sources and is bout at a time and a place (Creswell, 2014; Strang, 2015). Thus, this research methodology aligns with the research on the study of knowledge spillovers. The analysis unit would be the start-ups that are part of an incubator and accelerator programmes (Merriam, 2016).

4.5.1. Case Studies Discussion

The case study strategy focuses on understanding specific dynamics in a bounded system, which is justifiable for the assessment of knowledge spillovers (Eisenhardt, 2016). Case studies need to cover three main conditions which are: 1) what is the conducted research type; 2) The control that the investigator has on events that trigger behaviours and 3) the primary focus of the contemporary and its opposition to historical events (Yin, 2006).

The exploration of the nature of research methodologies is for dealing with how and why knowledge spillovers' flow affects start-ups. Since knowledge spillovers by nature are meant to be unintentionally absorbed and do not follow formal procedures or documentation, it is not intended to be controlled based on behavioural events (Yin, 2006). These indicators give an initial insight into the adequate research strategy as it alights with the pragmatic philosophical overview (Strang, 2015). In this case, the research can compare multiple case studies to obtain different insights (Collis and Hussey, 2014).

The selection of single or multiple case studies depends on the aims and objectives of the case study. Collins et al., (2014), mentions that case studies can also be descriptive, which focuses on the research on common practice. It is also illustrative, which enables the researcher to highlight the implementation of new systems.

Single case studies represent a critical or unique case that would enable the assessment to understand and uncover how knowledge spillovers are collected in start-ups. On the other hand, multiple case studies tend to replicate the findings from companies that share similar characteristics and follow comparable business strategies (Merriam, 2016; Saunders, Lewis and Thornhill, 2016). Upon completing these numerous case studies, the design enables the collection of data from various locations. This approach enables to compare and analyse data from cases linked to different institutions and types of companies (Merriam, 2016). The process used in this research to build a qualitative model from case studies is illustrated in table 4.3.

Table 4.3 - The Process of Building the Theory from Case Study Research, based on Eisenhardt et al., (2016)

Step	Activity	Reason
Getting Started	Definition of research question Possibly a priori constructs	Focuses efforts Provides a better grounding in construct measures
Selecting Cases	Neither theory nor hypotheses. Specified population. Theoretical, not random, sampling.	Retains theoretical flexibility Contains exogenous variations and sharpens external validity Focuses efforts on theoretically focused cases
Crafting Instruments and Protocols	Multiple data collection methods Qualitative and quantitative data combined Multiple investigations	Strengthens grounding of theory by triangulation of evidence. Synergistic view of the evidence. Fosters divergent perspectives and strengthens grounding.
Entering the Field	Overlap data collection and analysis including field notes Flexible and opportunistic data collection methods	Speeds analyses and reveals necessary adjustments of data collection. Allows investigation to take advantage of emergent themes and unique case features
Analysing Data	Within-case analysis Cross-case pattern search.	Gains familiarity with data and preliminary theory generation. Fosters investigators to look beyond initial impressions and see evidence through multiple lenses.
Sharping Hypotheses	Literature tabulation of evidence for each construct Replication, not sampling. Logic across cases. Search evidence for "why" behind the relationship	Sharpens construct definition, validity, and measurability. Confirms extends and sharpens theory. Builds internal validity.
Enfolding Literature	Comparison with conflicting literature Comparison with similar literature	Builds internal validity, raises the theoretical level and sharpens construct definitions. Sharpens generalizability, improves construct definition and raises the theoretical level.
Reaching Closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small.

The development of the analysis through case studies start with the deductive model (KST-QNCM), which enables to develop connections between second-order themes, and then expand the model with an inductive approach by developing propositions (Saunders, Lewis and Thornhill, 2016).

Case studies approaches can be holistic when the researcher focuses on a case study in a single organisation that involves different levels of units. On the other hand, embedded cases enable to approach three to four case studies, where the point is to distinguish between the cases (Saunders, Lewis and Thornhill, 2016).

The case studies analysis with open-ended questions is realised between or within groups. It is necessary to describe the types of incubator environments and the types of entrepreneurs that attend these programs. At first, the data collection at the first phase is the individual level (Strang, 2015). However, the analysis level can be considered for every one of the interviewees as the Chief Executive Officers (CEOs) or founding members in the company (Strang, 2015).

Thus, this research considers CEOs and founders of start-ups that attended an incubator or accelerator programme in Greater London as the unit of analysis. The study begins with a comparison with groups of entrepreneurs with similar types of industries and characteristics. It proceeds to make companies between these groups discuss developed themes in the model conducted in Chapter V. The qualitative phase enables the development of a quantitative model with the proposed hypothesis analysed in Chapter VI (KST-QNCM). A detailed initial description of the entrepreneurs and the incubators/accelerator programmes is illustrated in Appendix B.2.

4.5.2. Data Collection Procedures

The collection of data from start-ups involved in incubator and accelerator programmes depended on two points. First, the researcher conducted an introductory message to incubators, and companies considered gatekeepers (Creswell, 2014). The mention of the study included why the company was chosen for the study. The description clarifies that all the data collected is directed only for research purposes and keeps the interviewees' names and start-ups anonymous (Strang, 2015). This approach's importance is to take in consideration that used to provide a broad description to the entrepreneurs of the phenomena analysed or to generate new theory (Eisenhardt, 2016). The email sent to the participants is illustrated in Appendix B.3.

Following the building theory from Eisenhardt et al., (2016), the selection of cases was initially based on the incubator and accelerator programmes that run in London. This type of sampling selection scheme focused on generating or obtaining in-depth information from the interviewees about the analysed phenomenon (Tashakkori and Teddlie, 2010). The sampling scheme is different from the probability sampling schemes focused on implementing random sampling techniques and other adaptations such as stratified, cluster, two-stage or multi-stage random sampling (Tashakkori and Teddlie, 2010). The initial inclination to decide the type of sampling falls in determining if the qualitative phase's data will be used to analyse within or between groups (Strang, 2015). The different sampling techniques on research illustrated in figure 4.11.

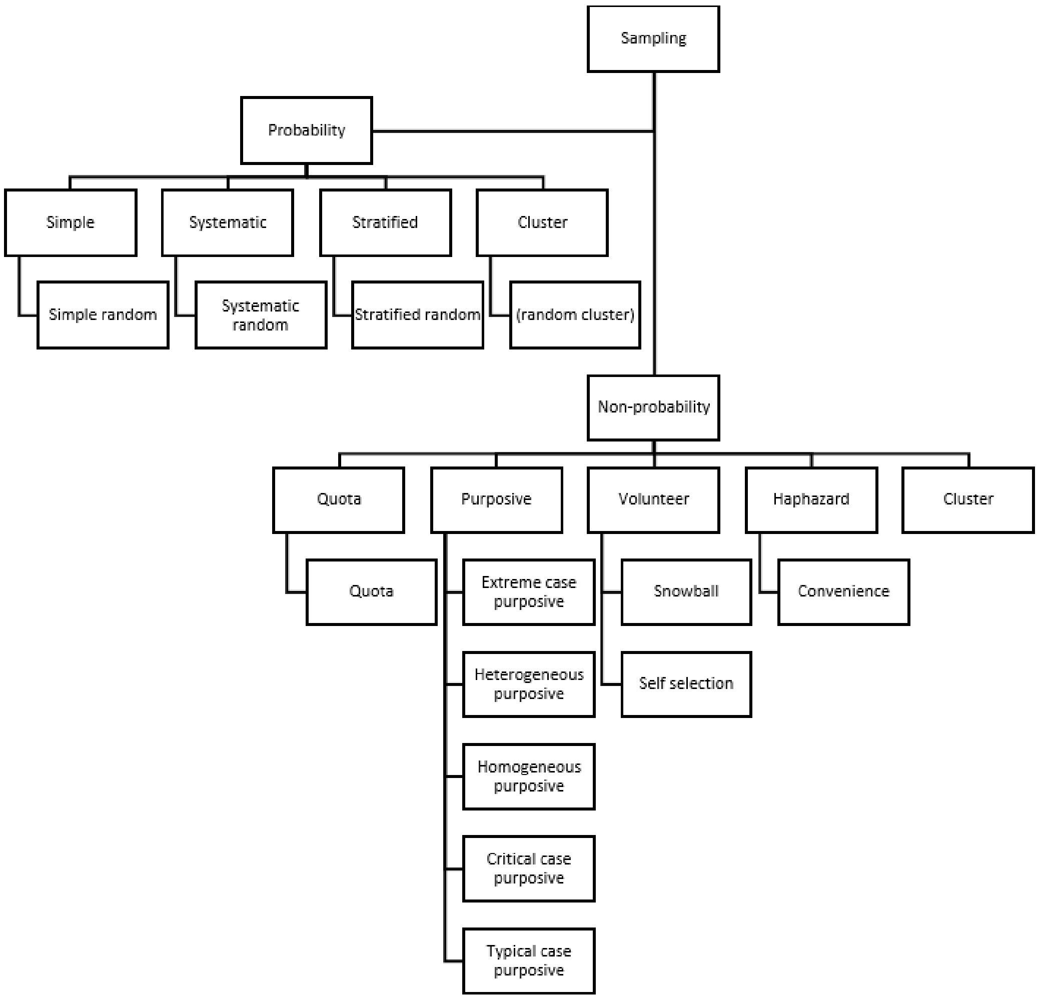


Figure 4. 11 - Sampling techniques, based on Saunders et al.,(2016).

In the qualitative phase, selecting a sample that is not-probabilistic has a level of the subjective type of range of the participants (Saunders, Lewis and Thornhill, 2016). The event most important is critical to consider that statistical generalization with a sample's choice cannot be attained from case studies (Yin, 2006). In particular, on the assessment of multiple case studies, the aim is to obtain results that can be generalized and dependent on the objective of the research (Yin, 2006). The logic of selecting multiple cases is to predict possible similar results or to discuss and contrast the main findings (Yin, 2006). The type of data collected from entrepreneurs' queries about the company's processes and the perceptions and attitudes that facilitate the access to knowledge spillovers (See Figure 4.12).

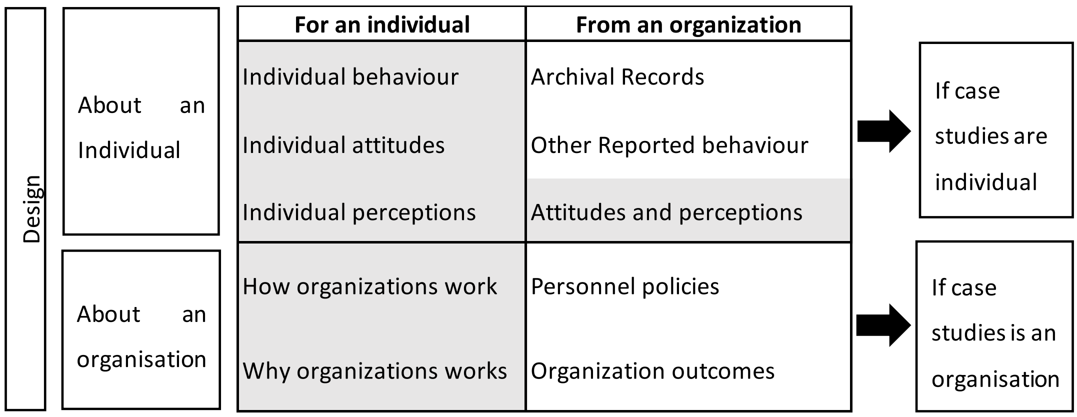


Figure 4.12 - Data versus data collection: different units of analysis, based on Yin et al., (2006)

The selection of start-ups has linked to companies located on a multinational city that increases knowledge spillover absorption (Desrochers, Kenney and Patton, 2009; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Considering that the population collection must be found surrounding start-ups that are part of an incubator and accelerator program, the non-probability sampling selection for qualitative research is illustrated in Figure 4.13.

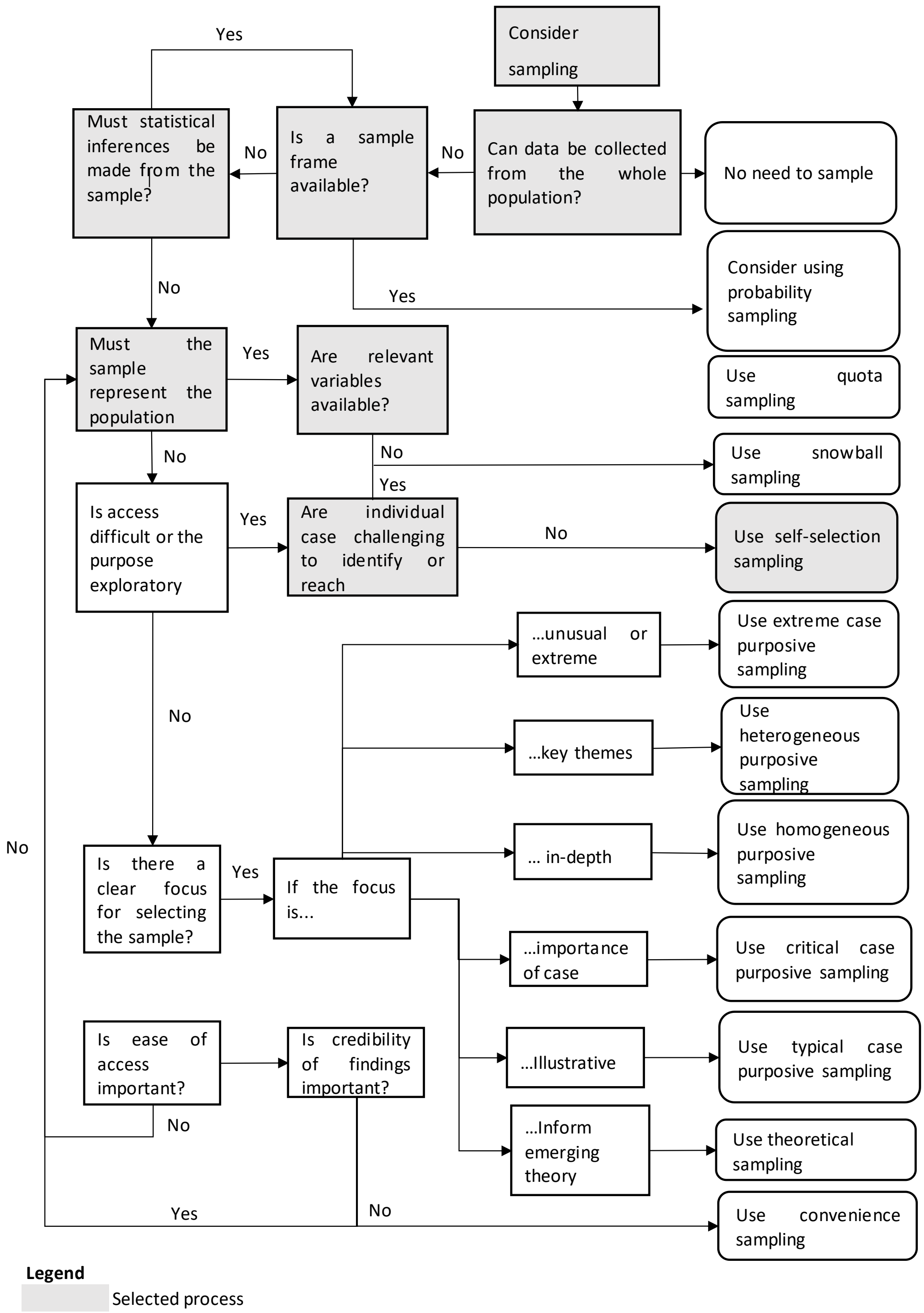


Figure 4.13 - Non-probability sampling, based on Saunders et al. (2016)

The selection of the data is non-probabilistic. The sample does not need to cover all the entrepreneurs who were part of the incubation or accelerator programme (Creswell and Plano Clark, 2018). In this case, since the access to entrepreneurs proves to be difficult, the ideal sampling technique would be to use *self-selection* (Saunders, Lewis and Thornhill, 2016). However, if the populations' sample focused on gaining an in-depth focus of the effects of knowledge spillovers, the ideal sampling technique would require using a homogeneous purposive sample (Saunders, Lewis and Thornhill, 2016). The assignation of the adequate sampling technique has to consider that data collection has the purpose of coding quotes and sentences that support concepts organised in nodes and themes (Creswell, 2014). In multiple case studies, the objective is to obtain replication of the effects of knowledge spillovers and not to follow a sample logic (Yin, 2006).

Case studies require to gather **at least 20 interviews** to attain theoretical saturation from the analysed data (Thorpe and Holt, 2008; Tashakkori and Teddlie, 2010). In using case studies with interviews, the recommended sample of the data corresponds to a range of six to eight participants (Tashakkori and Teddlie, 2010). The suggested research techniques the archival data, interviews, and ethnographic observation (Thorpe and Holt, 2008). It is also recommended to collect a sample of ten to thirty participants for conducting comparisons and identify patterns (Tashakkori and Teddlie, 2003; Thorpe and Holt, 2008) (See Table 4.4).

Table 4.4 - The minimum sample size for standard research designs, based on Tashakkori et al. (2016)

Research Design/Method	**Minimum sample size Suggestion**
Correlational	64 participants for one-tailed hypotheses; 82 participants for two-tailored hypothesis (Onwuegbuzie, Jiao & Bostick, 2004)
Casual comparative	51 participants per group for the one-tailed hypothesis; 64 participants for two-tailed hypotheses (Onwoegbuzie et al., 2004)
Experimental	21 participants per group for one-tailed hypotheses (Onwuegbuzie et al., 2004)
Case study	3-20 participants minimum (Creswell, 2005, Thorpe and Holt, 2008; Tashakkori and Teddlie, 2010)
Phenomenological	More than ten interviews (Creswell, 1998)
Grounded theory	15-20 (Creswell, 2005); 20-30 (Creswell & Plano Clark, 2007)
Ethnography	One cultural group (Creswell, 2005); 30-50 interviews (Denzin and Lincoln, 2018)
Ethnological	100-200 units of observation (Denzin and Lincoln, 2018); 12 participants for a homogeneous sample (Denzin, 2005).

Data Collection Procedure	
Interview	6-10 participants (Denzin, 2005).
Focus group	6-12 participants (Denzin, 2005).3 to 6 focus groups (Denzin, 2005).

In case studies, the data collection methods consist of general interviews, archival recourses, and observations (Eisenhardt, 2016). Interviews were the chosen data collection tool for this research. The researcher started to the entrepreneur the purpose of the research (Yin, 2006). In this particular research of start-ups, data collection seeks to investigate the phenomenon of the effect of knowledge spillovers (Saunders, Lewis and Thornhill, 2016). The data collection types and main advantages are illustrated in table 4.5.

While implementing mixed methods research with a sequential exploratory design, it is recommended to start the qualitative phase with interviews. The process is supported to generate a quantitative instrument to measure the themes and concepts identified from the qualitative phase analysis. The justification for using in-depth interviews is linked to the very nature of knowledge spillovers. The attributes that this type of information has is that it can con in a form that doesn't leave a physical trail, and is absorbed through the experience and transfer of tacit knowledge between individuals (Nonaka, Toyama and Konno, 2000). The evaluation of events that affect start-ups comes from the perception that entrepreneurs have on knowledge spillovers.

The meetings were conducted through face-to-face interactions, skype meetings, and mobile calls. The compilation of questions was structured in an interview guide to assess and formulate initial propositions from the deductive model (Eisenhardt, 2016; Saunders, Lewis and Thornhill, 2016). However, due to a low response rate from incubators and accelerators, the researcher directly contacted CEOs and founders. A total number of 833 emails were sent initially, with 323 email interactions from the entrepreneurs. From all the responses conducted, a total of 32 interview meetings with entrepreneurs. Identifying the type of industry and sector that the company is involved in and its link with the Sector portrayed in the online platform Beauhurst (Winston-Smith-Sheryl-Hannigan-Thomas-and-Gasiorowski-Laura_Peering-Inside, no date; Renski, 2009).

Table 4.5 - Qualitative research methods, Based on (Creswell and Plano Clark, 2018)

Data collection types	**Options Within Types**	**Advantages**	**Limitations**
Observations	Complete participant – researcher conceal roles. Observers as a participant – the role of the researcher are known Participant as an observer – observation role secondary to participant role	The researcher has first-hand experience with the participant. The researcher can record information as it occurs. Unusual aspects can be noticed during observation. Useful in exploring topics that may be uncomfortable for participants to discuss.	The researcher may be seen as intrusive. Private information may be observed that the researcher cannot report. The researcher may not have good attending and observation skills. Individual participants may present problems in gaining rapport
Interviews	Face-to-face-one-on one interview. Telephone – researcher conducts interviews by phone. Focus group – researcher interviews participants in a group. E-mail Internet interview	Useful when participants cannot be observed directly Participants can provide historical information. Allows researcher control over the line of questioning.	Provides indirect information filtered through the views of interviewees. Provides information in a designated place rather than the natural field setting. Researcher's presence may bias responses. Not all people are equally articulate and perceptive.
Documents	Public documents – minutes or meetings or newspapers. Private documents – journals, diaries or letters	Enables a researcher to obtain the language and words of participants. Can be accessed at a time convenient to the researcher – and unobtrusive source of information. Represents data to which participants have given attention. As written evidence, it saves a researcher the time and expense of transcribing	Not all people are equally articulate and perspective. It may be protected information unavailable to public or private access. Requires the researcher to search out the information in hard-to-find places. It Requires transcribing or optically scanning for computer entry. Materials may be incomplete. The document may not be authentic or accurate.
Audio-visual Materials	Photographs Videotapes Art objects Computer messages Sounds Film	Can be an unobtrusive method of collecting data. Provides an opportunity for participants to share their reality directly. It is creative in that it captures attention visually.	May be difficult to interpret. May not be accessible publicly or privately. The presence of an observer may disruptive and affect responses.

Legend

(shaded)	Used data collection types

4.5.3. Interview Guide

The research guide starts with a brief introduction concerning the aims of the study. This initial point enables the researcher to create initial rapport and inform the participants about ethical considerations (Hennink, Hutter and Bailey, 2011). It is the first part of the interview protocol, where the initial information required for the research is taken, such as a heading with date, location, the interviewer's name, and the name of the interviewee (Creswell, 2014). The background information obtained from the participants is illustrated in table 4.6.

Table 4.6 - Background information of the entrepreneurs and the companies

Type of question	Supporting literature
Name of participant	Nieto et al., (2005)
Name of the firm	Nieto et al., (2005)
Location	Connell et al., (2013); Hervas-Oliver (2015); Renski et al .(2008)
Age of the entrepreneur	Amoroso et al., (2017); Vivarelli el al, (2002)
Size: number of staff	Nieto et al., (2005); Vivarelli et al, (2002) Beugelsdijk (2007); Tsvetkova et al. (2014); Shu et al., (2014); Montoro-Sanchez el al.,(2017);
Number of directors	Helmers (2010)
Research and Development	Shu et al., (2014); Beugelsdijk (2007); Nieto et al., (2005).
Academic Qualification	Nielsen (2014); Vivarelli (2002); O'Gorman (2008); Wennberg et al.,(2011)
Nationality	Helmers et al.,(2010)
Name of incubator or accelerator programme	Audretsch et al., (2017); Bandera et al., (2016);
Ownership	Nielsen (2014); Beugelsdijk (2007)
Years of working experience	Vivarelli (2002); Wennberg et al., (2010); Wennberg et al.,(2011); Tsvetkova et al. (2014); Amoroso et al, (2017)
Years of entrepreneurial experience	Wennberg et al.,(2011); Tsvetkova et al. (2014); Vivarelli (2002); Shu et al., (2014)
Number of years of activity	Beugelsdijk (2007); Tsvetkova et al. (2014); Shu et al., (2014); Amoroso et al., (2017)
Type of Industry	Beugelsdijk (2007); Shu et al., (2014); Vivarelli (2002); Shu et al., (2014) Amoroso et al., (2017); Shu et al., (2014); Montoro-Sanchez el al.,(2017);
Background of members in the start-up	Wennberg et al.,(2011)

The selection of questions is directed towards the Board and Chief Execute Officers of start-ups. This sample leads to a focus on companies' characteristics as an indicator of demographics and characteristics (Yin, 2003; Bazeley, 2014). For that matter, questions are focused on obtaining an initial insight of the companies featured, and on setting an initial awareness of absorptive capacity enabled from the funders, the employees on the company towards knowledge spillovers and opportunity recognition (Nieto and Quevedo, 2005; Narula and Santangelo, 2009). The initial questions identify the company's details to make a comparison of the concepts between the case studies (Yin, 2003).

These questions in the interview guide link the company's characteristics with the primary key topics covered in the interview guide (Hennink, Hutter and Bailey, 2011). The aim is to uncover the founders' broad experience on the creation of the start-up and decisions influenced by knowledge spillovers (Tashakkori and Teddlie, 2010; Collis and Hussey, 2014). Some of the interviews' data might contain information that is not relevant for the study if the participants have tended to express broad ideas (Collins, Onwuegbuzie and Johnson, 2012). The detailed qualitative data strategy to develop the interview guide and research questions are defined in Appendix B.4.

The aim is to determine the type of industry that the company is involved, categorised by identifying the Standard Industrial Classification (SIC) (Helmers and Rogers, 2010). Identifying the type of industry and sector that the company is involved in and its link with the Sector portrayed in the online platform Beauhurst (Winston-Smith-Sheryl-Hannigan-Thomas-and-Gasiorowski-Laura_Peering-Inside, no date; Renski, 2009). The assessment is relevant since entrepreneurs may interact with other individuals, universities, start-ups or companies (Woodward, Figueiredo and Guimarães, 2006; Narula and Santangelo, 2009). The initial proposed conceptual model (KST-QLCM) with all the relevant theoretical dimensions, first-order categories, and second-order themes provided relevant discussion to structure the interview guide illustrated in Appendix B.5.

4.5.4. Qualitative Data Analysis

The data analysis consisted of the continuous comparison of the interviews collected with the deductive themes and concepts established from the literature. The study focused on identifying the most relevant variables, hypotheses, and concepts supporting the literature to highlight potential gaps in previous research (Bazeley, 2014; Dey, 2016). The objective is to uncover and reflect the entrepreneurs' thinking process regarding starting and operating a start-up and identifying knowledge spillovers absorption and implementation towards product conceptualisation (Dey, 2016). The data analysis consists of the development of interactions between individuals, organisations, and events where knowledge spillovers enabled an effect on the start-up (Narula and Santangelo, 2009; Wyrwich, 2014).

The initial investigation started with established deductive models that aligned with the interview guide's questions (Tashakkori and Teddlie, 2010; Creswell and Plano Clark, 2018). Afterwards, pattern matching was used to evaluate the propositions, dependent and independent variables, and formally state the possible relationships on propositions (Saunders, Lewis and Thornhill, 2016). Data collection from the interviews continued until obtaining theoretical replication and saturation from the data (Yin, 2003).

The analysis followed the process of Building Theories from Case Study Research formulated by Eisenhardt (1989) and conducting case study research (Yin, 2006). The focus was to conduct an in-between evaluation of knowledge spillovers' effects through different lenses of High-Tech start-ups with different characteristics. Hence, similar companies with within-group similarities that less than fifteen years of activity and less than one hundred employees (Eisenhardt, 2016).

These processes included identifying possible dependent and independent variables that uncover knowledge spillover mechanisms, actions, and events taken by High-Tech start-ups and building the explanation of the models from the analysis (Bickman and Rog, 2009). This approach aims to attain theoretical replication of the patterns identified across all the cases in the research (Yin, 2006). The discussion of the first other categories and second other themes is used as a reference in Chapter VI to identify the variables and constructs used in the factor analysis during the quantitative phase.

The analysis started by conducting an initial identification of concepts, and afterwards, held focused coding to discuss the findings based on theoretical dimensions and second-order themes (Saldaña, 2016). Next, a second cycle of pattern coding conducted a grouping of all the initial developed codes from the literature and the data which act as meta-codes for the development of an explanatory analysis seeking the cause, effect or quotes that support the analysis (Bazeley, 2014; Saldaña, 2016). The end objective of the analysis section is to attempt to build constructs that would further test the generated theoretical propositions (Eisenhardt, 2016).

The interviews were recorded and transcribed while conducting the analysis of the data and the development of memos and nodes using the qualitative software program NVivo 12 (Saunders, Lewis and Thornhill, 2016; Creswell and Plano Clark, 2018). The research team revised the interview guide and piloted with three entrepreneurs ongoing through incubator programmes in the biotechnology sector (J A Maxwell, 2013).

4.6. Quantitative Phase

This phase's main purpose is to identify relevant variables to group them in dimensions and constructs to develop a quantitative model. To that end, the section details why the collection of data via e-mail surveys is the most adequate to obtain a minimum of 200 responses for the statistical analysis (Barrett, 2007; Brown, 2015; Malhotra, 2020). Thus, the section provides details of the construct measurement chosen based on model KST-QLEM2 developed from the second qualitative analysis in Chapter V. The section concludes by providing detailed destruction of Structural Equation Modelling (SME) which enables to assess constructs interactions and hypotheses of multiple samples (Henseler and Chin, 2010; Becker et al., 2013; Benitez et al., 2020)

The quantitative analysis consists of exploratory factor analysis to evaluate the correlations and aggregations of variables (Hair, 2010; Brown, 2015). The grouping of variables is later tested on a confirmatory factor analysis by assessing factor loadings and commonalities that enable the assessment of the model fit and covariances between constructs (Barrett, 2007; Brown, 2015). Finally, the quantitative analysis ends with Partial Least Squares Structural Equation Model, which incorporates the Incoming and Network Knowledge Spillovers formative constructs through partial regressions to evaluate path regression (Hair, 2018).

4.6.1. Sample Selection and Size

The considerations to conduct a statistical analysis require conducting a probabilistic sampling to obtain a general representation of the population (Tashakkori and Teddlie, 2003). the participants must be randomly selected from high-tech entrepreneurs that form part of the high-tech sector under the Statistical Classification of Economic Activities (Timmermans, 2009; OECD Directorate for Science Technology and Industry, 2011). The entrepreneurs' selection also needed constants the characteristics of the entrepreneurs, the companies, and their attendance to incubators or accelerator programmes. The selection criteria also follow the rationale followed explained for the qualitative analysis phase.

The statistical analysis sample requires large enough responses to obtain statistical significance with usually 50 responses (Tashakkori and Teddlie, 2003). However, The development of Structural Equation Modeling (SEM) and factor analysis highly recommend collecting a minimum sample above 200 (Barrett, 2007; Masaki M., 2011; Brown, 2015). This size is required to attain enough statistical power by reducing the probability of accepting false null hypotheses (Type II error) of during the development of a Confirmatory Factor Analysis (CFA) (Brown, 2015; Kelava, 2016).

The statistical analysis and normality assumptions' performance increases with samples sizes of around 500 (Ullman and Bentler, 2003). However, the process requires to filter the data by eliminating outliers and reducing Kurtosis. The sample size also enables to assume that the variables follow a normal distribution in Likert scales enables to conduct CFA implicating the relations of variances and covariances caused by Kurtosis (Tashakkori and Teddlie, 2003; Byrne, 2008).

The requirements for conducting Partial Least Squares (PLS) are lower, as the analysis does not require variables to follow a normal distribution conducting a non -parametric analysis (Hair et al., 2016). However, the statistical indicators' precision and consistency increase with larger sample sizes (Hair et al., 2017). Even though PLS is superior in runinm small sample sizes, it is recommended to attain a minimun viable sample to avoid statistical rigour and raise confidence in the simulation runs conducted while bootstrapping (McIntosh, Edwards and Antonakis, 2014; Benitez et al., 2020). A high number of samples also increases the validity and reliability of reflective-formative models when using correlations and factor loadings (Becker, Klein and Wetzels, 2012).

A heuristic proposes to set a minimum sample by multiplying by ten on the number of paths or formative indicators (Lowry and Gaskin, 2014). In this research, the final model holds a total of twelve formative variables from the knowledge spillovers constructs (Incoming knowledge spillovers = 7; Network Knowledge Spillovers = 5). Thus, the minimum sample size for conducting Partial Least Squares is of 120. The statistical analysis review led to establishing that the research requires a minimum sample size of 200 and an optimal sample size of 500 responses from entrepreneurs in high-tech start-ups.

4.6.2. Data Collection and Survey Characteristics

This research chose to use surveys to collect data from entrepreneurs. This research strategy enables to collect data for quantitative analysis, such as factor analysis using closed-ended questions (Tashakkori and Teddlie, 2010). Surveys enable to conduct large sample and cross-sectional studies that can be used to evaluate start-ups characteristics and background of the entrepreneurs (Strang, 2015). This procedure is deductive, and it is used to support the development of exploratory research (Saunders, Lewis and Thornhill, 2016). The data collection strategy also supports probability sampling. It increases the confidence that the data is not biased, as it ensures that the measurement of variables is standardised across all the participants. In this case, the survey has to make sure to cover an analysis that is related to the processes related to start-ups. The survey methods include multiple methods, as shown in figure 4.14.

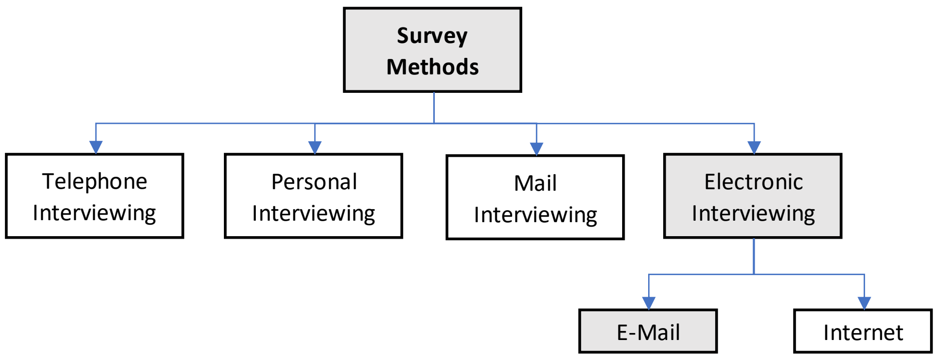


Figure 4.14 - Classification of survey methods, based on Malhotra et al. (2020)

The chosen method for data collection was online surveys using a cover letter informing the participants about the study's topic and the anonymity of the data (Malhotra, 2020). The emails of participants were gathered from linked in profiles and the platform Beauhurts, which track down start-ups' progress and characteristics. A significant advantage of this procedure is that it enables us to send the survey via email to participants (Tashakkori and Teddlie, 2003). The responses of participants were stored and retrieved from the online platform JISC.

The process enables to save time and is less time consuming but requires conduct followups to increase the response rate (Tashakkori and Teddlie, 2010). The data collection also enables to compile quantitative data that is precise and increases the validity of the results, as the responses are independent to the researcher's beliefs (Johnson and Onwuegbuzie, 2004). Surveys also enable to measure through constructs the behaviours and processes conducted to evaluate the processes of entrepreneurs without requiring direct observation (Strang, 2015).

The sample consisted of high-tech start-ups that at some point registered in the United Kingdom. Beauhurst was initially used to select the entrepreneurs that were part of high-tech start-ups in the seed and growth stages. The questionnaire used was revised and piloted by three academics, and three start-up CEOs and experts in high-tech. A total of 6551 emails were sent to new ventures members using a two-wave email approach between January and June 2017. The e-mail template used is illustrated in Appendix B.6. The entrepreneurs were asked how human capital and organisational knowledge facilitates innovation and survival of start-ups. After responding to various queries form participants, the researcher obtained 594 responses, leading to a response rate of 11.03%. The collection of data also considered that the companies should be within ten to fifteen years of operation.

The survey was structured using categorical variables to reflect the control variables used to define the entrepreneurs' background and the characteristics of the start-ups (A Field, 2018). The multiple-choice questions in this section were used to classify the participans for conducting multiple group analyses (Hair, 2018). The nominal scales were grouped and coded using numeric values (Hair et al., 2016). The survey's main body included ranking scales to evaluate the intensity of processes and decisions evaluated by the quantitative analysis's main constructs (Collis and Hussey, 2014). The ranking is presented in Likert scales from one to five, representing the engagement of entrepreneurs to actions and processes undertaken in the company. These groups' questions represent the ordinal variables to conduct the multivariable analysis and structural equation modelling (Tashakkori and Teddlie, 2010; Hair et al., 2016).

4.6.3. Constructs Measurements

4.6.3.1. Exploratory and Exploitative Innovation

The exploratory innovation construct evaluates to trails of thoughts for the analysis. First, exploratory innovation measure start-ups intentions to create new products (Su and Yang, 2018). The process sets to link how new extracted ideas and conduct experiments to test prototypes. The exploratory innovation construct's focus is to express the intentions of high-tech start-ups to continue expanding on generating new technologies (Enkel et al., 2017; Limaj and Bernroider, 2017). Exploratory innovation involves enhancing current products, services or operations if companies (Liao, Fei and Chen, 2007; Bouncken and Kraus, 2013; Roberts and Dinger, 2016; Enkel et al., 2017). The construct measures companies' actions to provide gradual enhancements to the value of products(Limaj and Bernroider, 2017). The constructs are measured with five variables using a seven-point Likert scale (1 = strongly disagree, 4 = neither agree nor disagree, 7 = strongly agreed) (Jansen, Van Den Bosch and Volberda, 2005; Enkel et al., 2017; Su and Yang, 2018).

4.6.3.2. Absorptive Capacity

The validated model of the absorptive capacity construct considers the steps taken by companies to capture external knowledge (Todorova and Durisin, 2007; Flatten et al., 2011). One side of research focused on the ACAP model (Ferreras-Méndez et al., 2015; Tzokas et al., 2015).

Absorptive Capacity is assessed through multidimensional constructs that evaluate a company's acquisition, assimilation, transformation, and exploitation activities (Flatten et al., 2011; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016). However, research on high-tech SMEs has used two multidimensional reflective constructs (Jiménez-Barrionuevo, García-Morales and Molina, 2011; Limaj and Bernroider, 2017; Flor, Cooper and Oltra, 2018). In this research, the approach contains the four-step absorption of external knowledge through acquisition, assimilation, transformation and final exploitation (Zahra and George, 2002; Flatten et al., 2011; Lau and Lo, 2015).

The potential absorptive capacity measures the start-ups capacity dimensions of acquisition and assimilation(Camisón and Forés, 2010; Jiménez-Barrionuevo, García-Morales and Molina, 2011). Overall, potential absorptive capacity enables start-ups capability to remain competitive, and the use of human resources to conduct R&D (Huang et al., 2015). Start-up's potential absorptive capacity offers the benefits of accumulating knowledge but can be exposed to gather operational costs without obtaining benefits (Jansen, Van Den Bosch and Volberda, 2005). The lower level dimensions of the construct are acquisition and assimilation. The initial evaluation of acquisition and assimilation was conducted with five and three questions respectably (Ferreras-Méndez et al., 2015; Tzokas et al., 2015; Limaj and Bernroider, 2017).

Realised absorptive capacity focuses on evaluating its ability to adapt new knowledge into the normal operations (Jansen, Van Den Bosch and Volberda, 2005). This absorptive capacity is considered supportive of product innovation (Scaringella, Miles and Truong, 2017). The process involves evaluating the learning processes, and the formation of groups in the company to exploit knowledge in the market (Jiménez-Barrionuevo, García-Morales and Molina, 2011; Limaj and Bernroider, 2017). The construct provides insights into how companies can attain profit but can fall into limited competence problems (Jansen, Van Den Bosch and Volberda, 2005). The construct's lower level dimensions are transformation and exploitation (Tzokas et al., 2015; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Limaj and Bernroider, 2017). A total of five questions was used to evaluate the transformation dimension, while three questions measured exploitation based on the use of knowledge and new technologies (Flor, Cooper and Oltra, 2018).

All the absorptive capacity variables were measured using a seven-point Likert scale adapted from the literature (1 = strongly disagree, 4 = neither agree nor disagree, 7 = strongly agreed).

4.6.3.3. Knowledge Spillovers

The construct of knowledge spillovers can have positive and negative sides on start-ups. In one end, sharing knowledge in collaboration between companies can lead to the unwanted appropriation of technology through knowledge spillovers (Hallin and Holmstro, 2012; Bouncken and Kraus, 2013; Ritala et al., 2015). Therefore, companies have to incur an additional cost to protect information. In contrast, knowledge spillovers considered crucial to engage in constant innovation effectively. In this case, incoming knowledge spillovers' initial construct involves access to knowledge spillovers through informal sources and collaboration (Cassiman and Veugelers, 2002; Belderbos, René; Carree, Martin; Lokshin, 2004).

The construct of Network Knowledge Spillovers measures start-ups' importance of conferences, white papers, publications, online communities, engagement with other companies, conferences and trail fairs or exhibitions as a source of knowledge (Cassiman and Veugelers, 2002; Belderbos et al., 2004; De Faria, Lima and Santos, 2010). In this case, sources of knowledge unbounded to collaboration (Foss, Lyngsie and Zahra, 2013; Sisodiya, Johnson and Grégoire, 2013). The participants were asked to evaluate the importance of the mentioned sources of knowledge on a 7 point Likert scale (1 = not at all, 7 = to a large extent) (Sisodiya, Johnson and Grégoire, 2013).

The construct of incoming knowledge spillovers categorised to evaluate flows of knowledge between companies, individuals, and institutions in collaborations or alliances (Shu et al., 2014). Individual forms of knowledge spillovers from competitors, customers, suppliers, universities or research institutions, consultants, and the government (Belderbos et al., 2004; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Lau and Lo, 2015). This evaluation of knowledge sources has been used on surveys that facilitated research at the regional level in the United Kingdom and Europe (Laursen and Salter, 2006; Amoroso, Audretsch and Link, 2017).

The classification distinguishes between the sources of knowledge that belong to the value of chain and academic consultants or partners (Bengtsson et al., 2015; Lau and Lo, 2015). Outside the entrepreneurial domain, the same categorisation defined with the constructs of *depth* and *breadth* (Laursen and Salter, 2006; Terjesen and Patel, 2017). On the other hand, knowledge sources of external knowledge that in most cases, operate in a single construct (Cui et al., 2015). For this research, the variables related to depth and breadth as a measurement tool of incoming knowledge spillovers, are evaluated on a 7-point Likert scale (1 = not at all, 7 = to a large extent).

Participants were asked to assess the importance of accessing the mentioned sources of knowledge to explore new business and technological opportunities (Cui et al., 2015; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016). Research has initially started to link knowledge spillovers to evaluating companies' performance (Chen, Chen and Vanhaverbeke, 2011; Ahn, Minshall and Mortara, 2015; Bengtsson et al., 2015). The research has supportive evidence to define the Incoming Spillovers and Network spillovers as formative order constructs. In this case, the study conducts uses Partial Least Squares Structural Equation Modelling (PLS-SEM) to conduct validity and reliability tests and text the final model (Hair, 2018).

4.6.3.4. Control Variables

The research considers the age, role, and highest qualification of the entrepreneurs (Limaj and Bernroider, 2017; Song et al., 2017). These indicators are potential evaluators that experience has on the performance of start-ups product innovation. The respondent's profile also included their current managerial role (Lau and Lo, 2015; Shafique and Kalyar, 2018). The research also consists of the control variables of start-up and work experience in the same industry (Song et al., 2017). The controls seek to identify the source of tacit and explicit knowledge spillovers to start and manage the company (Fallah, Howe and Ibrahim, 2004; Schmidt, 2015). The variables align to the use of knowledge obtained from clusters of knowledge developed around universities and science and technology parks (de Jong and Marsili, 2015; Amoroso, Audretsch and Link, 2017; Song et al., 2017).

The controls of companies size, age, and type of industry are included. Participants were asked to provide the number of years that the company has been working since the foundation (Lau and Lo, 2015; Jin, Shu and Zhou, 2019). The company's size is evaluated by taking into account the number of full-time employees currently working in the start-up (de Jong and Marsili, 2015; Lau and Lo, 2015; Jin, Shu and Zhou, 2019). The research includes dummy variables to classify the start-ups. The NACE list distinguishes between high-technology (35.3, 30, 32, 24,4, 33), knowledge-intensive high-technology services (60, 72, 73), and others falling in the area of knowledge-intensive financial services (65, 66, 67).

The research also controls the location of the company. The variable ownership asked if the companies are headquartered in the united kingdom (Jin, Shu and Zhou, 2019). The control variable of diversity evaluated if the company had multiple businesses (Zobel, 2017). The evaluation asked the entrepreneur if they have been part of an incubator or accelerator programme in the United Kingdom (Rothaermel and Thursby, 2005; Sedita et al., 2017; Journal, Xiao and North, 2018). In this context, research is interested in the attendance enabled to enhance the absorptive capacity and innovation processes of start-ups. The control variable responses were classified with binary numbers stating: (0 = no, 1 = yes).

Finally, we measured technological turbulence by asking entrepreneurs if they considered that technological change is continually changing (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Zobel, 2017). The variable seeks to identify if high-technology companies consider technological change a tool for survival or a restriction that affects product innovation (Santarelli and Vivarelli, 2007; Su and Yang, 2018). Technological turbulence was measured using a 7 point Likert scale stating: (1 = Strongly disagree, 4 = neither agree nor disagree, 7 = Strongly agree).

The survey with the structure of the questions used for the constructs is illustrated in Appendix B.7.

4.6.4. Data Analysis

4.6.4.1. Structural Equation Modelling

Structural equation modelling or (SEM) has been used to evaluate models that can evaluate interactions between variables (Hu and Bentler, 1999a). It is used to assess complex models with latent variables and constructs (Henseler and Chin, 2010). Quantitative models are developed by establishing relationships between actions taken by the company through hypotheses. In this case, model KST-QNCM produced in the quantitative analysis in Chapter VI results from the qualitative analysis conducted in Chapter V in the form of constructs used to tests the relationships. These approaches are also considered a multivariable analysis, uses measurements obtained from individuals or companies gathered from surveys (Hair et al., 2016). SEM practices have focused on the so-called "first generation" analysis, which uses techniques to analyse the covariance (Barrett, 2007; Benitez et al., 2020).

These tests seek to evaluate the differences between the empirical evidence and preestablished theoretical concepts by evaluating model fit statistics (Masaki M., 2011; Benitez et al., 2020). This approach's essential characteristic is to enable the researcher to evaluate unobserved latent variables, which allows evaluating the actions and behaviours of entrepreneurs (Lowry and Gaskin, 2014). Therefore, the first approach to take for this analysis established a potential quantitative model (KST-QNCM). The model evaluates the influence of incubators and accelerators, the evaluation of spillovers, the start-up's absorptive capacity, the effect of technological change towards product innovation.

SEM also consists of second-generation analysis would start to develop by considering at first potential hidden heterogeneity of models caused due to the evaluation of multiple samples on a single model (Becker et al., 2013). This led to the implementation of Partial

Least Squares path modelling (PLS-PM), which enables statistical analysis to use a composite model using reflective and formative constructs (Benitez et al., 2020). This “second generation” SEM analysis enables the evaluation of hierarchical component models and uses lantern constructs as proxies to evaluate effects that cannot be measured directly (Becker, Klein and Wetzels, 2012; Lowry and Gaskin, 2014).

The process incorporates the evaluation of multiple groups using bootstrapping (Benitez et al., 2020). Moreover, the combination of constructs enables to evaluate casual-formative measurement models and not to be restricted to the evaluation of covariances (Henseler, Ringle and Sarstedt, 2016; Benitez et al., 2020). Thus, PLS enables testing on new theories that remain to be confirmed (Lowry and Gaskin, 2014). This research implements this second approach due to the inexistent formal evaluation of knowledge spillovers as constructs on a model of entrepreneurship.

4.6.4.2. Exploratory Factor Analysis

The exploratory factor analysis (EFA) used to evaluate the nature of the factors or latent variables and assess the correlation among them (Brown, 2015). The ultimate role of the EFA is to identify a structure of aggrupation and interrelationships among variables (Hair, 2010). These lead to the identification of factors that can be correlated and represent dimensions of a model. This process was chosen to identify all the essential information from the data while maintaining the most critical information and reducing noise error (Masaki M., 2011). This preliminary analysis enables the researcher to establish a stepping stone to conduct a Confirmatory Factor Analysis (CFA) and a Partial Least Square (PLS) regression while aiming to maintain the validity and reliability of the data (Ullman and Bentler, 2003). The analysis based on common variance seeks to identify the explanatory constructs or lantern variables, including all the clusters of variables that have a high correlation (A P Field, 2018).

The factors and components are visualised on an **R-matrix**, which shows the variables on-axis, and enables to identify variable classification through a **factor loading** (A Field, 2018)**.** In this research, all the variables represented by sets of items shown on a questionnaire (Brown, 2015). In a sense, factor analysis conducts s multiple regression analysis, were the shared variance among every item is a communality (Malhotra, 2020). This analysis is conducted using the statistical software SPSS. The detail of the analysis regarding the extraction of factors and rotations are illustrated in Appendix B.8.1.

4.6.4.3. Confirmatory Factor Analysis

Among the first generation techniques, the CFA is focused on testing factors identified from the EFA (Hair et al., 2016). This analysis focuses on assessing pre-established relationships between constructs through hypothesis (Brown, 2015). The evaluation carries on from the assumption that the constructs cover adequate factor loadings and commonalities (Brown, 2015). CFA enables multiple groups to test for measurement invariance, which makes sure that the survey does not cause bias (Ullman and Bentler, 2003). The analysis calculates a model fit that highlights the covariances between the factors (Barrett, 2007). The fit tests are compared in contrast to the chi-square distribution (X^2) and to evaluate the model's implied covariances and the residuals obtained from the data (Barrett, 2007). This approach enables to test the nature of reflective factors.

The CFA is conducted by evaluating latent variables, which enable to assess behaviours and actions of entrepreneurs that cannot be observed (Brown, 2015). Thus, the researcher needs to implement adequate metrics for the factors through scales for every item. As a rule of thumb, every construct should have at least three variables, each variable should only be linked to one factor, and the existing errors between the items should not be correlated (Blunch, 2013). The CFA's final objective is to produce a variance-covariance matrix and factor loadings that enable to test the overall model (Brown, 2015). A representation of the measurement model is shown in figure 4.15.

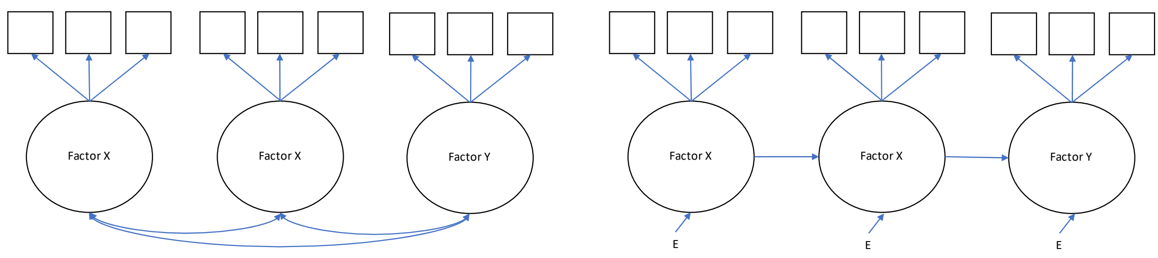


Figure 4. 15 - Measurement and structural model based on Brown (2015).

The models' initial assessment is to evaluate that the Cronbach's alpha correlations above 0.7 (Hu and Bentler, 1999b; Byrne, 2008; Blunch, 2013; Malhotra, 2020). The evaluation of the models is conducted by assessing the model's absolute and incremental fit indices (Malhotra, 2020). The comparative fit index (CFI) should be above 0.95, the root mean square residual (RMSR) has to be above 0.09 or 0.1, the root square error of approximation (RMSEA) should be above 0.6 (Hu and Bentler, 1999b; Byrne, 2008). Also, the validity of the measures needs to make sure that the average variance extracted (AVE) which enables to assess discriminant and convergent validity is above 0.5, which indicates that the construct accounts for more than fifty percent of the variance (Barrett, 2007; Benitez et al., 2020; Malhotra, 2020).

4.6.4.4. Partial Least Squares Structural Equation Modelling

This approach evaluates indicators generated from linear combinations that represent the model (Hair, 2018). The statistical analysis maximises the validity of the model and variables by assessing the correlations and covariances (Henseler and Sarstedt, 2013). The parameters are taken into consideration on PLS-SEM evaluate on the factor loadings, evaluation of the measurement-error variances, the coefficients that indicate the unidirectional relationships between the constructs and variables, and the assessment of prediction errors linked to the endogenous variables of the model (Yuan, Wen and Tang, 2019).

Partial least squares path modelling (PLS-PM) differs from CFA as it enables to evaluate reflective, causal formative models and composite models (Benitez et al., 2020). PLS-PM can deal with second-order emergent variables, assess possible multicollinearity between the constructs of the model, and conduct a multiple groups comparison (Benitez et al., 2020). PLS-PM focuses in this research to further reinforce and explore the inclusion of constructs on an established model due to its focused of a prediction variance (Hair, Ringle and Sarstedt, 2012; Lowry and Gaskin, 2014).

The most important reason to use PLS-PM is to use reflective and incorporate formative indicators (Henseler, Ringle and Sarstedt, 2016). In this case, formative constructs are composed of explanatory indicators and variables that do not require correlation (Henseler, Ringle and Sarstedt, 2016). Thus, the inclusion of weights is not directly affected by measurement errors (Yuan, Wen and Tang, 2019). Formative indicators focused on linear combinations, independent variables that evaluate explanatory sources (Hair et al., 2017; Yuan, Wen and Tang, 2019). The analysis of these constructs does not require to be assessed using EFA.

Moreover, the construct variables cannot be eliminated since it could change the meaning of what is being evaluated. The assessment of hierarchical approaches is conducted through a two-stage approach (Brown, 2015; Hair, 2018). A visual representation of the possible combination of constructs is shown in figure 4.16.

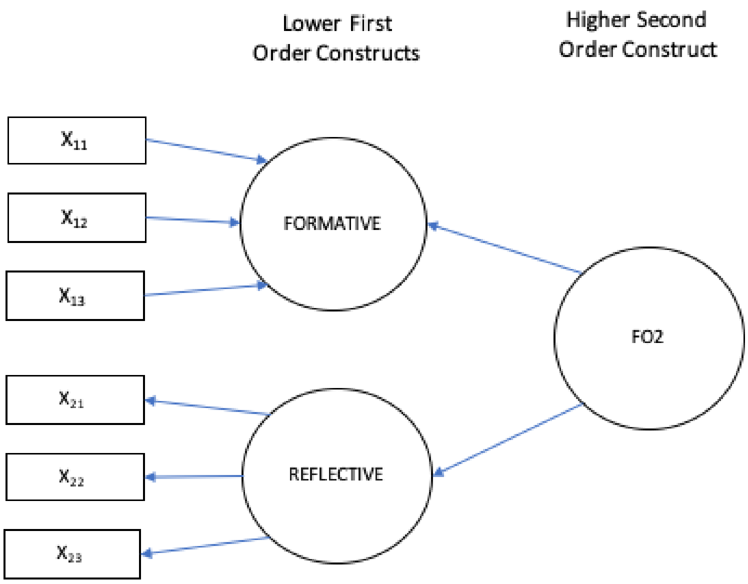


Figure 4.16 - Reflective-reflective and formative reflective constructs, based on hair et al., (2012)

This approach also enables to evaluate common factors related, but that could also belong to different factors (Becker, Klein and Wetzels, 2012). These characteristics are essential due to the multiple constructs used to evaluate absorptive capacity (Flatten et al., 2011). Besides, knowledge spillovers have usually been assessed as independent variables using weighing criteria or regressions (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Amoroso, Audretsch and Link, 2017). The evaluation of independent sources independent between each other leads to test constructs of knowledge spillovers formally. This statistical analysis type was conducted using the statistical software Smart-PLS, which is considered one of the advanced statistical software up to date for this analysis (Lowry and Gaskin, 2014; Hair et al., 2017). The evaluation of the models and assessment of heterogeneity on multiple groups is illustrated in Appendix B.8.2.

4.7. Conclusions

The research design proposed for the analysis of knowledge spillovers is established as follows. Conduct a filly mixed-methods sequential strategy (Tashakkori and Teddlie, 2010; Doyle et al., 2012). The type of design consist of the approach of a sequential exploratory design, were all the aim is to enable the creation to create a research tool that facilitates the generally of the results obtained from the hypothesis, and the selection of the adequate concepts and variables to understand the effect of knowledge spillovers on high-tech incubators (Tashakkori and Teddlie, 2010; Bryman and Bell, 2015; Creswell and Plano Clark, 2018). The first phase starts with the full qualitative spectrum that can use the theories related to the Knowledge Spillover Theory of Entrepreneurship. The first step is to generate a conceptual deductive model, and on previously adapted research strategies (Creswell, 2014; Saunders, Lewis and Thornhill, 2016). The approach is to evaluate if there are Cretan types of differences and evaluate the participants' responses. On that matter, the research will focus on cross-sectional studies with a between-group approach through the use of case studies (Strang, 2015).

At this point, the sample selected for this initial phase consists of interviewing the Chief Executive Officers (CEOs) and founders of high-tech start-ups, which act as an individual and a representative of the group of the company (Strang, 2015). The conduction of the analysis of incubators enables to extend the understanding of knowledge spillovers on the geographical proximity of sources of knowledge and enables to evaluate start-ups on high-tech that focus on the growth of the company despite the competition on urban areas (Renski, 2009; Acs, 2013). From this perspective, the approach to selecting incubator programmes is directed towards space where entrepreneurs can have access to a location to operate their business, is focused on the independent commercial incubators (Zedtwitz, 2003).

On this point, the qualitative phase consistent on first sending an introductory message to the organizers of incubator programmes, which act as gatekeepers (Creswell, 2014) (Creswell; research design). This approach is extended by requesting start-ups on face-to-face interactions on entrepreneurial evens through London were companies and incubator programme organisers gather to participate with no potential harm (Hennink, Hutter and Bailey, 2011). This approach aims to obtain replicability and theoretical saturation from the data collected (Yin, 2006).

The qualitative phase's capture of data is focused on the individual behaviour, attitudes, and perceptions of high-tech entrepreneurs (Yin, 2006). On this note, the research strategy is to conduct multiple-case studies (Yin, 2006; Strang, 2015). The analysis will consist of gathering data from three to five participants per incubator programme and a total of six to twelve participants (Tashakkori and Teddlie, 2010). This initial selection and characteristics of the types of entrepreneurs also identify the types of entrepreneurs that are part of the programme (Burns, 2000; Welter et al., 2017). The aim is to make the independent private incubators participate in the session (Grimaldi and Grandi, 2005).

The adequate form of initial qualitative data collection consists of face-to-face one-on-one interviews on the incubators or other locations preferable by the researcher and the entrepreneurs (Creswell and Plano Clark, 2018). This type of collection avoids the problematic of the missing trail that knowledge spillovers in some cases are not linked to a document (Audretsch and Stephan, 1999). The qualitative analysis is focused on thematic the thematic review of concepts and variables that connect from the data and the literature collected (Tashakkori and Teddlie, 2010). The study of the interviews through coding using NVivo 12 will focus on drawing the draw the cross-case conclusion and including the theory (Yin, 2006). The qualitative data analysis is conducted by coding the responses of the participant into theoretical dimensions and second-order themes (Yin, 2006; Eisenhardt, 1987) The coding of quotes from the transcribed interviews is conducted on two cycles to contrast the discussion of the literature and conceptual model with with the data collected.

The quantitative design requires collecting data from online surveys set to CEOs and founders of high-tech start-ups (Malhotra et al., 2016). The phase requires a minimum of 200 valid responses (Ullman, 2003; Barret, 2007, Brown, 2015). The surveys used categorical and ranking scales that reflect the variables. The objective is to evaluate start-ups processes during the absorption and implementation of knowledge spillovers towards innovation. The main quantitative analysis consists of an initial phase of exploratory and confirmatory factor analysis to evaluate reflective variables. The purpose of the analysis is to identify the correlations between variables to aggregate them in constructs and dimension in a model (Hair, 2010; Brown, 2015).

The analysis ends with PLS-PM implementation, which evaluates reflective-formative models through regressions and bootstrapping of a defined model (Hair, 2018; Henseler, 2016; Benitez, 2020). The analysis includes multiple group analysis between groups to compare the characteristics of entrepreneurs' start-ups and background (hair, 2018; Limaj and Bernroider, 2018; Zobel, 2017).

5. CHAPTER V QUALITATIVE ANALYSIS

5.1. Introduction

Chapter V seeks to identify the types of knowledge spillovers that affect entrepreneurs in the early stages of start-up development. The chapter is dedicated to cover the first contribution to the knowledge of developing an empirical model and themes discussed from the model KST-QLCM developed in Chapter IV. The qualitative research includes conducting a multiple case study approach involving high-tech start-ups that have attended accelerator and incubator programmes in Greater London, United Kingdom (UK). The research conducted 32 semi-structured interviews with Chief Executive Officers (CEOs) and co-founders of start-ups.

5.2. First Qualitative Analysis

This study's analysis section is centralised on comparing the identified themes and concepts identified from the literature review. The topics were compiled in a set of proposed indicators, constructs, and variables to evaluate knowledge spillovers' effect on high-tech start-ups. The discussion in this section describes and discusses the initial proposed initial conceptual model KTS-QLCM: of the identified themes and concepts discussed following the structure illustrated in figure 5.1 through the perspective of participants and start-ups that took part in the research. The interview collected the base information on the nationality, age, highest qualification, number of employees, job position, and years of operation. The founder's characteristics and experience have led to identifying sets of decision-making process and experience on knowledge spillovers capture and innovation.

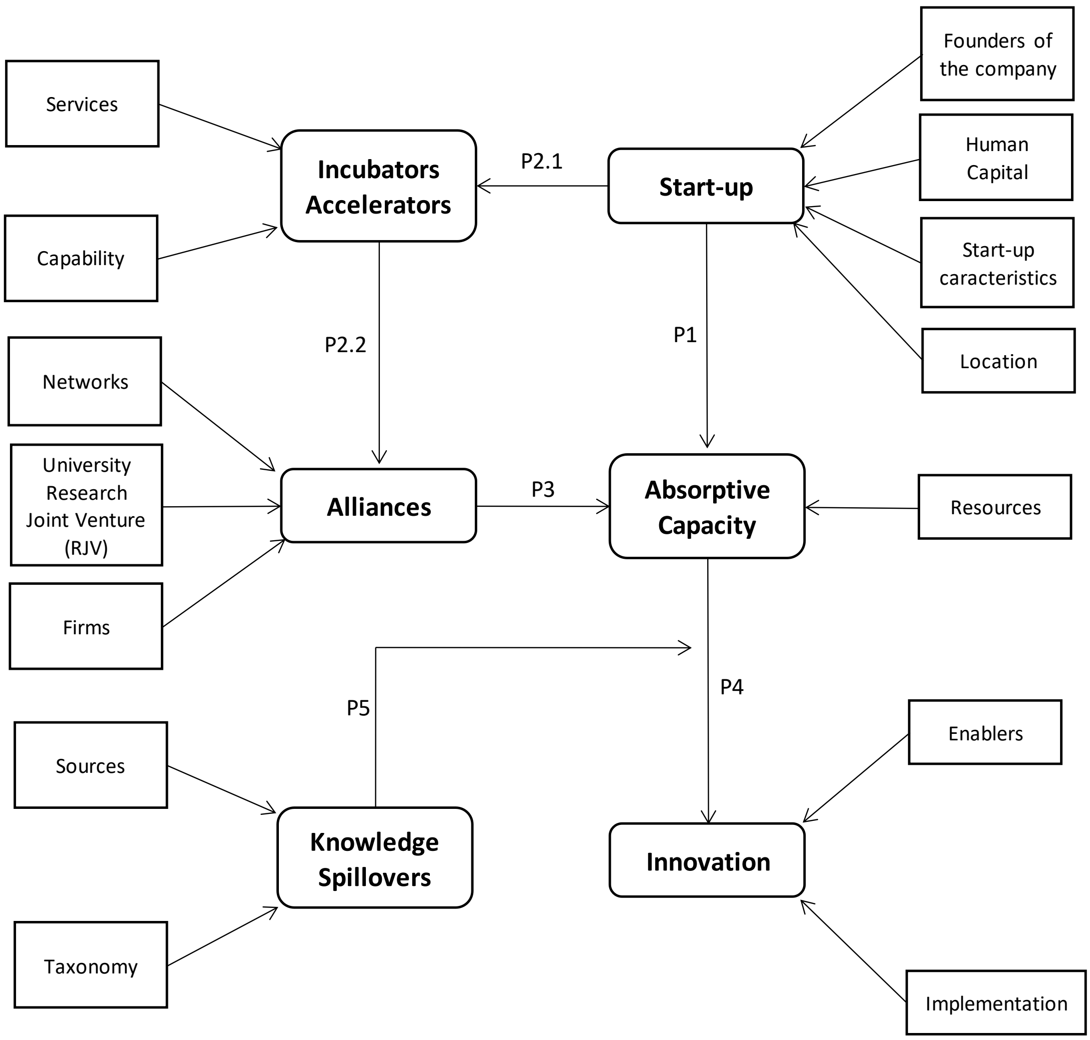


Figure 5.1 - The initial deductive conceptual model (KST-QLCM)

The researcher analysed the data and developed inductive codes (Zaborek, 2014; Eisenhardt, 2016). The process enabled to analyse the data through multiple interactions to develop a final conceptual model. The approach is used continuously to develop valid constructs that can support the quantitative analysis phase (Bryman, 2006; Bentahar and Cameron, 2015). Research in the entrepreneurship area using interpretivism approach has focused on evaluating teams, outcomes produced, and the mobility of new ventures (Breugst, Patzelt and Rathgeber, 2015; Suddaby, Bruton and Si, 2015). Research on incubators and accelerators has also explored the programmes' curriculum, sources of funding, mentorship, access to investment, and the interactions between entrepreneurs. Also, research of knowledge spillovers developed new typologies and definitions that can be extended to the use of quantitative research (Ko and Liu, 2015a; Cantù, 2017; Scaringella, Miles and Truong, 2017). The structure of the analysis discussion for the first order themes and second-order categories is illustrated in figure 5.2 The participants' demographics are illustrated in table 5.1.

Table 5.1 - Demographics of the start-ups and the entrepreneurs

Interview	Nationality	Age	Highest Qualification	Number of employees	Job position	Years of operation
1	Greek	36	PhD.	4	Chief Executive Officer	7
2	British	50	PhD.	26	Vice president of COC	2
3	British	55	PhD.	57	Chief Executive Officer	6
4	British	68	BA Business Manager	12	Executive Chairman	12
5	British	60	MBA	24	Chief Executive Officer	2
6	Canadian, Irish	34	MBA	50	Chief Executive Officer	3
7	British	35	PhD candidate	1	Chief Executive Officer	2
8	French	37	Master’s degree	15	Chief Executive Officer	3.5
9	British	31	Doctorate in medicine	8	Operations Director	3
10	British	44	BA Science	32	Chief Executive Officer	3.5
11	French	38	Master’s degree in science	7	Chief Executive Officer	2
12	British	39	Master’s degree	80	Chief Executive Officer	7
13	Indian	25	Master’s degree MIT	14	Chief Executive Officer	3
14	Lebanese	34	Bachelor’s degree	9	Chief Executive Officer	5
15	Irish	24	Bachelor’s degree	16	Customer Engagement Manager	3
16	British	29	Bachelor’s degree	5	Chief Operations Officer	2
17	American	43	Master’s degree	11	Chief Executive Officer	2.5
18	Danish	34	Master’s degree	9	Chief Executive Officer	2
19	Greek	34	Master’s degree	15	Chief Executive Officer	6
20	British	50	Master’s degree	30	Chief Executive Officer	15
21	British, Canadian	41	Bachelor’s degree, engineering	5	Chief Executive Officer	4
22	Canadian	28	Bachelor’s degree	8	Chief Executive Officer	2
23	British	28	Bachelor’s degree	9	Chief Executive Officer	4
24	British	49	PhD.	4	Chief Executive Officer	4
25	Italian	34	Master’s degree	5	Chief Executive Officer	3
26	Australian	47	Bachelor’s degree	65	Chief Executive Officer	3.3
27	British	45	Bachelor’s degree	19	Chief Executive Officer	3
28	British	39	MBA	4	Chief Executive Officer	3.5
29	British, Uzbek	27	Bachelor’s Degree	2	Chief Executive Officer	2
30	Israeli	42	MBA	25	Chief Executive Officer	3
31	British	42	MBA	11	Chief Executive Officer	4
32	British	43	MBA	27	Chief Executive Officer	4

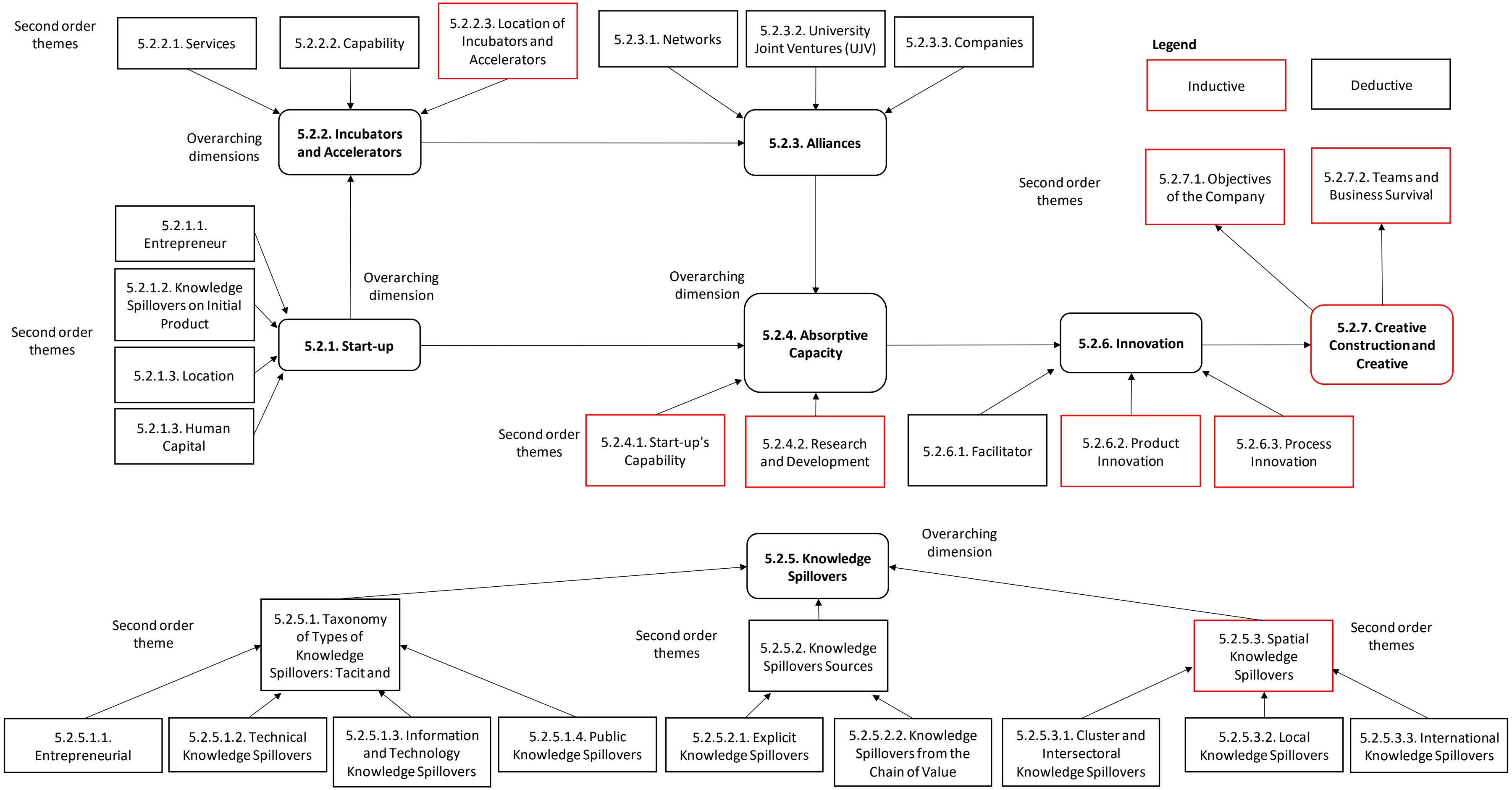


Figure 5.2- Overarching Dimensions, first-order dimensions and second-order themes discussed in qualitative analysis, Empirical model (KST-QLEM1)

5.2.1. Start-up

5.2.1.1. Entrepreneur

Entrepreneurs that operate in the biotechnology would hold a PhD related to biological sciences and years of experience in the pharmaceutical sector (SU-FC1, SU-FC2, SU-FC3). In these cases, the decision to break the knowledge filter and start developing the new company realises founders that it is a highly risky decision that comes with great rewards, expecting to work on the start-up for two to four years (SU-FC4). Also, Biotechnology companies initially identify knowledge spillovers from previous institutions before starting the company, and endogenously develop new knowledge (SFU-FC5). In summary, the entrepreneurs of companies in this industry decide that commercialising new knowledge generated from companies and escape incumbents' static structure (See Table 5.2).

Table 5.2 - Quotes for the theme Founder of the Company, entrepreneurs in biotechnology

Base 2nd Order Theme	Relevant Quote	Interview	Code
Founders of the Company	Well, we were in Academia, my partner and I became ------------, and we thought it would have other applications outside the academic.	1	SU-FC1
	I studied biochemistry here at the University of Westminster between 83 and 86. I then became a research assistant from Cambridge, where I completed my P.H.D.in biotechnology, and I've worked for ---------and also worked for about 17 years in institutional drug development so a big pharma. I changed career direction completely went from drug development into biotechnology and gene therapy and since 2012 I've been working with G.S.K. until the end of 1216 and since January of 2017 I've been working in ------ is a small biotech company.	2	SU-FC2
	Have a P: H:D: in pharmacy A.J. and N.D.A., but the P.H.D. Overseas.	3	SU-FC3
	Frankly, I became increasingly frustrated by the bureaucracy of a large working pharma company, the procedures --------- way of working wasn't able to adapt to a new area science, so everything took longer than it needed to take to get things done, so you can't achieve very ---------------, decisions were never made, so you could not progress your project. I was offered the opportunity to work in small biotech. It's high risk but potentially highly rewarded, so that's the differentiate, staying in a small start-up. Or a big pharma company. You kind of perception that you have a long time career, but that's not true. Working for a small biotech company where you have the promise of two to four years is as good as a big pharma company.	2	SU-FC4
	So this is the knowledge that we created, so it comes internally that this company's establishment was based on new knowledge from 2or 3 individuals from the scientific family. So that's where the intellectual knowledge comes from so we used the initial founding knowledge, and then we develop, but we rarely take additional key knowledge from outside. I want to establish that— intellectual funding or intellect. To start with an intellectual foundation, you need 2 or 3 founders, and we've got all that.	1	SU-FC5

On High-Tech companies that are engaged in services; The founder often decides to collaborate with other co-founders to finance the development of the new venture. Therefore, at least one of the founders acts as an economic agent that identifies knowledge spillovers and find ways to commercialise it. On the other hand, other entrepreneurs and co-founders that did not hold the initial business idea provide knowledge spillovers through technical expertise to develop the product (SU-FC6, SU-FC7).

Companies' critical difference in high-tech located in an urban city is their ability to develop a product or platform that does not require many resources. Therefore, entrepreneurs in software rely on the business idea, the human capital enrolled in the company, and funding available (SU-FC8). The CEO would decide to start a new company based on their motivations to use **tacit knowledge spillovers** from previous business experience (SU-FC9).

Based on the evidence obtained from the transcripts, it is accurate to propose that the company's creation depends initially on the individual alliance formed between the co-founders of the company and the start-up’s human capital. There is a distinction between CEOs in the Biotechnology sector in comparison to the other entrepreneurs. The differences include entrepreneurs who have a doctorate and the use of academic research. The codes of this analysis are illustrated in table 5.3.

Table 5.3 - Quotes for the theme Founder of the Company, entrepreneurs in other industries

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Founders of the Company	After 13 years of a corporate job, the question was what to do next, ----------------------------- I am not a natural-born entrepreneur. A lot of people around, friend and so have been talking for years, they want to start a new company and so. What led me on that path was first the business ides the business model the technology etc. I got it to speak out of the job I had dealing with the implementing tributary change that was a big part of my job as an engineer. The second part that influenced were encountered, so I went with my co-founder who is also from Cologne to work together, and we both had the will and the desire .--------------------- and we were in the same timing in our lives ------------------------------ and the ability to do it with someone else, this looks like a good partnership.	11	SU-FC6
	I saw how much money was needed to make this idea come to life. ---- the practicality this is something I can build I did not need to buy equipment of 1000,000 pounds, hire a team of 15 engineers, I felt like that I could start to work on this myself, so it was a mix of action and practicality that began, later there was market research ------ location -------- I brought in my friend and co-founder who is my C.T.O. so until October I did it by myself when he was a big millionaire.	13	SU-FC7
	I´ll describe it in film terms. So, I´m the producer, so I´m finding the finance, I´m finding the distribution. He´s the director, he creates the magic, he finds the creative people, designers, engineers, and so that’s his skill. He is a U. X. guy. He´s an experienced guy, so he is actually from a tech. Base, I´m actually from an insurance base. But we both have some time in each other’s area. So, I’ve been involved in some business transactions; he´s been involved in the insurance side. So we knew each other’s area, I think the chemistry between the 2 of us, from my point of view, is very good., so we said, let´s give it a go.	5	SU-FC8
	Yeah. You get better and better at it, you do not make the same mistakes, like if I said “do academia for 20 years” you would be pretty good at it. No? This is my point, businesses may change, but the principles remain the same. How you find a co-founder, what you look for in the business structure, how to raise money, how you hire people, how you market business, how you go to the market with your product, all these things are transferred. Hence, as you do this more and more often, you pick up a lot of experience. And this helps you because it is a job that demands a lot of commitment and tenacity and energy. As you get older, you need to have some experience to offset the fact that you are older, and I found myself in that position.	10	SU-FC9

5.2.1.2. Knowledge Spillovers on Initial Product Development

The business's initial identification can be unintentionally absorbed in the previous institution where the entrepreneur was operating on, acting as a mechanism for start-ups formation to engage in innovation (Nieto and Quevedo, 2005; Cantù, 2017). Entrepreneurs have detailed that the identification of the product alone is not enough. The validation of the idea includes market investigation and product development through R&D that can come in different forms. For instance, exploration in biotechnology sectors is embedded in academic research from universities, connections to experts, and human capital hiring (SU-KSIPD1). However, such development requires funding, that if not obtained, can prevent the formation of the company, and initially direct the on the development of products. Hence, funding can come from different cases, starting with finding investors and exploiting networks from its initial funders (SU-KSIPD2).

Entrepreneurs that capture **technological knowledge spillovers** coming from the product will decide to start capturing **customer knowledge spillovers** to gain insights on the value of the market's idea. The search's development would enable to identify the characteristics of the constant development of new products, or product features, even if initially the market does not provide with enough information (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Such a process can lead to a continuous process on initial product enhancement until the creation enables revenue from the market or funding from investors. In such a process, creating this product is essential to the foundation of the start-up (SU-KSIPD3).

Experienced entrepreneurs develop a business case set from the beginning, causing a reduced perception of accelerator programmes' effects once the company is created. Furthermore, the assessment from experts in the field would enable to evaluate the product at hand, which can come from the experience of an expert on the organisation, and the comparison with **Competitors Knowledge Spillovers** (SU-KSIPD4) (Hájek and Stejskal, 2016; Cantù, 2017)**.** On the other hand, start-ups on new products' development process can obtain insights from knowledge spillovers captured from the accelerator programme services and capability (SU-KSIPD5) (See Table 5.4).

Table 5.4 - Quotes for the theme on Initial Knowledge Spillovers on Initial Product Development

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Knowledge Spillovers on Initial Product Development	So evaluating biotech market values is quite difficult. So during my recruitment process, I evaluated the technology, the ideas, and looked into the security of the funding. The initial funding. The serious A funding, basically a company is established through ----------- because they are a significant funder they establish biotech companies and philosophic ------- continue to fund these companies all way through to commercial success. ------------------- so that's reassuring that they are in for a long game------------------ they understood the challenge around developing gene therapy drugs and this specific work is a kind of unproven biology. Still, it could be very successful, so it's high risk.	2	SU-KSIP1
	When I joined, one man had written some software, wasn´t going anywhere, didn´t know which way to go. But he got a good investor, ------ an Italian reply. They liked Alex, the founder. They could see he was a good technician, good at presenting, so the senior investor powers knew me. Would I come along ------initially as a chairman, but then the executive chairman means I do the business development and set the strategy------. I know everyone in rail, aviation is similar, but I don´t know anyone, so I have to start from scratch.	4	SU-KSIP2
	So I knew that this idea was appealing to customers. I also knew that the insurers would need to deliver this new type of service. And I didn´t know how much money I was going to have to raise to do it., so in the early stages a little test a bit and did some research and then the key was to find the right people to do it. Yes, the right business partner. My last start-up. Was not a success. We built it and built it, but it wasn´t making money and then we sold it. But we didn´t sell it very well. I view it as a failure, which was very painful. So in this start-up, I learnt a lot of lessons, doing something different and enjoying it more, working with people, and I would say, I´ve learnt a lot about running a business. My last business was not tech. It was a very different way of working, so I've had to adapt to it.	8	SU-KSIP3
	One of our keys to teaching new partners is that I've always got along well with them, even though they were competitors. When we raised ---- security, I said right it´s through card ship because we are a small start-up. And they are a big company; they got their kick on three and a half thousand trains, 25.000 buses, all of which need side security.	4	SU-KSIP4
	Well, let me talk about ELEMENTOR because I did not start the other one. It came out of our experience in the--accelerator. When we were there, we talked about a particular customer problem. We saw ourselves in the perfect place in time and stumbling on that particular problem we realised we could help. Before we formed the company, we had a customer, a small contract to develop the technology we kind of formed the company on the back of that. In the accelerator, we did quite a bit on market research. We had indication classes and segments of customers, especially government, financial services, and costs, so from the start we knew it was something worth. for the first two months, we did more research and digging to build our financial globe.	4	SU-KSIP5

5.2.1.3. Location

Start-ups that are not developed initially in an accelerator or incubator programme can decide to initially design the company in a location that enables the reduction of operational costs (Renski, 2017). Hence, the first location to develop the company may not be linked to the advantages provided by an entrepreneurial ecosystem (Welter et al., 2017; Audretsch et al., 2018). However, the company's development in such characteristics can lead to potential growth if the product provided used as a supplier item for incumbents.

The second most important characteristic of the company is the industry in which the start-up decides to enter. This single decision guides the start-up on the further decision to engage with similar industries, establish a perceived required number of employees, focus on the level of technology that is going to use, and to engage with the local government (Wong, Lee and Foo, 2008; Markovitch, O'Connor and Harper, 2015; Qian and Jung, 2017). Decisions consider the start-up's engagement with the market, and the initial adaptation to the regulations. The quotes linked to the characteristics of the company are illustrated in table 5.5.

Table 5.5 - Quotes for the theme Characteristics of the Company

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Characteristics of the Company	One colleague lived in Canada, and he needed the internet to his house, he lived in the countryside. And this guy came along and installed a WYMAX station on his house that transmitted the internet signal about 10 miles. That got him thinking: where is the only place that you can't get an internet connection? On trains. So, they did some tests with this technician guy who came to do the trial, and so we did an initial trial which worked. So, the first project we did was we managed to persuade Southern Railways to do a trial, and so we did an initial trial which worked. We built a trackside network, which was the first trackside network that provided connectivity on the internet for trains. At this time, Team Mobile was keen. They were developing about their hot spot, so they had Starbucks, and all using team mobile. They then came on board, and they branded up the train as a Team Mobile hot spot, which was very interesting. We got some quite big investments from the investment house AMADEUS, investing in technological companies. And from then we started and won one contract and later another contract and some of the equipment. I made some of it in my workshop, and some of it is still around. Then we won huge contracts like Dutch Trains, a 30 million pound contract, then AMTRAK, a lot of U.K. business projects worldwide, and one of the things that helped us, I set up a deal with one of our main suppliers….rail cables and antennae.	4	SU-CC1
	We are called WEEBATS; we operate in a few industries, the easiest way to put it is: we help tourists ---- funds on their shopping in Europe. So we are in the travel industry, in the finance industry, a little bit in the slash government authority, all of our revenue comes from the taxes in the U.K., and when we are not going to focus just on tourists, we ---- with the tax authorities. So we have a few verticals that we have touched. We have travel, finance and tax. Yes, those are the three main ones.	29	SU-CC2

5.2.1.4. *Human capital*

Entrepreneurs emphasised hiring human capital that is motivated and understands the implications of working on entrepreneurship. One of the most critical is that new ventures offer a high risk-rewards in contrast to a safe job position due to the possibility that the company needs to lay off employees in times of crisis (SU-HC1). Hence, the company's development and the employment of entrepreneurs on high-tech start-ups depend on the evaluation of the initial business idea captured through knowledge spillovers Regarding academic training. Founders seek professionals that hold technical degrees such as biologists, biochemists, electrical, mechanical engineers, and master's in business administration (MBA), with prior experience in the industry (SU-HC2). In some cases, knowledge spillovers support the business idea's analysis by hiring human capital that can form a first base foundation of technical knowledge (SU-HC3).

Entrepreneurs consider that team members with a different background usually are not consciously perceived as a source of knowledge spillovers. Still, it is embedded in the organisational culture of the company (SU-HC4, SU-HC5). Knowledge spillovers awareness raises when employees are assigned to for the company in a different city. Students centre their attention to develop their knowledge in the UK and look to have the best from both parts (SU-HC6). On the other hand, CEOs consider that employees hired from new positions require a technical background from the industry and not academia (SU-HC6, SU-HC7). Also, start-ups use human capital to exploit previous networks and employees' experience from different countries (SU-HC8, SU-HC9, SU-HC10, SU-HC11, SU-HC12, SU-HC13). The quotes related to human capital are illustrated in table 5.6.

Table 5.6 - Quotes for the theme Human Capital, hiring new employees

2nd Order Base Theme	Relevant Quotes	Interview	Code
Human Capital	It's much easier to recruit than to let go. We hire motivated people who understand (19) the environment. It's a growing start-up and is risky. Many people are better off in a more established start-up where there are less pressure and less potential.	1	SU-HC1
	Mostly engineers, electrical, mechanical and two business development people with an MBA in finance.	1	SU-HC2
	Well, we create our knowledge, the key thing is recruiting the right people, with the right experience and the right knowledge ---- were developing a ------- manufacturing process, I can't buy that technology I can't go out and buy that technology, you develop it yourself, and you need people, skilled individuals, to be able to do that. You have to equip these people.	2	SU-HC3
	Knowing people, you have with the experience and knowing the quality of their work, cultural fit. I´d say he's been very instrumental in making sure we have very high levels of quality of the people we have got, and that means more expensive, so I had to raise more money…but the result is that we have a very strong tech. Platform. So everybody has done good intelligence on this. It´s very good, so high quality, good chemistry, good culture, very open and very honest culture.	5	SU-HC4
	We do not hire for skill set; we hire for cultural fit. ----------------------------------- the trick is to get someone with a few more skills than you need ------------------------- we tend to employ smart and curious --------------- those are a few things about hiring.	10	SU-HC5
	Rarely from academia --------------------- it really depends on the role, if you are looking for salespeople ------------------------------- if I look for business development I look for a company that is doing well, so that is kind of how you do it.	10	SU-HC6
	Very rarely from Academia, I mean this start-up. Is too developed; people in Academia don't have the skills required to be in development. Technical development expertise comes from working in clinical ------------ so we are bringing in very specific functional experts—for example, C.M.C. manufacturing lead. And we're targeting, targeting on people who have worked in manufacturing for some time and have expertise in the area or have worked in big drugs, in big projects. So, we're not looking for academics. We were with academics ---- are---- as experts. In clinical trials design, for example, we have a number of expert panels in ----cross, and it's populated with experts, global experts. We've got a panel in ---------, again with global experts and again it's also with four experts, two from the U.S and two from the U.K. That's wher5e we get our academic -----, and they are all academics.	3	SU-HC7
	Yeah, in my team I have a British guy, Australian guy, Lithuanian, a couple of Polish, a lot of people ----------- from East European countries. There´s quite a lot of these people. ------because they probably studied in those countries, they come to the U.K. and learn --------- science industry in the U.K.	2	SU-HC8
	One of the keys was the CO -----he came from ------, so when he came in, we got some discipline, and then we have a doctrine. We have developers in Spain, in America -----so we have a very high standard of development.	4	SU-HC9
	They have all deeply experienced tech. People, multinational: we have Russian, Lithuanian, Hungarian Austrian, Singaporeans. So probably on the other side. On the tech. And design: 2 British and six overseas. Insurance side: all British. #people on insurance. Two people on marketing…so it's very rational. All business is conducted in English.	5	SU-HC10
	We have a system officer from Tai Wan and a developer from the other side of the U.K. a mixture. We brought in the systems architect from Tai Wan because he can speak Mandarin and at that time, one of our suppliers was from China, so it helped that he could communicate with them.	9	SU-HC11

2nd Order Base Theme	Relevant Quotes	Interview	Code
Human Capital	We employ people in the U.K, Canada and the Philipines. We have many ethnic backgrounds from wherever they come from, the question for us is: are they culture fit and can they do the work and help expand the business. ---------------- all the time we encourage our team to share ideas ---- we have someone Brazilian who works in our team in Canada ----------------------------- coming up with a solution.	10	SU-HC12
	It is a mix of people but not academia because I don't know how to find them. I guess, for example, if somebody studied a P.H.D. in tourism and I work with Chinese tourists; I would consider that. That would be for a full-time role, a big salary which we can't afford right now, instead we have hired people on a part-time basis with the view of later full time, most of our engineers used to work for Delloyds consultant as engineers, so they are working on developing new apps, so I guess they come from the industry but not the startup industry. Not from academia, they would know something in a particular area, and I would hire them. I want to hire an AX academic that would be good for the company; I'm looking for a B.A.T. to come from academia.	29	SU-HC13

The founders of the company can consider the experience of the employees and their motivation and drive as an entrepreneur (SU-HC14, SU-HC15, SU-HC16). The decision to start a new company can also go beyond the need to obtain economic independence, but to seek professional habits and standard operations that guide incumbents' operational processes (SU-HC17) (Santarelli and Vivarelli, 2007; Renski, 2017). The data indicate that entrepreneurs require to have a founder with a strong capital network to develop initial partnerships, and reliable human capital to develop the product (SU-HC18).

If the funding is non-existent, the entrepreneurs use customer knowledge spillovers and networks to validate the business idea. Suppose the market is not generating the necessary information to develop the product. The company has to decide to stop the initiative and decide to innovate on a new business idea (SU-HC17). Gaining entrepreneurial experience and lessons learned that could prove useful for the development of a venture (SU-HC19). The critical insight is that high-tech companies not involved in research may also capture and implement *public knowledge spillovers* or use *tacit knowledge* of earlier experiences to identify the market gap. The quotes on human capital are illustrated in table 5.7.

Table 5.7 - Quotes for the theme Human Capital, business idea valuation

2nd Order Theme	Relevant Quotes	Interview	Code
Human Capital	So, this is the knowledge that we created, so it comes internally that this company's establishment was based on new knowledge from 2 or 3 individuals from the scientific family. So that's where the intellectual knowledge comes from so we used the initial founding knowledge, and then we develop, but we rarely take additional key knowledge from outside. I want to establish that—intellectual funding or intellect. To start with an intellectual foundation, you need 2 or 3 founders, and we've got all that.	31	SU-HC17
	It is everything, take my co-founders, we are interchangeable in a number of things, we are also very good at certain things, so individually, so we are quite compactable with the cofounders there is a great number of our developers that meant a lot in terms of speed, and adding a fresh look to something we have had ---- and you know it is important not to put all in your first bubble. The new members of the team------- becoming a service alive and real and also with challenging ideas, validating our WORK.	25	SU-HC18
	Sometimes, you think something, and you do not why, but it has to be done. So you have always to conduct market research, sometimes the market will not tell you much, personal vision says that it could work. That you should try it out. To see the weather, it works or not. I go for a walk and try to get new ideas.	8	SU-HC19

5.2.2. Incubators and Accelerators

5.2.2.1. Services

The services provided by the accelerator and incubator programmes have proven to foster the enhancement of the innovation process to enter the market by introducing a new innovative product (Wong, Lee and Foo, 2008). As such, the location also provides the required infrastructure to enable access to knowledge in a physical space, but also through the use of Internet-based technologies such as cloud computing, the internet of things, machine learning, social media, and the internet of things (Audretsch and Belitski, 2017). These capabilities enhance the exploitative discovery of start-ups undertaking an incubator or accelerator programme, which can direct the type of industry to target in the market and the geographical focus (Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016). The incubator and accelerator programmes promote the start-up exposure to different to exposure to relevant stakeholders, access to the market, and the potential creation of alliances (Cantù, 2017).

Furthermore, the location enables access to resources that increase the chances of survival for start-ups and access to knowledge sources while reducing the expenses to maintain the company's everyday operations (Baptista and Mendonça, 2010; Hayter, 2013). Therefore, the utilisation of the amenities and services used by entrepreneurs with experience raises awareness of the accelerator and incubator programmes' importance to survive (IN-SE1).

Business incubators and accelerators promote common sharing of knowledge. The programme's type of services and strategic objectives affect the perception of the kind of knowledge spillovers and market exposure perceived by the start-ups (Zedtwitz, 2003; Vanderstraeten, Matthyssens and Campus, 2004). Accelerator programmes provide support on the company's basic operations, lead entrepreneurs to focus on the effects that the location has on the company's human capital and access to sources of knowledge. Moreover, the installations used to present the company's image to potential stakeholders such as bankers and investors (IN-SE2) (Desrochers, Kenney and Patton, 2009).

The accelerator and incubator programmes provide the conditions necessary to facilitate an active knowledge sharing process to establish a moderate flow of knowledge through knowledge assets, and to facilitate the constant transformation between tacit and explicit knowledge (Nonaka, Toyama and Konno, 2000; Bandera, Bartolacci and Passerini, 2016). However, the nature of the unidentified or passive effect of knowledge spillovers could lead to outcomes that can be difficult to measure outside a formal knowledge management process (Bandera, Bartolacci and Passerini, 2016). The perception of high-tech start-ups on the effects of knowledge absorption and explorative discovery increases in the cases were the business incubators, and accelerator programmes directed towards the exploration of technological innovations (IN-SE3) (Vanderstraeten, Matthyssens and Campus, 2004; Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016).

Seed-stage start-ups involved in the company's product development facilitate access to international knowledge spillovers through the development of projects (Cantù, 2017). Thus, the start-ups and incubator's goals align with the exploitative discovery of the market (Markovitch, O'Connor and Harper, 2015; Mrkajic, 2017). Moreover, the participation on pitching events and the development of joint projects between companies facilitate an informal set of the alliance that facilitates a process for sharing knowledge, which can be dependent on the type of explorative discovery, and the scope of the partnership (IN-SE4) (Nonaka, Toyama and Konno, 2000; Shu et al., 2014).

Accelerator and incubator programmes provide start-ups with the opportunity to access a network and international knowledge spillovers that break the geographical proximity requisite to locate knowledge sources (Audretsch and Keilbach, 2007a; Cantù, 2017). Such development incorporates how entrepreneurs are open to engaging in access to experts in the industry and investing in hiring human capital (Ko and Liu, 2015b). Also, the entrance to virtual platforms provided as a service from the incubator and accelerator programmes facilitates the exchange of knowledge spillovers. Thus, the development of social networks supports the development of entrepreneurship through the interaction between regions, which is a form of the entrepreneurial ecosystem (IN-SE5) (Nonaka, Toyama and Konno, 2000; Huggins and Thompson, 2015).

The interviews highlight the essential development of the start-ups and the time spent in the programme (IN-SE1). The research on incubators has evaluated the development of start-ups on the generation or access to new patents (IN-SE6) (Rothaermel and Thursby, 2005; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Nicolopoulou et al., 2016). However, business incubators and accelerators programmes focus on creating a business plan, the development of a Minimum Viable Product (MVP), and the materialisation of funding and creation of alliances (Zedtwitz, 2003; Zapata, 2010; Cantù, 2017). Hence, the managerial knowledge provided to the accelerators on a constrained time provides the reputation and the required basic structure to develop the company and focus on the innovation process. The quotes related to the services of incubators and accelerators are illustrated in table 5.8.

Table 5.8 - Quotes for the theme Services

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Services	This incubator? Yeah, I think this is a super incubator, the facilities, the access to space, and services to the office. We don't have allowance into the office just to the systems that they have, simple things like electric things that if you are starting from scratch, having to wire up buildings, we don't have to worry about any of that, they take all of the pressure out, some of the hygiene. Other housekeeping factors that are important at the start, you don't have to worry about that, we pay them, and they work very hard having receptions to make useful connections. The fact is that we personally in this start-up. Are so focused that we tend to make our connections, we don't particularly need connections. I am very well into collaborating ----- to assist them; we are not collaborative, we're very focused on what we have to do and willing to help others if we can, in an exact fashion. You know there's no time for fluff.	3	IN-SE1
	The incubator program was not very good. And to be fair, I did tell them that. I needed to explain that it was not accessible to a broadly diverse group of people representing a business. Too prescriptive, too much black and white, speaking to other people there, they said they felt the same. I am not entirely sure how beneficial to startups it is, but I did hear positive things from people who like different training than me. They were given a business mentor to work directly and to help with the ideas ------------------- more successful that business plan, financial planning, information that was hard to contextualize for me. FOR ME IT HAS NOT BEEN THAT HELPFUL for the others am sure it has been better.	7	IN-SE3
	There needed to be a lot of big corporates we were pitching to as well. Their main offices were in London. As I said before, we had interactions with insurance, being in the proximity helps, but it is not a requirement. The convenience and ease for us were good.	9	IN-SE4
Base 2nd Order Theme	Relevant Quotes	Interview	Code

Services	I have been in several; the first one was ------- U.C.L. had an incubator called the hatchery free office space for students with businesses where you could -------- the entrepreneur visa –we joined IDEA LONDON in 2016, this is an incubator partner with U.C.L. ------------------ I was there for about two years, they also gave free office space ------------------------ the value there was that we were building our market strategy --------------------- also in early 2016 we joined MARKTALENT ----- ---------------------------- that accelerator was not much use to us, ------------------- their industrial partners were not very useful --------------------------. At the beginning of 2017, we joined LAFAYETTE------ in Paris which was great for because it was very focused on retail and it was sponsored by one of the top retailers -------- in France, so it was great. That was the turning point. It gave us a lot of credibility with retailers, and we started to get intros. We closed our first sale with one of the retailers we met in the program. In mid-2017 we did one here in the U.K. ----------- ------ in the other programs we did not have to pay mone, but here we did, we are still part of their network and can make use of their ecosystem. They were very retail-specific connected to -- --, and we found ourselves having success with European retailers -------, and it was a way to expand our market. At the end of 2017, we did one more in Munich ---------------------- which is the largest electronic consumer in Europe -------------------------- if we select you, then we want to do business with you. -- we had 100's of retailers interested in what we were doing.	13	IN-SE5
	I'd say we joined that accelerator for a few reasons but really: one of the key reasons was that we wanted to improve our prestige, prestige is a prime thing for fundraising, the more prestige you have, the easier it is to fundraise. So having prestige has enabled us to talk to investors The second reason was it prepared us to show documents, agreements with investors, contracts, ----- both helped refine the material for our fundraising, to be looking what kind of valuation --- and providing us with the prestige for-------. In terms of an accelerator, I don't know if SEEDCAMP is an accelerator. ---- we aren't looking for project development, that we can do, in our particular case they were not helpful in terms of sales or marketing either, so if they are useful depends on the type of company you are,-------------------------------------, so it depends if the accelerator is focused on what you are planning to do.	28	IN-SE6

5.2.2.2. Capability

The evaluation of the effects that an accelerator and incubator programme consider how start-ups can increase on their market value that the company develops on the process and create patents (Markovitch, O'Connor and Harper, 2015; Sedita et al., 2017). It is expected that the explorative capability of start-ups increased due to R&D activities supported by the incubator or accelerator programme such as the personnel involved in the process, external communications. Also, start-ups can be influenced by the orientation that the business incubator or accelerator (Zedtwitz, 2003; Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016). The interviews suggest that high-tech start-ups are exposed to rent knowledge spillovers from resources and equipment located in incubators (IN-CA1) (See table 5.9).

Table 5.9 - Quotes for the theme Capability

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Capability	When it was set up because of the backers they had there was quite a lot of instrumentation ---------------------- so a lot of that equipment was donated by G.F.K. to help companies as they started, so we had access to some of that equipment. So the company G.E. General Electric----- they established an ------ on the side. The other thing is the supply of gases and a kind of raw materials that were used by science companies. That's all done to a certain group, so you don't have to establish those contracts if you need ……….. so we just pay them for usage and utilities as well, electricity and gas -------------------------- that's now probably deteriorating because after that initial investment ------ the group that managed that organization ------------------ they are now working to their own budget ------ and so are making decisions ----------- a negative impact on us. A lot of maintaining the equipment they are not replacing the equipment. So we have to ----- ourselves, so essentially that support function disappeared -------- that was one of the key benefits.	2	IN-CA1
	During the programme, we had to be there 3 days a week, and most days they would bring in people for us to meet. They'd be marketing people. --------they could be ------management people; they could be customers. Several investors, we met a lot of V.C., and we met the chief scientist that enthusiast you, so they can talk to us. It´s really fantastic. It´s exceptional. I'd say it´s probably one of the best accelerator programmes that have been run. We would meet them through the accelerator, and that would either be a group or a 1 to 1, or a combination of both and then we would meet on their premises as well.	4	IN-CA2
	Mostly they were face to face. What we all did was a ten-week program, an average of 2 days a week. The first day we took the whole team, some of the other CEO teams had done incubator programs before, for us, it was the first one, so we decided to throw everybody at it, so they knew where we would be going if disappearing for the whole day, and I think that was a good thing to do. It was a good signal, and it brought our business closer. From here, it's an hour and a half away, so it took the whole day. But we arranged by 12. We had very structured days; our time was very well managed, we had to do weekly reports, weekly videos, you know, it was a machine. A well-oiled machine!!!	5	IN-CA3
	There were a few of them, and we could choose the one we were more comfortable with the community as a whole has gotten very good at sharing -------------------- that shared their insights and knowledge ---------------------- and our industry changes so quickly that you cannot use knowledge like that to educate yourself.----- so it is a key part of what we do a slack channel where we share with the whole company articles that are important to read or books so that type of personal development I am doing for investment. To make sure my team and me.	10	IN-CA4

The impact of accelerators and incubators can have depended on the personnel's capability and the connections that programme must enhance explorative capacity. However, entrepreneurs with relevant industrial experience and previous academic training consider that networks and experience built before the development of the start-up (Amoroso, Audretsch and Link, 2017). On the other hand, seed entrepreneurs undertaking the programme would exploit the opportunity to access an extended network of experts facilitated by the accelerator programmes (Pauwels et al., 2016; Cantù, 2017). Hence, High-tech start-ups involved in such entrepreneurial ecosystems such as London would focus on developing the absorption and implementation of knowledge (IN-CA2).

The accelerators and incubators' capacity initially facilitates the exchange of knowledge on face-to-face interactions (Nonaka, Toyama and Konno, 2000). In such cases, the accelerator's influence can also expand the development of exploitative discovery by providing support on business capability and market research through shared projects and simulations (Pauwels et al., 2016; Mrkajic, 2017). Thus, shared objectives facilitate the development of networks and alliances that enable access to international knowledge spillovers and utilise virtual platforms (Nonaka, Toyama and Konno, 2000; Wang and Wang, 2012). In such cases, the development time for such projects would differ from accelerator to accelerator programme (IN-CA3).

Open space incubators facilitate the transition from sharing start-ups location, and accelerator programmes foster a process of simulating the development of innovation and technology on the seed stage (Zedtwitz, 2003; Pauwels et al., 2016). Further operation of knowledge spillovers and knowledge sharing transforms to utilising virtual mechanisms that foster international openness through the internet (IN-CA4) (Ho et al., 2011; Huang et al., 2012).

Start-up's perception of the services and resources available from the incubator programme depends on the incubator or accelerator programme's business and technical capabilities, which supports the development of innovation in the programme (Cantù, 2017; Sedita et al., 2017). As such, accelerator programmes have to supply mechanisms to access technological knowledge that supports product innovation. (Vanderstraeten, Matthyssens and Campus, 2004; Markovitch, O'Connor and Harper, 2015). Start-ups in the stages of validation of the business idea and the development of the business plan seek support on developing the company's structure to raise funding (IN-CA7). The start-up and accelerator objectives do not align on the type of stage of development, which can happen on limited occasions (IN-CA5, IN-CA6). The continuation of the capability quotes is illustrated in table 5.10.

Table 5.10 - Quotes for the theme Capability (Continuation)

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Capability	Yes sometimes yes, they can help you with your branding, marketing, help you to find them ---- because they have a very big network, we could be looking for a deal, so the documents ----- Sometimes it could be with an actual resource like the credit of A.W.S. ------ or it might be free desk ---- yes there always is some resource or another, what you have to see as a startup is what you are giving, equity, right; the time you are spending. Is it worth the value in terms of introductions, resources, etc., that the program is giving back to you? Look at that young company "3 spears" is amazing ------ what they were giving free space, we have that……… Always, always, there is something that you don't know. I mean 99% of the things you don't know, About a company and you learn on the way. The accelerator has its name because it accelerates the process, it accelerates your knowledge, some give more than others you have to find. The most important point I can tell anybody is that you have to find the right accelerator for you. What is right for me may not be right for you. And if it was great for me, it does not mean it will be great for you. It is a good thing that the accelerator can help somebody, but you should understand why did it help that person, here comes what type of business are you doing.	13	IN-CA5
	I will tell anybody that these programs should be avoided at all costs. It distracts you from the essential things ----- for developing survival skills because, you spend a lot of time on theory focusing on stuff that is not really ---- ., and developing things that are only on books. You can't execute it, and you wind up working for someone else because nobody has a clue to what the market needs, the best thing to do is go out there, get feedback from potential customers, and see if what you are trying to do will work with them or not. I went through two programs, and I can tell you that this is the advice I give to the people asking me if they should.	14	IN-CA6

The capacity of the incubator and accelerator in regards to the communication settings, the access to experts in the fields, and the positive experience provided by the location facilitates the access to knowledge spillovers to innovate and to set the minimum required conditions to raise funding and survive (Vanderstraeten, Matthyssens and Campus, 2004; Markovitch, O'Connor and Harper, 2015).

The exposure to experts in the field and the business incubator capacity involved in the process facilitate access to knowledge spillovers (Ko and Liu, 2015a; Markovitch, O'Connor and Harper, 2015). The continuous process of start-ups to be involved in multiple programmes under the motivation of acquiring prestige that can be used to expand the network and attract customers, suppliers, and investors which has been replicated on science and technology parks and universities (IN-CA7, IN-CA8, IN-CA9, IN-CA10) (O'Gorman, Byrne and Pandya, 2008; Squicciarini, 2009; Nicolopoulou et al., 2016).

It has been proven that the incubation capacity developed from the accelerators and incubator programmes enable the capture of business knowledge spillovers through the development of joint projects and simulators (Vanderstraeten, Matthyssens and Campus, 2004; Pauwels et al., 2016; Cantù, 2017). However, strong formal alliances or to connect to the government are limited, due to the perceived value from economic agents could be attained from the sharing of knowledge spillovers due to its heterogeneous nature and to the variety of information that can be attained (Audretsch and Lehmann, 2005; Colombelli, 2016). On the contrary, the perceived level of competition boost innovation and motivates start-ups not no collaborate, but to attain knowledge from the access to human capital (van Oort and Atzema, 2004; Bouncken and Kraus, 2013). The government's relations in the early stages can be disrupted due to the lack of perceived prestige from the economic agents (IN-CA11) (See Table 5.11).

Table 5.11 - Quotes for the theme Capability

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Capability	First the Public Sector Launchpad, it was good because it promised us public exposure and significant relationships there, it took us from having a vague idea of what we wanted to do to have a more clear one, at this time. My partner and I were salaried. Without a clear idea of what to do, this accelerator allowed us to be around other entrepreneurs, advisors, majors, and feel that it was something real and tangible. It was also good it was once a week, and we could network with other people --- so it was an excellent program. And the third one, the SERIUS program, honestly we did it because it came with financial support to each member, there were 14 got a monthly value which is incredibly grand. They are part of the government team, and they have good networks, and they gave us open space, which was very attractive, and the one we did in the U.S. was because we now had good relationships in the U.K. but did not have anyone in the U.S. They were well connected. They had dealt with Google. We went to that program because we were not even near the U.S.	14	IN-CA7
	So it was a very good opportunity to start in Germany at an early stage, we were only six months old and had done various activities understanding French requirements, but as we are in England -------------------------- reach the requirements of the German market, so we said we do not want it France we want it in Germany. We have German program managers, which connected us to the German ecosystem and it a great way to understand both markets in France and Germany. At a very early stage. There is a huge difference between a good and a not-so-good accelerator. Some have great mentors, access to investment, are very focused on how they form and train their start-ups and have these very many informal programs that do not have. Often their curriculum is enforced by a big sponsor, they help, but there is a large quantity that is not so good. In my opinion, only 5 out of 10 do it right.	21	IN-CA8
	Yeah, it is prestigious, it is one of the best accelerators in the building. We are the first --- to go through it in 2014; it was the first in London. They got ten: Seattle, San Francisco, Berlin etc. I think about 500 companies applied, ten were accepted. I think it was good. It was sort of the thing you did. I was the oldest founder by 25 years there, but it is very useful for me to take a step back, engage with a different kind of founder. Getting to Microsoft, they are the most significant business to business --- customer in a software company. They were a beneficial partner for us, and I had just come back from Seattle (touch wood) rolling out an education program. So, if you play the game with the host accelerator Microsoft and you take advantage of everything --- you can make that relationship work well. You know it is six weeks or twelve weeks. I think you have got to have a little experience, Microsoft --- I recognise that. I think I realised that It is also good to get a fresh perspective. I did not have any answers --- training it was just good to be in an environment. But I think that those accelerations are what you make of it, you know they are an industry now, and most of it is BULLSHIT. They are taking advantage of young people that do not have any real-world experience, in which council to use. There is a whole decay system built around accelerators.	28	IN-CA10
	There are a few competitors, and soon there will be more because we are doing something new and more people are going to try to join in, and that is why we need to hire the best possible people to scale across the world. And we one to steal people from our competitors, that is the number one thing. To hire the most capable people who exist and two places to get them GLOBAL BLUE and COMTAXFREE, they are a monopoly. But it the partnerships that will develop our defensibility, so you hire the people who can get you closer to them, a company that is the travel industry, with the hotels, airlines, airports, and even financial services companies like ----. Even banks, we want to have very high partnerships with our customers, so when our customers trust us and trust us more than anyone else, they will say we are the only ones that CARE ABOUT THEIR TAX REFUNDS. That is the big challenge we have to overcome over the next few years.	29	IN-CA11

5.2.2.3. Location of Incubators and Accelerators

The incubators' location and accelerator programmes oriented to high-tech start-ups primarily focus on the simulation of innovation and the generation of new companies in a bounded system such as an entrepreneurial ecosystem (Nicolopoulou et al. These effects are not limited to the incubator and accelerator programmes but on the location of the start-up. Hence, in the case of the characteristics of a city, characteristics such as the support from the government, availability of infrastructures, internet access capabilities, and a set of norms and entrepreneurial culture can influence the perception of entrepreneurs towards the formation of clusters, and the access to knowledge spillovers (Nicolopoulou et al., 2016; Audretsch and Belitski, 2017). The empirical evidence related to location is illustrated in table 5.12.

Table 5.12 - Quotes for the theme Location, infrastructures and development of clusters

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Location	There are good and bad----because there is a lot of feasibility here, a university's collaboration. It’s easier to meet the people, like manufacturers of equipment, of course, it’s expensive, it costs a lot in rent, mostly just in living wages. For us, it's mostly collaboration with incubators and universities in the London area and proximity.	1	LO1
	One of the benefits of the G.F.C. campus, it’s got backing, as I said earlier through ------- organisations. But it’s also establishing yourself as a -------- for the U.K., so there’s a growing power-----. We’ve government backing, incentives to develop the manufacturing and ------ distribution from that side. So you seem ---------- could potentially come over the next 10 or 20 years. Because from my experience I know that--- other organisations, in other parts, struggle to recruit because of the location. For example,---- a company in Wales ----- there was significant government support, they established something in Wales and then struggled to recruit people to populate that space.	2	LO2
	I moved from Paris to London because there is a lot more money in London for startups. SEEDCAMP was the accelerator for us, and the investor -------------------- was also our first customer. We had built; we have a great---- system to start, and also we had the market --- the market is much bigger in English speaking countries, like Canada, U.S. and U.K.	8	LO3
	This is the first business that I have started, from a technological point of view the initial location does not have a big impact but, being exposed to so many events that you can go to and meet people I think there are a lot of advantages especially for technology., in an urban city especially London. I think it would cause more challenges; having a place in London creates more credibility. If you are in London people might give you some time, but in the rural areas, it becomes much more difficult to set meetings etc.	9	LO4
	The third is that London is a great place for the type of business we are in, RENTECH. A third ---- was a publicized will of the regulator here in the U.K. and the Bank of England ----------------------- to favour that particular sector -- and London has 5 pillars that people seek: the --- institutions, the infrastructure, with the consultants and legal firms, the 3rd is the access to a global pool of talent, the fourth one is access to funding, and the fifth one is the regulations they have here. So are the five pillars of why London is a fantastic place.	11	LO5
	I think London has a great ecosystem, from various perspectives, nationalities, ----------------------- it is very open country ---- it also has great time zones so you can address Europe, U.S and Asia, sitting out of London and that has really huge advantages ------------------------ you have English as a common language which makes it easy to transact with a lot of different countries. England has good branding, so if you are a British company ---------- a lot of energetic, enthusiastic engineers -------------------- there is a lot of sharing of ideas and knowledge.	23	LO6

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Location	I think it is something everybody must do very smart. Exposure and there are many so it all adds up, many talents — a new market with an appetite for new products. It's the centre of the Government; you can realise a lot of procedures. ------ there are many possibilities of the hunt.	27	LO7
	The costs are high, but on the other hand, the concentration of talent is higher you much more people to draw from some of the best universities in the world, some of the best incubator programs, ---- so in a certain sense, it is even easier to start a business in London as opposed to Birmingham or Liverpool. It's great for me because I live at a 20-minute walk from here., but seriously as I said before London is an attractive place for various persons and reasons, it has the people with the qualifications.	28	LO8
	London is a great place to start a business, the infrastructure for young start-ups is fairly mature, ----- a lot of angel money, a lot of capitalist's money available. It is the second biggest market outside the U.S., and there are a lot of energetic start-ups that have succeeded .------- house sports ---- a way of improving as well, so it's a great place to be: London is where the is----- the land of opportunity, where the money and the funding is, and where the programs help start-ups	29	LO9
	I would argue that London has a good and bad ecosystem. It is a good but immature --- system, ----to raise capital in London is difficult generally speaking you have to go to bankers, go to the bank with a problem, and the bank does not understand the problem. But banks don't write out big checks. If you are in a Pharm tech business, it is harder trying to raise money. There are angel networks and other opportunities I think it is a high-risk hostile environment. Where in the U.S., the risk appetite is much greater, which makes it easier to raise money from fewer individuals. The other side of it is London good; the regulator is quite active for Pharm tech companies in trying to support companies like us, so for financial solutions they ------- I think the S.T.A. is one of the most advanced in helping start-ups ----- approval.	30	LO10

The data suggests that the access to a location in the urban core enables the start-up to build a higher level of credibility that facilitates the access to knowledge spillovers in the form of social capital (McKeever, Anderson and Jack, 2014; Ko and Liu, 2015b). In this case, main metropolitan areas such as London or Paris provide early start-ups with resources to develop the company (L11, L12, L13, L14, L15, L16). However, such an aim is not directed to build a community among entrepreneurs, but to expand on the capabilities to attract large firms' attention and to the market by building a network capital foundation and getting access to angel investors and networks (L11).

Start-ups consider that the city in the urban core as an essential characteristic that enables newly established start-ups to survive and growth is expected to raise employment (van Oort and Atzema, 2004; Renski, 2009). Thus, start-ups seek entrepreneurial opportunities to seek technical knowledge and adjust regulatory requirements and support to set the business on track, which is motivated to focus on innovation. Aside from the access to capitalists and bankers, entrepreneurs are driven by universities as a source of knowledge for accessing high-skilled human capital but can share the same common language that facilitates communication with the market and investors (LO13, LO15, LO16).

The availability of skilled human capital at some instances is viewed as a source to access knowledge spillovers in the form of an intermediate, but the investment in R&D is restricted to the hiring cost (Spithovenm and Knockaert, 2012; Rodríguez-Pose and Hardy, 2015; Ghio, Guerini and Rossi-Lamastra, 2016). At the same time, cultural diversity is perceived as positive for the ecosystem, but not viewed as a critical factor towards the company's development (LO12). However, entrepreneurs with experience outside of the UK can consider that risk aversion can prevent start-ups from gaining investment from banks. The quotes related to opportunities and networks are illustrated in table 5.13.

Table 5.13 - Quotes for the theme Location, access to opportunities and networks.

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Location	I moved from Paris to London because there is a lot more money in London for start-ups. SEEDCAMP was the accelerator for us, and the investor -------------------- was also our first customer. We had built; we have a great---- system to start, and also had the market --- the market is much bigger in English speaking countries, like Canada, U.S. and U.K.	8	LO11
	This is the first business that I have started, from a technological point of view the initial location does not have a big impact but, being exposed to so many events that you can go to and meet people I think there are a lot of advantages especially for technology., in an urban city especially London. I think it would cause more challenges; having a place in London creates more credibility. If you are in London people might give you some time, but in the rural areas, it becomes much more difficult to set meetings etc.	9	LO12
	I think London has a great ecosystem, from various perspectives, nationalities, ----------------------- it is very open country ---- it also has great time zones so you can address Europe, U.S and Asia, sitting out of London and that has really huge advantages ------------------------ you have English as a common language which makes it easy to transact with a lot of different countries. England has good branding, so if you are a British company ---------- a lot of energetic, enthusiastic engineers -------------------- there is a lot of sharing of ideas and knowledge.	12	LO13
	I love it; it is my favourite city in the world, I was first in Manchester for three years ---------------- I love Manchester, great city, but when I came to London it was a significant change, I realized just how big the city was where are the opportunities, the people, the networks, the talent. It ticked all the boxes. ----------------------, you need more money in the U.S., and I had never been or lived there. ----------------, and if later I needed, I could move to the U.S.	13	LO14
	The costs are high, but on the other hand, the concentration of talent is higher you much more people to draw from some of the best universities in the world, some of the best incubator programs, ---- so in a certain sense, it is even easier to start a business in London as opposed to Birmingham or Liverpool. It's great for me because I live at a 20-minute walk from here., but seriously as I said before London is an attractive place for various persons and reasons, it has the people with the qualifications.	15	LO15
	London is a great place to start a business, the infrastructure for young startups is fairly mature, ----- a lot of angel money, a lot of capitalist's money available. It is the second biggest market outside the U.S., and many energetic startups have succeeded. ------- house sports ---- a way of improving as well, so it's a great place to be.	16	LO16
	I would argue that London has a good and bad ecosystem. It is a good but immature --- system, ----to raise capital in London is difficult generally speaking you have to go to bankers, go to the bank with a problem, and the bank does not understand the problem. But banks don't write out big checks. If you are in a Pharm tech business, it is harder trying to raise money. There are angel networks and other opportunities I think it is a high-risk hostile environment. Where in the U.S., the risk appetite is much greater, which makes it easier to raise money from fewer individuals. The other side of it is London good; the regulator is quite active for Pharm tech companies in trying to support companies like us, so for financial solutions they ------- I think the S.T.A. is one of the most advanced in helping start-ups ----- approval.	17	LO17

The location and effect that universities may have on high-tech start-ups can also differ from the type of university and intensity of innovations. For instance, companies involved in manufacturing would prefer to locate near universities closer to suppliers to reduce transportation costs (Woodward, Figueiredo and Guimarães, 2006). As such, companies with sufficient capital aim to locate to sources that enable access to similar technologies and entering a field of high-level competition if the innovation developed on start-ups is disruptive (Dyerson and Pilkington, 2005; Greenstone, Hornbeck and Moretti, 2010).

Companies that locate outside the urban core have a considerable effect on other high-tech industries would consider that survival and operations of the start-up can increase due to lower cost of human capital, taxes, and more support from the government (Woodward, Figueiredo and Guimarães, 2006; Renski, 2009; Acosta, Coronado and Flores, 2011). As such, start-ups located outside the urban core continue operations on a distance while maintaining access to business opportunities offered by the cities and reducing costs and access other research institutions. Hence, companies with such exposure and awareness would consider taking advantage of both situations. However, companies that don't have the required network capital or initial investment to start in the initial bases consider the urban core as a crucial decision to develop the company (LO18, LO19) (see Table 5.14)

Table 5.14 - Quotes for the theme Location, preferences to the urban core

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Location	So location wise it does not make a huge difference. London is convenient for getting people to a lot of advances, which is good. London is not in the middle of nowhere like the accelerator in-----; it is generally expensive, so that is on the downside. I don't think it is good to have a team based in London. There are much competition and too high a cost. So we don't want to be restricted to just one area. We are right bang in the middle of the city; everything is a short walk; it is our house. A lot of our places are in places easy to get, the same for international contacts, London is a place where they may pass through, London is that kind of place.	19	LO18
	Before my time we had people working here in Bristol, it made sense to be close to-----, universities here, to where the people were working. ------------------------------------, I think we have to be very flexible on location. London is a big draw so we might set up an office there to exclude ourselves. I do not know. There are benefits to both places. Bristol is not as nearly expensive as London; it's tough to say. You have to take the best of both.	20	LO19

5.2.3. Alliances

5.2.3.1. Networks

Companies in biotechnology end up interacting with incumbents and investors from the same industry, which enables them to engage in interactions that could lead to access to knowledge (NT-EV1). In a sense, the biotechnology companies seem to be involved in the process of technological sharing that is limited to the level of trust created from previous joint projects, or Intelectual Property (I.P.) restrictions. However, networking events enable entrepreneurs to have access to technological knowledge spillovers through human capital hiring can lead to forming alliances with individuals. Also, specialised meetings allow uncovering innovations in the field (NT-EV2).

When start-ups expand on future alliances through networks, the new firms tend to engage in networking activities not directly linked to the incubator or accelerator programmes' services. This exposure enables entrepreneurs to attain knowledge and resources to form different urban locations. The process opens entrepreneurial opportunities for expanding to markets, access the international market, gain industrial diversification and develop connections with incumbents through ICTs (Lasch et al., 2013).

Such development of location and expansion even without the substantial acquisition of assets enables collocation and the potential exposure to new competitors, joint-ventures and collaborations with another company (NT-EV4) (Hervas-Oliver, Lleo and Cervello, 2017). In some instances, companies' networking facilitates the access to **business knowledge spillovers** from individuals and the government that enables to understand the required regulations to develop a product (Desrochers, Kenney and Patton, 2009; Cantù, 2017). However, entrepreneurs perceive that it is easier to gain access to industrial partners than government institutions (NT-EV6, NT-EV7).

Interactions with entrepreneurs are more involved with discussing how to raise money for the company or incubators is enabled through an established community and an initial level of trust (NT-EV8) (Nicolopoulou et al., 2016; Audretsch and Belitski, 2017). In the context of networking events that high-tech start-ups undertake on pitching events. Companies can use different types of electronic tools and techniques to absorb the **competitor's knowledge spillovers** and be aware of the kind of information to present on pitching events.

The presentation has to be adapted to the marker and have a high level of intellectual knowledge that facilitates the exposure to local and international experts in the field (EV-NT9, EV-NT10). This process can undoubtedly be considered a side effect provided by incubators or accelerator programmes that provide the government's funding structure or the industry (Pauwels et al., 2016). Thus, accelerator and incubator programmes can act a mediator that increases the possibility of gain financial support from the government (EV-NT11). The quotes on networks are illustrated in table 5.15.

Table 5.15 - Quotes for the theme Networks, interactions with the industry

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Networks	Networking always helps Doing pitches and, most importantly, being in the same room with customers, is the number one thing that helps. Oh, Academia, I wouldn't say so much. We go, for example, one good presenter; I say this is good. It creates a name for the start-up. I would say it doesn't help the innovation proses much. It does create a brand name. So, investors come in and start talking to us.	1	NT-EV1
	It's a kind of agricultural, commercial ----- challenges that small companies face with their projects so the regulations, your expectations and guidelines are changing all the time The last people we integrated with have the best knowledge and also a kind of commercial landscaping, so the challenge of manufacturing your products and to establish contracts with manufacturers. And has this type of interaction also enabled you to ----- some ideas or information that helped your company think of new ways of improving your prosthesis or products that could be exploited in the market? We could explore; we are developing our processes, so to make it change is quite significant. So, you keep an eye on the latest technology, what's happening, and what's being discussed, but to make a change, you have to consider new technologies before making that change.	2	NT-EV2
	It's a kind of agricultural, commercial ----- challenges that small companies face with their projects so the regulations, your expectations and guidelines are changing all the time The last people we integrated with have the best knowledge and also a kind of commercial landscaping, so the challenge of manufacturing your products and to establish contracts with manufacturers. And has this type of interaction also enabled you to ----- some ideas or information that helped your company think of new ways of improving your prosthesis or products that could be exploited in the market? We could explore; we are developing our processes, so to make it change is quite significant. So you keep an eye on the latest technology, what's happening, what's being discussed, but to make a change, you have to consider new technologies before you make that change.	2	NT-EV3
	Yes, there was an event three months ago from ELEVATE, which is a sports health industry. It was over open data, and how it affects the industry --- the core drivers, that was interesting --- other people interested in the subject and came to speak to me.	16	NT-EV5
	We are called WEEBATS; we operate in a few industries, the easiest way to put it is: we help tourists ---- funds on their shopping in Europe. So, we are in the travel industry, in the finance industry, a little bit in the slash government authority, all of our revenue comes from the taxes in the U.K., and when we-we are not going to focus just on tourists, we ---- with the tax authorities. So we have a few verticals that we have touched. We have travel, finance and tax. Yes, those are the three main ones.	29	NT-EV6
	Yeah, we have met bigger companies, the government not yet, find it quite difficult to ------ with large companies, what we want to do in a month, they want to do in a year, amazingly with fewer resources, we move faster than them. The style of work and coordination is VERY different. ---.	22	NT-EV7
	I have interactions with other entrepreneurs, with other seniors, sharing insights, significantly when I was raising money for the business. ------- You know it's important to share insights into how about going to raise money. Entrepreneurs what they fundamentally to do is raise money, if there´s no money, there's no business and the whole process of fundraising is quite challenging -----, and they're sharing war stories with different C. O's ensures the process is essential ----. I spoke to 2 or 3 established seasoned entrepreneurs who have been incredibly successful in getting insights from them about raising money to make the start-up. Attractive. That's very valuable.	3	NT-EV8

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Networks	When you are a young start-up, you got to raise money one way or another when I came to London, I did not know anyone, but I knew every major B.C. in town in two months. The reason is that I could look in SEEDCAM'S portfolio and scan the 150 companies there ---------------- so that made a considerable difference ------------------------------- we are scared as hell for pitching to people you know, the largest companies in the world.	8	NT-EV9
	There needed to be a lot of big corporates we were pitching to as well. Their main offices were in London. As I said before, we had interactions with insurance, being in the proximity helps, but it is not a requirement. The convenience and ease for us were good.	9	NT-EV10
	And the third one, the SERIUS program, honestly we did it because it came with financial support so each member, there were 14 got a monthly value which is incredibly grand. They are part of the government team, and they have good networks, and they gave us open space, which was very attractive, and the one we did in the U.S. was because we now had good relationships in the U.K. but did not have anyone in the U.S. They were well connected. They had dealt with Google. We went on that program because we were not even near for the U.S. ---- I think it would make more sense to do that program now that we are ready to go the. The last one was the P.W.C. U.S. Venture Out we did about a year and a half. This was an interesting one. It allowed us to develop networks on the east coast, again about education because it was an education program. With both of these going we will probably go back and pick up those relationships, those are the U.S. ones. I just wanted to have some relation out of the U.K. The last one was the P.W.C. accelerator this one we had to pay, but I think it was worth it because P.W.C. is such a big name --- it is always better to work with such a respected brand, and they also have quite a good network.	4	NT-EV11

Interactions in networking events can lead to the formation of partnerships or formal alliances through networking events. These cases manifest when both companies can increase revenue and engage in future knowledge sharing with international markets (Cantù, 2017). Such a process has the potential to increase the exposure of knowledge spillover effects in alliances. Further engagements to break the knowledge filter to local networks in different countries start creative construction (Agarwal et al., 2010; Hervas-Oliver, Lleo and Cervello, 2017). However, the informal sharing of knowledge requires that both parties agree on the signing of confidential agreements (NT-EV12).

The literature states that supportive entities such as venture capitalists, lawyers and investment bankers should be located on closer proximity on a distance over fifty miles from the start-up's headquarters (Desrochers, Kenney and Patton, 2009). The compilation of potential resources for start-ups is considered an externality and influences clusters of knowledge spillovers on urban areas (Nicolopoulou et al., 2016). Hence, supportive sources of knowledge spillovers enable new ventures to enhance the quality of products and human capital, increasing the level of trust and open sharing of knowledge between companies (NT-EV13) (Nicolopoulou et al., 2016; Audretsch and Belitski, 2017).

Connections are enabled through proximity to sources of knowledge. However, incubators and accelerators allow new ventures to gain access to institutions and companies located outside the city's boundaries (Amoroso, Audretsch and Link, 2017). The resources available out of accelerators and incubators' services include public or corporate investment facilitates, consultants, clients, and suppliers. Therefore, early start-ups use this opportunity to engage in the process of mutual knowledge sharing and exploitative discovery (NT-EV14) (see table 5.16).

Table 5.16 - Quotes for the theme Networks, accelerators and partnerships

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Networks	Both, so we have a formal global alliance, signed a partner's agreement with all of them, we have mutual non-disclosure and confidential agreements. ------------------------- sharing with I.P. but there is also informality. Of course, we have our knowledge all locked up through copyrights.	**20**	NT-EV12
	At that time, I was there, there was another type of model than now, we had co-host ------------------------- ---------------------------------- 20 companies and then only 7. We were competing among entrepreneurs --- build relationships because they had been through the process before it was challenging because you would pitch in front of 500 investors --- in Berlin or Paris or London. So the whole experience was ---- challenging and helped us build some connections we would not have built otherwise, so that was at the very beginning of SEEDCAMP. Progressively ---------------- you can play football together, or drinks or --- and you become friends, and they become people that you can trust and with whom you share advice that you would not share with anyone. ----------- it is a very tight community.	8	NT-EV14

On the other hand, disruption of openness and innovation can disturb networking processes, acting as a form of knowledge filter blocks access and collaboration with other companies and institutions. This phenomenon is caused due to natural asymmetry (Audretsch and Lehmann, 2005, 2017). Experienced start-ups with a higher number of employees and capital would most likely form part of established associations that facilitate access to knowledge. Therefore, companies with resources would not seek knowledge spillovers from networking events (Hayter, 2013). The data suggest that early start-ups and founders can perceive networks as a low value. Therefore, negative experiences can cause to lose potential opportunities access to the market and to capitalise on the effects of knowledge spillovers (NT-EV15).

To gain exposure to the effects of knowledge spillovers, entrepreneurs depend on the development of the start-up to gain access to the reputation and services provided from the incubator or accelerator programme (Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016). The faster the new venture can gain access to revenue by selling the product to local and international markets, the higher the chances that the company will survive in the following years (Desrochers, Kenney and Patton, 2009; Montoro-Sánchez et al., 2011; Cantù, 2017). These resources are accessible through making use of the reputation gained from attending reputable accelerator programme or using the experience of a member or third party recruited in the company or a third party that can support the development of the start-up (NT-EV16).

More experienced start-ups seek to gain access to technological knowledge spillovers, set in place adequate knowledge management systems and set the IPs (O'Gorman, Byrne and Pandya, 2008; Squicciarini, 2009; Helmers and Rogers, 2010). Networking and the formation of alliances depend on gaining access to formal and informal technological knowledge spillovers from entrepreneurial clusters (NT-EV17) (Kerr, 2010; Nicolopoulou et al., 2016; Cantù, 2017).

On the other hand, seed start-ups in the process development would question that networking events enable entrepreneurial ecosystems. These structures include cities that hold incubator or accelerator programmes that boost entrepreneurial opportunities to engage in innovation and collaboration (Markovitch, O'Connor and Harper, 2015; Nicolopoulou et al., 2016; Audretsch and Belitski, 2017). Hence, a form of knowledge filter would be generated from the unawareness of entrepreneurs to purposefully capture knowledge spillovers (Nieto and Quevedo, 2005; Markovitch, O'Connor and Harper, 2015; Sedita et al., 2017). Hence, unintended knowledge spillovers effect would be at its nature, were its existence and impact of the company are difficult to capture and measure. Moreover, entrepreneurs can perceive knowledge spillovers as a cause that generates harm for the company (NT-EV18). Hence, experienced CEOs with strong academic and industrial experience can perceive networking events as a viable source of knowledge. The quotes on networks are illustrated in table 5.17.

Table 5.17 - Quotes for the theme Networks, human capital and platforms

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Networks	There is a lot of information shares between these networks. A lot of the stuff was focused on first-time founders, which I am not one so thing like ------- was not as relevant to me as they would be to someone else. Another thing is that I am not that big on networking with new founders. I have had bad experiences in my businesses. So, my exposure to that was limited.	9	NT-EV15
	Just focus on the type of people we wanted to meet, retailers, wholesale. Right? At the start, there are three levers that you are always pushing; the building, the selling and the financing. Building means that you need engineers, people to build, the selling is again with a team. Still, it also depends on your network, and you are…, so we wanted to sell to large retailers, It's tough for us to make that connection ourselves, we have some3 guy who is a retailer himself and knows some others, one of the key guys is that retailer, we want that. Our main goal was the retailer --- but the few networking events. Sometimes it could be with an actual resource like a credit of A.W.S. ------ or it might be free desk ---- yes there always is some resource or another, what you have to see as a start-up is what you are giving, equity, right; the time you are spending is it worth the value in terms of introductions, resources, etc., that the program is giving back to you.	13	NT-EV16

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Networks	I´m terrified about investing my time in something that doesn't have a guaranteed return if I go to any event. I know that ten of my friends are going I know even if there are 50 people and I don't like them I go, because they are my friends and we finally wind up talking, and my return will enjoy and ----. Now if I go to an event and I don't know anybody, I'm going to be worried about "will I find something useful" or should I wait the two hours, half an hour travel time, and the energy. I think, will it be justified, is it going to be worth it unless I know the people, but how can I expand my network if I always hang out with people that I know. I'm doing this with you because I think it's interesting, but usually, I'm susceptible to my time. GENERALLY, IT TAKES PEOPLE A LOT OF EFFORT TO TRY TO REACH ME. I would say no knowledge, ZERO knowledge. Because I don't believe that what gives me value these days is necessary knowledge, I think it's meeting people--my company. So, it's not like they told me a story and I learned something from that, it's more they introduced me to someone, or there is some way we can cooperate with that or even if there is no way to cooperate maybe we are in the same space and we share the same contacts. So, it's the network that is valuable. When you work in the travel business, everybody will talk about you and are going to mention you. That is the value we get. Not so much on knowledge.	29	NT-EV18

5.2.3.2. *University Joint Ventures (UJV)*

The interviews suggest that entrepreneurs locate near institutions and universities that develop research projects (Acosta, Coronado and Flores, 2011; Amoroso, Audretsch and Link, 2017). As such, start-ups should have the capability to engage in research joint ventures, or engagements with academia members to develop shared endeavours on product innovation and the expansion of knowledge (Audretsch and Link, 2017). Such boost would incorporate engagement with university incubators, or the participation of TTOs that boost entrepreneurship and start-ups creation on regions (Rothaermel, Agung and Jiang, 2007; O'Gorman, Byrne and Pandya, 2008). Surprisingly, the interviews highlighted that start-ups that have been in research for a couple of years engage with academics from previous networks built from the founders of the company. One assumption relies on start-ups' requirement to adopt the open channels of communication with universities (AL-UJV1).

On the other hand, entrepreneurs who have not engaged in masters or PhD programme perceive that universities build an initial foundation on capturing knowledge (Nielsen, 2015; Amoroso, Audretsch and Link, 2017). Hence, universities' indirect effects caused due to the mobility of human capital in the form of graduate students (Audretsch, Huelsbeck and Lehmann, 2012). The data suggest that the connection between researchers and academics and start-ups through networking should be improved to boost a collaboration of the company and start-ups such as development programmes, and capture of investment to facilitate the commercialisation of new technologies (AL-UJC2, AL-UJV3) (Grimaldi and Grandi, 2005; O'Gorman, Byrne and Pandya, 2008; Pauwels et al., 2016).

A significant restriction is preventing the exchange of knowledge between universities and entrepreneurs is the perceived value that academia has for entrepreneurs. For that matter, a unidirectional connection from start-ups require more variables to consider aside from the localisation economies, the formation of clusters and the infrastructure of urban cities to facilitate a more enabled entrepreneurial ecosystem for start-ups that have no previous connections with academia (Woodward, Figueiredo and Guimarães, 2006; Audretsch and Belitski, 2017).

Access to universities' knowledge requires hiring academics motivated to conduct research projects and RJV with start-ups (Audretsch and Link, 2017). The development of the start-up and the group with a leading researcher identifies previous research and development technologies (AL-UJV4).

Start-ups would even consider using the free installations of universities to use them as the company's location. The established infrastructure build fosters such behaviour on the entrepreneurial ecosystem (Acs et al., 2017). However, new ventures would not consider forming direct contact with the university's researchers to engage in RJVs (O'Gorman, Byrne and Pandya, 2008). Such behaviour fosters the belief that networks and alliances that are perceived to require a monetary value to implement through the process prevent start-ups from gaining access to university knowledge spillovers and focusing on minimising costs and property taxes (AL-UJV5). Quotes related to RJVs are illustrated in table 5.18.

Table 5.18 - Quotes for the theme of University Joint Ventures

Base 2nd Order Theme	**Relevant Quotes**	**Interview**	**Code**
University Join Ventures	Mean no, that's the job of the C.O. -----but I ---- the phase of Twitter ------of start-ups and certain people because I find them ------- only two weeks ago I saw twitter fade--. A company like ours is highly judged when it goes on stage, we are in a very richly -------- in the broader sense of the word in a university but smart, clever people, who are not necessarily linked to an academic environment. But they academics, scientists or innovators, so the work we do is highly scrutinized, so you can't approach it naively, but to approach it in a highly intellectual way, it's got to look like the artist ------ and it has to be contextualised and seen in the context of the competitor, so I know as much of my competitor as much as I know about my start-up. Because that's the only way, I can make my company look different. Yes, we use technology but use it minimally, we are very connected to the environment, but in a very high fashion. We work with the University of Canada.	3	AL-UJV1
	-------------------------------------with the University we help their students get work experience ---------------------------- we are on a list that recruits students can work at we get them all the time. I think they should do a better job of marketing for this community; we do not interact with any university in the U.K. not because I do not want to, but because the significant amount of time and resources involved. I can work with AMAZON they come out and offer solutions, that is what the universities should do here.	10	AL-UJV2

Base 2nd Order Theme	**Relevant Quotes**	**Interview**	**Code**

University Join Ventures	Yes, We collaborate with Imperial college -----------research and engineering, that is one part of our service that we are looking into, so we have a strong R&D stream and a blockchain, so it is something we worked on together so ---- a prototype, but we are still in ---- study ------------------------- working with students from the science departments. Recently we are doing a workshop with ------------- for testing, so in terms of academia, we work quite closely. With entrepreneurs only with our investors, ------------------------ organises breakfasts for us ---- they may not be relevant to ours, but we do get to speak to new people.	7	AL-UJV3
	That is what we have to do to survive because I have not had a budget of ten million to buy University access. So my position is pretty grand. I like to do a research study with University Westminster with a thousand students. We can co-publish the results ---- through the U.K. other companies do not have that advantage. Hence, some of our U.S. So we have to build alliances with other universities, so I would say we are doing something at every opportunity. Many work teams in universities only want to work with big companies ---- so S. and B. start-ups need some equity in that, and the government is trying to force that change. Still, you are dealing with different kinds of people obsessed with appeals, so I think it is challenging. Just getting to Bath has taken three years, and we are two minutes away. One of our professors is head of the M.B.A. course ---- and even with his support it has been challenging to get Bath University to open up ----- so I think it depends, we would like to do more research with Westminster we see that as an opportunity for both parties. With their consent alliances like you, you will be working with companies individuals--a top process, we agree that we are interested and share resources, so I think that is sensible. We are always keen to do that any 50% of the time is useful. Sometimes you have to do that; you never know until you try.	24	AL-UJV4
	I go to U.C.L. quite a lot like to work in the library there, the reason I do that because our customers are there it is both a place to recruit people and find customers. It also inspires me to develop our software further. But we don't have any formal relationship with any university, I want to, but I don't have that at the moment. For example, there are many universities across the U.K. and many courses on tourism or tax or many things relevant to us, and I wish there would be a way to match that, but I haven't found the way at the moment. I could google, but it is a cold E-mail exercise, and I have to make a list of 100 lecturers and them I would have to mail each one of them to find something specific, but I don't have the time to that. So, I wish there'd be a bridge between the universities and start-ups, my start-ups who would love to participate in something like that but have not had the opportunity.	29	AL-UJV5

5.2.3.3. Companies

The development of an incubator and accelerator programme has the intention to focus on setting allocation that provides a physical location, and a plan that promotes innovation and open collaboration to enhance the growth of start-ups and to obtain funding and offer post-programme support (Pauwels et al., 2016; Cantù, 2017). As such, the accelerator should enable the constant transformation between tacit and explicit knowledge through face-to-face and virtual interactions and engage in the process of continuous knowledge creation (Nonaka, Toyama and Konno, 2000; Bandera, Bartolacci and Passerini, 2016).

High levels of competition among companies can be considered an enabler for the development of innovation or perceived locally that can force start-ups to survive to incumbents (van Oort and Atzema, 2004). As such, entrepreneurs seek to form alliances with established companies that can support the company's development. Hence, the competition barrier does not prevent the flow of knowledge between companies (AL-F1). Thus, the companies that are part of the incubation process do not foster a strong, established alliance since entrepreneurs do not perceive that the companies involved in the programme share similar knowledge (AL-F2) (Nieto and Quevedo, 2005).

Competition develops a process of creative destruction, were companies innovate to disrupt the market and cause the displacement of companies. (Dyerson and Pilkington, 2005; Agarwal et al., 2010). The development of such process, incumbents and start-ups would consider engaging in creative destruction, were a mutual collaboration with the industry seeks to foster the development of joint projects that share a similar form of knowledge (AL-F3).

The formation of alliances with individuals from third parties can also develop initially from the chain of value. Such expansion of relationships and partnerships would consider the joint development of a company on utilising ICTs that are partly dependent on the presence of big firms. The human capital harbours in the start-up (Lasch et al., 2013). Such development depends on various companies and the activities focused on R&D (Acs et al., 2017; Hervas-Oliver, Lleo and Cervello, 2017).

High-tech start-ups can develop alliances with individuals as third parties that are not entrepreneurs. In this stance, companies can now consider these alliances as human capital, providing or covering funding goals for the company. Such movement of skilled professionals can be viewed as a form of tactic for exploiting tacit knowledge spillover (Audretsch and Vivarelli, 1996; Audretsch and Lehmann, 2010). Hence, the development of alliances with individuals would be dependent on the quality and duration that external experts would have on the development and the performance of the start-up. The creation of partnerships is established on relationships from the perspectives of the suppliers. Hence, suppliers alliances have to be an invaluable source for start-ups' innovation process, if the type of knowledge shared is similar (Lasch et al., 2013).

On the other hand, the relationship with competitors identified through a process of competitors knowledge spillovers can be enabled even with the possible fear of competition (Bouncken and Kraus, 2013). Moreover, open innovation through globalisation could affect new companies' development at a lower level (van Oort and Atzema, 2004; Audretsch and Lehmann, 2017).

The interviews show that forming a new alliance through initial knowledge spillovers capture can be attainable if competitors are perceived as big organisations that can be for a partnership in the future, causing the effect of creative construction or destruction (Dyerson and Pilkington, 2005). However, such an approach is apparent in highly educated

CEOs with experience (AL-F4). Start-ups deal with individual experts in the field that can provide the technological knowledge located near the development areas not directly linked to the services and resources, knowledge input, supplied by accelerator or incubator programmes (Pauwels et al., 2016; Cantù, 2017).

Accelerator and incubator programmes should prove to be an edge technical skill that enables establishing a strong presence of competition in the market (Bouncken and Kraus, 2013). Therefore, entrepreneurs that seek advice and guidance seem incubators as a programme that can facilitate collaboration with other start-ups. Hence, start-ups engage in an informal collaboration that leads to the exchange of knowledge. The transfer of information can only be facilitated by the lack of start-up competitors that may be part of the programme (AL-F5). The quotes related to companies is illustrated in table 5.19.

Table 5.19 - Quotes for the theme Companies

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Companies	At that time, I was there, there was another type of model than now, we had co-host -- 20 companies and then only 7. We were competing among entrepreneurs --- build relationships because they had been through the process before it was challenging because you would pitch in front of 500 investors --- in Berlin or Paris or London, so the whole experience was ---- challenging and helped us build some connections we would not have built otherwise, so that was at the very beginning of SEEDCAMP. Progressively ---------------- you can play football together, or drinks or --- and you become friends, and they become people that you can trust and with whom you share advice that you would not share with anyone. ----------- it is a very tight community.	8	AL-F1
	For me to remain focused is more important than to build alliances. It is nice and cute but if you are innovating you have things that none have. And the world's vision on how it should work, you want to keep it to yourself. Unless there is a commodity derived. I did not look into that too much. In my incubator there was nobody else that did what I did --- in my work there is more collaboration than the competition--------------------------- a lot of what I do is a personal experience based -------------------------------- so the competition is not very because you are offering something that no one is offering. So there are not 4 or 5 companies that do it.	7	AL-F2
	No, no, I´ve known them for some time, and they started just as a supplier, and then I thought," hang on a minute" There´s more to this------we can work together more, much closer, partnership, a strategic partnership. I´ve always been very keen on strategic partnerships, work well for both parts. So yes, that is what we did, and then going back before the internet business, I had my start-up. Doing two things, one was distributing car parts; we had about ten outlets doing that. We should have been, that should have been us, so it shows you now that you take your eyes off the ball. Like NOMAS, they were focusing not on winning projects. They were focused on covering, no risk in the process, and not being aggressive. Whereas we were doing 80% and 20%-----. But we were getting the orders. When I thought the new guy didn't look after the customers, they ignored existing customers, which got them a bad reputation, and then this other cia., which incidentally insecure, where I´m in now. One of our keys to teaching new partners is that I've always got along well with them, even though they were competitors. When we raised ---- security, I said right it´s through card ship because we are a small start-up. And they are a big company; they got their kick on three and a half thousand trains, 25.000 buses, all of which need side security. So I said we need to have these people as partners so we can sell by them, so when we get big orders, the procurement team of the team that is buying the software, they don´t have to worry about us because we are behind their existing contract	4	AL-F4
Companies	In my incubator there was nobody else that did what I did --- in my work there is more collaboration than the competition--------------------------- a lot of what I do is a personal experience based -------------------------------- so the competition is not very because you are offering something that no one is suggesting. So there are not 4 or 5 companies that do it.	7	AL-F5

5.2.4. Absorptive Capacity

5.2.4.1. Start-up's Capability

Absorptive capacity development has been developed from uncovering how the generation of new knowledge towards the development of entrepreneurship depends on human capital's skillset existing on start-ups and incumbents (Qian and Acs, 2013; Qian and Jung, 2017). Such capture at the regional level depends on the knowledge generated in regions and the amount the capturable form of knowledge generated from an investment in R&D (Acs and Audretsch, 2008; Qian and Jung, 2017). The implementation towards innovation depends on the cognitive abilities, social, systems, and technical skills required from the CEO or the entrepreneurs working in the company (Qian and Jung, 2017). Thus, entrepreneurs would initially be able to capture business knowledge spillovers that would enable the company to set the company's adequate direction and goals (AC-SUC1).

The accelerator and incubator programmes' services and capability can cause a possible saturation on the amount of knowledge that the start-ups would be able to absorb (Hausberg and Korreck, no date; Huggins and Thompson, 2015). For instance, the engagement of start-ups under a programme facilitates access to a broader network capital and the exposure of knowledge spillovers that influences regional innovation (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). However, the disclosure and transformation of knowledge require investment in R&D on human capital to attain technological innovations (AB-SUC2, AB-SUC3).

Hence, indicators such as the companies' expenditure in R&D requires start-ups to have invested on the resources necessary previously and have a technological focus that enables the connection with other additional endeavours outside the accelerator programme in major cities (Spithovenm and Knockaert, 2012; Audretsch and Link, 2017). The drive to innovate for entrepreneurs is to focus on developing a product that enables the exploration of technological knowledge at the required pace. For that matter, start-ups in the seed stage would focus on capturing customer knowledge spillovers towards the innovation of products (AB-SUC4). The quotes related to the capability of start-ups is illustrated in table 5.20.

Table 5.20 - Quotes for the theme Start-up's Capability

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Start-ups Capability	Every time ------ there's always an idea, that in every situation, that somebody says something. It's not a fundamental change of strategy, but it's an improvement, an enhancement, a twitch, a minor realignment, and I perceive ---- into that. I'm always listening to that, that's very hard for certain team members to cope with because what you find in a team is ------ a specific function, -------You told me to this, I have a plan, and I'm doing it. And when you come in and say ----- we need to twitch -------so we are doing X study on X population ------- is that population what we need to focus on. People between that age and that age, so it's a minor realignment, but it's not -----because people like to implement what they said they would, so my job is to make change ----- so we can continue to grow and progress.	3	AC-SUC1
	At this point, we have ------ engineers ---- the average span of experience is about 10. The thing we are really after is ----- skill and understanding knowledge of how this works ----- so intimate knowledge is beneficial. As we grow, we are going to start looking for more junior people.	11	AC-SUC2
	We have about 12 engineers when they have a problem. They use a series of the----------- knowledge base; they might even attend workshops outside to re-skill themselves. ------------------------------ deeper and deeper into this knowledge sharing.	12	AC-SUC3
	What you have now in technology will be obsolete in a year or behind the year's curve advance. Hence, no matter how small you are you always have to have a budget for R&D. The program helps you think in new ways, so you are not only looking at your way, you are happy to see things done differently----- but some companies need that pivot to be able to scale or be successful. You have to have a starting word; our starting word is the word from our customers. --------, we have to see if we can build that feature into our product. -----, we do not do it as a formal service, but we are listening to our customers. That is where it starts from, and then we speed it to the product team, which speeds it to the technical team, the product does the research, tech does the ----, and eventually, you have something new.	13	AC-SUC4

The development of these new sets of technologies requires that start-ups locate in cities that enable the exposure of adequate ICTs that facilitate the capture of similar knowledge to capture knowledge spillovers and technological opportunities (Nieto and Quevedo, 2005; Narula and Santangelo, 2009). Entrepreneurs implement adequate platforms and ICTs to facilitate the innovation process to keep up with fast technological change. Therefore, knowledge spillovers access, and implementation flexibility to keep up with the competition (Bandera, Bartolacci and Passerini, 2016). Hence, the development of such new products requires openness and flexibility to identify entrepreneurial opportunities (AC-SUC5, AC-SUC6).

As such, the capture of knowledge with companies and the web requires investment in R&D that is dependent on the needs of highly skilled human capital. Such behaviour replicates on knowledge-intensive reliant companies that focus on the delivery of service as a product (AC-SUC10).

Accelerators and incubator programmes provide the perception on the infrastructure required to run the start-up operations and utilization of the adequate ICTs infrastructure to access the market during the permanency of the time in them, on which the further support extends to the access of a network of entrepreneurs that assisted the programme, and a virtual platform (Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016;

Mrkajic, 2017). On the other hand, the capture of knowledge spillovers would further depend on identifying research programmes, and information generated from publications and conferences (Amoroso, Audretsch and Link, 2017). As such, the development of further innovation on product innovation is developed from the application of explicit knowledge, on which incentives the entry on international markets (AC-SUC11) (Wang and Wang, 2012; Audretsch, Sanders and Zhang, 2017) (See table 5.21).

Table 5.21 - Quotes for the theme Start-up's Capability, description of development and flexibility

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Start-up's Capability	I believe in the agile process ---- building something for five years, and then it is something your clients don't want. I believe in communication, so the better you communicate, the better your clients will feel that you want to communicate with them and build the products they DO want to use. ---- a nice to have a tool, but it is not what I paid you for. And they have to quit because they have to build the product in 6 months.	18	AC-SUC5
	I just believe on openness-------------------------------- frustrations and ---- we should not really be here, so just be open and be frank -------- it is very tempting to try to give it the best complex----- and that is very hard, but you have to be HONEST. That gives the other party space to reveal their stuff, and you do not have to agree with any of it, but you have to listen and absorb ------ your perspective and view. All three .you are looking for all 3, especially at an early stage the most you for is to sell your software; it is all about selling there is a heavy focus on selling — closing license deals. At some point, were you able to absorb knowledge without a monetary value? All the time that is a priority for us we need revenue ------------------------ but if you do not engage with anyone because you think no one will give you money, you miss so many opportunities, so you must keep your mind completely open. I look to collect many business cards you are looking for experience, expertise, sales opportunities, partnerships, learn tech information, approaches, skills, so all the aspects of knowledge are crucial to an entrepreneur.	20	AC-SUC6
	Well, we create our knowledge, the key thing is recruiting the right people, with the right experience and the right knowledge ---- were developing a ------- manufacturing process, I can't buy that technology I can't go out and buy that technology, you develop it yourself, and you need people, skilled individuals, to be able to do that. You have to equip these people. Initially, it will be to improve technical knowledge---. So we have programs of research --------------- we provide experience --------- to develop ---------------- and we ---- form our own experiences ------------------------------ we know that packages have worked ------- to take that program along with the timeline. So then we establish the project, members of the project team -------------------- and then we meet monthly to obtain the progress ----------- technology, the planning, and the budget. And the members of this team have a high level of …….? Yes, 15 years of experience --------.	2	AC-SUC10
	Yeah, Microsoft would be one ----- but all the team absorbs knowledge, especially the younger graduates. I do tell them to go on courses ----stuff, sign up to these broadcasts, get as much information so we can short cut or create shortcuts, no point in developing something that has already been developed, you use that absorption of knowledge to mousetrap what we do. That is a difficulty because everybody thinks they can do it their way, but nine out of ten you can't, I think I know that because I'm older try telling that to a 22-year-old. That is a difficult concept that is going around, but that comes from experience. It is good to try it; it is good to fail ------ adapt those.	24	AC-SUC11

5.2.4.2. Research and Development

The data and research have backed the dependency on the skillset of human capital hired from employees that used to work on companies involved in the high tech sector (Wong, Lee and Foo, 2008). For that matter, entrepreneurs can be highly dependent on the type of technological knowledge and capabilities required, and the level of technical complexity necessary for the further development of the company (Narula and Santangelo, 2009; Qian and Jung, 2017). Hence, it can be argued that High-tech companies starting on the initial seed stages of development are not initially involved in the creation of patents or the formation of alliances (Narula and Santangelo, 2009; Tseng, Pai and Hung, 2011). Hence, start-ups that are technology-oriented, and that develop services would focus on initial setting of highly qualified employees with cultural diversity (Audretsch, Dohse and Niebuhr, 2008; Markovitch, O'Connor and Harper, 2015). However, such an approach can change if the company would focus on investing most on R&D budget on the hiring process of human capital from the industry, which is a knowledge spillover mechanisms (AC-R&D1).

The development of innovations on products and processes has to focus on the constant sharing of knowledge with the network, and the influence on the explorative discovery of the start-up (Castro Soeiro et al., 2016). However, in the case of absorbing knowledge spillovers and generating regional development and growth effects, the data suggests that the geographical location and the population diversity are not substantial considerations towards product innovation (Audretsch, Dohse and Niebuhr, 2008; Huggins and Thompson, 2015).

The development and usage of knowledge focus on product development while exploiting tacit and explicit knowledge (Wang and Wang, 2012). The data suggest that entities that have a heavier weight on customers, suppliers, and competitors rely on the absorptive capacity of the company (Tseng, Pai and Hung, 2011; Amoroso, Audretsch and Link, 2017). Hence, the R&D process initially depends on the economic agent's capability to identify knowledge spillovers, the qualified employees. They work in the company, and not directly influenced by R&D activities from incumbents and the government (AC-R&D2).

Thus, entrepreneurs use previous experience to identify an opportunity through the lenses of knowledge spillovers (Vivarelli, 2004; Audretsch and Lehmann, 2005, 2017). Human capital in the start-up depends upon investment in R&D towards training and increasing absorptive capacity capabilities towards knowledge spillovers capture and implementation (Audretsch, Dohse and Niebuhr, 2008; Stam, 2013). Hence, CEOs' approach towards R&D depends on the availability of investment and funding (Qian and Acs, 2013; Srivastava, Gnyawali and Hatfield, 2015). The data suggests that funding generated with alliances with customers or incumbents is considered an informal agreement, facilitating access to the perceived value of knowledge spillovers (AC-R&D3, AC-R&D4).

With financial resources raised, start-ups aim to first invent in highly skilled human capital and ICTs that facilitate the capture of knowledge spillovers (Narula and Santangelo, 2009; Stam, 2013). Hence, hiring new or permanent staff takes priority over training, on which employees use previous experience to enhance technical, social, and cognitive skills by specialised training (Nielsen, 2015; Qian and Jung, 2017). The data suggest that experienced CEOs would be aware of the required expenditure necessary for product innovation, which would fluctuate between 30 and 50 percent on R&D (AC-R&D5, AC-R&D6, AC-R&D7, AC-R&D8). The quotes related to R&D are illustrated in table 5.22.

Table 5.22 - Quotes for the theme Research and Development

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Research and Development (R&D)	Well, we create our knowledge, the key thing is recruiting the right people, with the right experience and the right knowledge ---- were developing a ------- manufacturing process, I can't buy that technology I can't go out and buy that technology, you develop it yourself, and you need people, skilled individuals, to be able to do that. You have to equip these people. ------ Initially, it will be to improve technical knowledge --. So we have programs of research ---------------- we provide experience --------- to develop ----------------- and we ---- form our own experiences ------------------------------ we know that packages have worked ------- to take that program along with the timeline. So, then we establish the project, members of the project team --------------------, and then we meet monthly to obtain the progress ------------ technology, the planning, and the budget. ------- Yes, 15 years of experience --------.	2	CA-R&D1
	Well, we create our knowledge, the key thing is recruiting the right people, with the right experience and the right knowledge ---- were developing a ------- manufacturing process, I can't buy that technology I can't go out and buy that technology, you develop it yourself, and you need people, skilled individuals, to be able to do that. You have to equip these people. So the approach you take is: you develop that technology, you develop it to a standard that meets the nature of the requirements basically, so you take something that is purely research-based that may have fundamental issues and the original design and some technology used, and you fix that so it's suitable to a commercial environment, and so it's ----- required to commercialize, so you re-design, but it's the fundamental science.	2	CA-R&D2
	Ok. So, it's technology. In NARROWS therapeutic we have ------, so that's the technology, so we've raised money from investors were going to take up money and invest it to see if we can turn it into medicine ---- and the study that we are doing ------- It's the spread of money invested in seeing whether or not -------- because the study is big enough and if it's well-conducted if the survey is positive it's likely higher, it's a 50/50 that we have something that could be a medicine. It's the technology ------in uncovering the value to the medication.	10	CA-R&D3
	They were developing about their hot spot, so they had Starbucks, and all using team mobile. They then came on board, and they branded up the train as a Team Mobile hot spot, which was very interesting. We got some quite significant investments from the investment house AMADEUS, investing in technological companies. And from then on, we started and won one contract and later another contract and some of the equipment. I made some of it in my workshop, and some of it is still around. Then we won huge contracts like Dutch Trains, a 30 million pound contract, then AMTRAK, a lot of U.K. business projects worldwide, and one of the things that helped us, as I set up a deal with one of our main suppliers…..rail cables and antennae. The deal was that they would hold all of our stock and what we buy from them as well, and they would make all the bracketry for us, they managed everything.	12	CA-R&D4
	We have a dedicated R&D department, which counts with four people, and we undertake a series of investigations background scientific research on virgin technology trends. Then we look towards how we can commercialise our ideas ----. We have all kinds of in house tools that capture that knowledge, but we have dedicated people in our organisation, in their job to seek out the scientific research and then test learn and fly to our product. What if we think that research and development are --on our current road map' yes it is a value, you want me to put a percentage on that I can't.	39	CA-R&D5
	We have a rigorous budget; we divide work, resources, intercourse way for a part; our relief is usually 33 %. So the R&D will be what we need to develop the product we progress on our work, on what we want to deliver at any one time and the impacts it feels now, and then we re-design a road map to work with those directional timelines. Our team can't tell how or when it will be built; they don't know. So the thing with I.T. is at the delivery time. You can't sit for 2 or 3 months; you don't know. -----, so we just give them that time ------ if there is a spare, just take it away.	40	CA-R&D6
	Idea generation, finding solutions to problems, it is also useful in terms of team dynamics. Team with more diversity produces more. It is something harder to achieve than you had hoped ------ we are 40%males and 60% females. We have people from different parts of the country, so yes. In terms of religion, nobody is very religious; we have one protestant, one Catholic, and one Muslim. So we got a variety of religions, but nobody practices them much.	41	CA-R&D7
	We spent 30.000 pounds with a specialist consultant who made a two or 3-week sprint analysing it and getting customers, testing things out, and gave me enough evidence to say YES, We this have an exciting proposition. And then I was lucky enough to bump into my ….at her insurance dinner; I knew that he had the balance of skills I didn´t have…so I said to him, "would you be interested if I gave you a years salary and gave you some shares? Would you be interested?	13	CA-R&D8

Start-ups located in this stage process would focus on allocating a considerable amount of resources to conduct experiments and developing the product through multiple life cycles using customer knowledge spillovers on similar technologies (Nieto and Quevedo, 2005; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Hence, the employees involved in the product innovation are mostly regarded by their technical skills obtained from industry, which is an indirect effect of the level of education in the country (Stam, 2013). Start-ups can also decide to have a limited number of active students and PhD students to engage in its operations. Simultaneously, researchers access can be limited to the previous networks of the Chief Executive Officer (Audretsch and Link, 2017).

High-Tech start-ups are to focus on investing R&D budget towards human capital that can identify technological knowledge spillovers to be able to enter the market (Nieto and Quevedo, 2005; Wong, Lee and Foo, 2008; Nielsen, 2015). As such, the type of knowledge spillover capture would be technical, with a focus of constant engagement with the customers is flows between companies that don't have to be from the same industry (Glaeser and Kerr, 2009; Cantù, 2017). The development process consists of continuous research that focuses on building a product that can satisfy the market needs and make sure that the research project has been developed so far to avoid unnecessary resources (CA-R&D9, CA-R&D10, CA-R&D11, CA-R&D12, CA-R&D13, CA-R&D14). The quotes related to R&D are illustrated in table 5.23.

Technological tools required for the capture of information towards innovation would depend on the network platforms facilitated by the accelerators or the entrepreneurs' previous experience (Pauwels et al., 2016; Mrkajic, 2017). Human capital would use virtual platforms and search engines that can be adapted to the development of the product that can be considered among the access to knowledge with customers and competitors (Ho et al., 2011; Acs et al.

Table 5.23 - Quotes for the theme Research and Development

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Research and Development	So the approach you take is: you develop that technology, you develop it to a standard that meets the nature of the requirements basically, so you take something that is purely research-based that may have fundamental issues and the original design and some technology used, and you fix that. So it's suitable for a commercial environment, so it's ----- required to commercialise, so you re-design, but it's the fundamental science.	2	CA-R&D9
	It´s a small start-up, mainly it getting customers in all the time. Probably two a week, we get customers and do testing. So, we build something, test it with them, get feedback and change it. That´s how. It´s customary engagement rather than…. mostly it´s directly with customers.	5	CA-R&D9
	The first you learn is to be in love with the problem, in our case we started knowing there was a real problem ------------------------------ the first thing I did was to put together a business plan, did some research to find out an approximate of the cost, and how much institutions are spending and the numbers speak for themselves --------------------- also using some platforms such as STAR---, yes there are a couple of platforms out there to share the knowledge we do use those platforms.	11	CA-R&D10
Research and Development	What you have now in technology will be obsolete in a year or behind the year's curve advance, so no matter how small you are, you always have to have a budget for R+D. The program helps you think in new ways, so you are not only looking at your way, you are happy to see things done differently----- but some companies need that pivot to scale or be successful. You have to have a starting word; our starting word is the word from our customers. --------, we have to see if we can build that feature into our product. -----, we do not do it as a formal service, but we are listening to our customers. That is where it starts from, and then we speed it to the product team, which speeds it to the technical team, the product does the research, tech does the ----, and eventually, you have something new.	13	CA-R&D11
	Yes, we released an act, purely for testing purposes, we probably spent 15.000 on that. That is the most we have spent on a project --- which we scrapped and are now starting from scratch.	16	CA-R&D12
	Well, I suppose all the classic one: Google researches a couple of universities with free academic tools. One of my research team's criticisms is that they are not very good at discovering stuff unless it is handed to them on a plate. It would help if you looked at these areas. There is a lack of creativity in-----. I would say we use a lot of sources I.P.I. Product analysis, the stats, ---- We put in course fees, ---- university fees. ---- Probably I am not the best person to request. The best person would be my R. and D. guy	24	CA-R&D13
	Well R&D is something that comes from inside, and investment comes from the outside of the company, ---------------------------------- so in our case project development is about 50% of what we do and 50% on customer development. ---, not far into the future.	28	CA-R&D14

Hence, start-ups without the required technical knowledge or budged would not consider implementing technologies such as machine learning or artificial intelligence, as these would require a considerable amount of resources that the start-up does not have or based on the perceived value of the entrepreneur (Yan, Khoo and Chen, 2005; Ho et al., 2011). However, data would suggest that the process of knowledge spillovers absorption is more reliant on the entrepreneurial capabilities of the CEOs to identify opportunity on knowledge spillovers. In case that a level of technical skill is required, another founder with the necessary technical expertise would be involved in the process to implement knowledge (Audretsch and Stephan, 2000b; Audretsch and Lehmann, 2005). Entrepreneurs transform customer knowledge spillover to create prototypes through assigned to projects that take five to seven years to complete before entering the market (AC-R&D15, AC-R&D16, AC-R&D17, AC-R&D18, AC-R&D19, AC-R&D20, AC-R&D21). R&D quotes are shown in table 5.24.

Table 5.24 - Quotes for the theme Research and Development, investment on technological tools and human capital

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Research and Development	Mainly by my co-founder James and me. We are in the development stage now, but we have to do a lot of research; customer behaviour, other products that work well in parallel industries, and work on that together before we launch it online. I continue to do it in my spare time-----. Yes, m, we released an act, purely for testing purposes, we probably spent 15.000 on that. That is the most we have spent on a project --- which we scrapped and are now starting from scratch.	16	CA-R&D15
	The knowledge hits a team member from there. It is dispersed anywhere. I read ----- digest; I get letters with informative papers, I do a lot of scouting in that way-----. The first level; here is a bit of information for the team. ---- that usually happens on our chat apple, ---- we capture bits of information that later turn into tasks. I know we have a bunch of information scattered around; e-mail, That's it.	19	CA-R&D16
	Well, I suppose all the classic one: Google researches a couple of universities with access to free academic tools. One of my research team's criticisms is that they are not very good at discovering stuff unless it is handed to them on a plate. It would help if you looked at these areas. There is a lack of creativity in-----.I would say we use a lot of sources I.P.I. Product analysis, the stats, ---- We put in course fees, ---- university fees. ---- Probably, I am not the best person to request. The best person would be my R&D. guy	24	CA-R&D17
	We have a data analysis tool; we have DATACOM ----- we have various apps, what the people want. And we use GIROB to handle the r+d, project management Q.A., and delivery, we also use confluences, we can media a platform to capture data, and then make sure we don't repeat ---- it is written somewhere where we can have a look. It depends if it is knowledge to redesign, train people in a new process, and teach them how to use it if it is technical tools, we might go to formal training, or the developer will be sent to train in that technology.	30	CA-R&D18
	We have to be sure the product is relevant, so we put an enormous amount on project development first, you build your development centre. Your development team, then your sales team, ------------------------------------ so you make sure that cycle after cycle your product gets better and so receiving more benefits, as you grow appropriately. Well we know where we want to go in terms of new markets ------------------------ or how much our product has helped, ----- we have figured out this, our client can save this much money, -------------------- but we can say "over the next seven years------" we are more to develop.	32	CA-R&D19
	We have a data analysis tool; we have DATACOM ----- we have various apps, what the people want. And we use GIROB to handle the r+d, project management Q.A., and delivery, we also use confluences, we can media a platform to capture data, and then make sure we don't repeat ---- it is written somewhere where we can have a look.	30	CA-R&D20
	We use BAITCAM to organise anything we do ----------------- that is part of the TO DO WHEN I COME ACROSS something interesting ------------------ on a personal level I use pinboard to track the possible links and I use CROKET ---- school, those are the tools I use at the moment. --------------------------- so whenever I need to learn or have a question, SEEDCAMP has a network community called MOBILIZE where you can find anything in the SEEDCAMP community. Then the message will be sent to all the founders quickly. It is precious for all types of information.	8	CA-R&D21

5.2.5. Knowledge Spillovers

5.2.5.1. Taxonomy of Types of Knowledge Spillovers: Tacit and Explicit

The process of innovation of start-ups is deeply attached to the transformation of tacit and explicit knowledge that takes place through the socialization, externalisation, combination, and internalization model established on the SECI model (Nonaka, Toyama and Konno, 2000). One of the initial forms of tacit knowledge spillovers absorption comes from the transference of information based on face-to-face interactions and high trust levels through networks, start-ups, and companies (Agarwal et al., 2010; Shu et al., 2014). Hence, it is expected that the recognition of the idea required to start the newly founded company comes from the identification of entrepreneurial opportunities and new knowledge generated from R&D investment form companies and institutions (Audretsch and Lehmann, 2005; Stam, 2013).

The process of the development of the SECI process on the initial stages of the company depends on the previous experience of CEOs, and of the initial human capital that is part of the start-up that enables the initial development of the company, and the identification of the business idea (Nieto and Quevedo, 2005; Wyrwich, 2014). Also, suppose the background of the entrepreneur provides from the industry or academia. In that case, it can influence the survival of high-tech start-ups if the company enters an industry-based or profitability, or in the case that the valuation of the product in the market is uncertain (Nielsen, 2015; Amoroso, Audretsch and Link, 2017).

In the case of founders with the academic experience, entrepreneurs embrace the understanding of technical methodologies and knowledge applicable to the development of a product and the company. On the other hand, business knowledge spillovers from the industry, or the creation of a previous start-up provide experiences that boost the company's managerial decisions on how to interact with stakeholders, understand how to develop the business, and be able to enhance the development of products to the market. Hence, the quotes obtained from the data suggest that the company's development is embedded in *entrepreneurial or business knowledge spillovers* (KS-TX1, KS-TX2, KS-TX3, KS-TX4, KS-TX5, KS-TX6, KS-TX7). The quotes related to knowledge spillovers taxonomy are shown in table 5.25.

Table 5.25 - Quotes for the theme Taxonomy, tacit knowledge from entrepreneurs

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Taxonomy	I didn't bring any processes here at all, and the only thing we brought in was a skill set, and experience set because the most crucial thing in biotech ----- the people there can understand the science, understand when decisions need to be taken, and strategy needs to be reviewed. Take decisions, make decisions, and implement them very quickly, and operationalise, -----well ---- so, I think decisions make more important than processes. Yeah, well, the technical skills, the functional expertise tends to come from functional experts and not necessarily in this building but in other places ----- we take additional advice -----. We locate an I.P. specialist firm, we've taken advice from top psychologists, located specialists' top firms that regulate trade or C.M.C. and there are partners connect ants we work with. Still, they aren't entrepreneurs. They are people who are providing skills and experience ----- entrepreneurs themselves.	3	KS-TX1
	So, I knew that this idea was appealing to customers. I also knew that the insurers would need to deliver this new type of service. And I didn´t know how much money I was going to have to raise to do it., so in the early stages a little test a bit and did some research and then the key was to find the right people to do it. Yes, the right business partner. My last start-up was not a success. We built it and built it, but it wasn´t making money and then we sold it. But we didn´t sell it very well. I view it as a failure, which was very painful. So, in this start-up, I learned many lessons, doing something different and enjoying it more, working with people, and I would say I´ve learned a lot about running a business. My last business was not tech. It was a very different way of working, so I've had to adapt to it.	5	KS-TX2

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Taxonomy	Yeah. So you get better and better at it, you do not make the same mistakes, like if I said "do academia for 20 years" you would be pretty good at it. No? This is my point, businesses may change, but the principles remain the same. How you find a co-founder, what you look for in the business structure, how to raise money, how you hire people, how you market business, how you go to the market with your product, all these things are transferred. Hence, as you do this more and more often, you pick up a lot of experience. And this helps you because it is a job that demands a lot of commitment and tenacity and energy. As you get older, you need to have some experience to offset the fact that you are older and I found myself in that position	10	KS-TX4
	The S.W. business is an exciting one because to produce quality software is very expensive and very time-consuming. To be prepared to pay for it, you have to find a solution they can afford. So you have to pay close attention to your clients and see how these problems are manifesting, how the opportunities are manifesting and see the opportunity to monetise on them. Working in I.B.M. for 15 years was valuable, so I see it as a core experience precious to me in all the aspects, talking to people, board meetings, .and second was the experience in S.W sales. Without disrespect, sometimes learning how not to do it is as valuable. Before that in Black and Decker, it was a great way to start a career solving real problems. My education here in Westminster was precious in the time in high tech.	20	KS-TX5
	About 5%, it was just one more step, but the experience that I got in Delays helped me to talk to people, learning how business is done. There were some practical skills like product design or interviewing people, or like tracing pinpoints, there were some practical skills, but that was a really small part in helping me run the company. I have learned the vast majority of things outside that --- in other companies.	29	KS-TX6
	Much of the work I have done in the past has been about technology, enhancements and implementation on launching new products and processes; a lot has been about enhancing existing products or adding new features or functionality. Yes, I have a lot of experience doing it, innovating in that way and leading teams and being the touchpoint between the business and the technical. The team is something that I have had quite a lot of experience in it. Yes, and I would say that experience helped develop the company differently if I did not have this experience, I would not have approached the business the same way.	31	KS-TX7

It has been questioned how the business idea identified from entrepreneurs provide from R&D generated from incumbents, or through the interaction held on the incubator, or accelerator programmes (Qian and Acs, 2013; Cantù, 2017). However, the capture of business ideas through knowledge spillovers can generate an incentive for the entrepreneur to create a new product to enter the market. The perception that the business idea has a high evaluation (Audretsch and Stephan, 2006). On the other hand, entrepreneurs that identified knowledge spillovers in the initial stages of the start-up, depending on their perception of the evaluation of the idea to develop a product, and the potential that its development can have on the access to international markets (Acs et al., 2012; Audretsch, Sanders and Zhang, 2017).

The data provided insights that one route of capturing knowledge spillovers towards identifying the business idea is caused by the sharing of knowledge between the co-founders before the development of the start-up (Tsvetkova, Thill and Strumsky, 2014; Cantù, 2017).

Market research conducted by the founders enables us to confirm the monetary value of the product idea. In the face of uncertainty, entrepreneurs would proceed to do market research through informal interactions or interviews with customers and obtain feedback from experts in the field (Wong, Lee and Foo, 2008; Ko and Liu, 2015b). Hence, the purposeful capture of knowledge spillovers is used to obtain an evaluation of the company. Also, entrepreneurs can decide to skip the market's assessment by testing the product through the review of explicit customer knowledge spillovers (KS-TX8, KS-TX9, KS-TX10, KS-TX11, KS-TX12, KS-TX13, KS-TX14, KS-TX15, KS-TX16, KS-TX17) (See table 5.26).

Table 5. 26 - Quotes for the theme Taxonomy, evaluation of the business idea before the foundation

2nd Order Theme	Relevant Quotes	Interview	Code
Taxonomy	I got together with my co-founder, and we both shared experiences of how our used cars caused problems, and at that point, the idea was born that we wanted to try free trust for a used car market. That is how it came about.	9	KS-TX8
	We saw a gap in the market. We saw ------- residential apartments in London. We thought that we could pitch this value and profit, enabling them with high-quality furniture and letting large corporate travellers use them as an alternative to a hotel. We looked at the supply-demand chart in critical cities, looked at the time required to set up --- we looked at the rise of ---- and using these three critical models judge where the price ------ that is how.	10	KS-TX9
	Number one, we knew there was a problem with international trade. I saw it as an importer of pharma. And again when we did --- a value for Shell.		
	We started with a problem and said how big is the problem, so we worked our way back and then found a solution, now that we are close to the solution we have to monetise that and see how far we get. Yes, as a business you learn, there are always gaps, for us initially it was marketing, we understood sales and face to face marketing, but in terms of digital marketing and things like that. Yes, we went out to solve a problem with international trade and what we realised that it was a problem for us. So yes, we learned a lot of things along the way.	17	KS-TX11
	It was an idea of my cofounder --- he was the creative director for many T.V. stations, and he realised that a lot of the trailers that he and his team created never got out, so it is a waste of work. He said why don't we create a tech platform where the users are on a mobile base, used with tablets, ----, we presented the idea to senior vice president of Discovery, and within 10 minutes, he validated the idea and was sold. He also said he would pay as well for the development.	18	KS-TX12
	It was part of intrusion, part of a process. We knew in 2014 that cybersecurity was going to be big according to market trends. WE ARE CYBERSECURITY EXPERTS FOR YEARS, SO WE KNOW (12) it was necessary, etc. We decided when we founded the company to focus on that topic without really knowing the value proposition. And what we do for almost one year to conduct interviews with possible customers because we had nothing to sell at that time. ----------------------------------- and finally building the solution we have today.	21	KS-TX13
	When I went to university, I saw it was an issue to get tickets. There was no efficiency I had a friend that run events, and sometimes they could not find a printer, …. So I said **** I will do it myself. So I got a business going and strived to be as efficient as possible. ..to an idiot group so anyone could buy a ticket, you could do it on your phone, and then the ticket company will charge you. After that, it grew and grew and grew.	23	KS-TX14
	We had a big ambition to combine not only our physical ---- with ------------------------, and that is what we are developing right now ----- but it was our first step coming from cybersecurity we are trying to develop a device that would help us to maintain our identity. , no matter what the ---------. We did research and interviews to validate our idea the value of the ----- if there was an actual demand for such service, the results were positive and encouraged us to go forward. And with the investors, we said: OK. Let's give it a try.	25	KS-TX15
	I was looking for ideas, one day I was in a pub with my girlfriend, and we were arguing about who was going to go to the bar to order food and drinks, neither wanted to go to the bar to order, nor sitting there waiting with nothing to do, so I thought, this is crazy, everyone has a phone in his pocket, why can't we just order food from we sat. That was sort of the initial idea of what became CRABB. After taking it around offering it, we found out people wanted it more to order drinks from the bar than food. So CRABBS was a significant bar and drink service. We ran for a while with this business until we saw it did not work out, ---- so after going back to the food, we decided to combine the food and the drinks in one tablet and put it on the table. The service would be speedy, convenient, and not traditionally using the waiter. So, it took a long and devious route to get to what the market wanted.	27	KS-TX16
	I saw the opportunity to build a product in technology that would make a difference to many people. And how did you identify this brilliant idea to start a company worked in the industry for large companies, so I saw the need forehand, head of sales operations mostly? Within my position, it was apparent that the need was there. I looked at the number of people affected by the problem, the revenue from the number of transactions, I can make the market size on the base of the people that have this need. Get the average volume for each transaction, and you know: multiplication over three.	30	KS-TX17

Networking events are a source of tacit knowledge of industrial clusters, incubator, or accelerator programmes (Narula and Santangelo, 2009; Connell et al., 2014). The data suggest that entrepreneurs' conglomeration facilitates intended and unintended access to tacit knowledge spillovers from entrepreneurs and businesses (Qian and Acs, 2013; Cantù, 2017). However, the exchange of knowledge spillovers is limited to general business information, and not to specific technical knowledge due to secrecy, and awareness of knowledge leakage. In such instances, knowledge spillovers can be perceived as an adverse effect on the new venture (Ritala et al., 2015; Ferenhof et al., 2016).

On the one hand, knowledge spillovers can provide insights on how to develop the company. Therefore, business knowledge offers direction to the company's growing development, which is considered valuable. Entrepreneurial and business knowledge sharing is conducted in meetings and informal gatherings. This process occurs on physical location in accelerator and incubator programmes between entrepreneurs and experts in the field (Nonaka, Toyama and Konno, 2000; Cantù, 2017). The data suggest that tacit technological knowledge spillovers are acquired purposefully through the interaction between entrepreneurs with customers during the product development and innovation (KS-TX18, KS-TX19, KS-TX20, KS-TX21, KS-TX22, KS-TX23, KS-TS24, KS-TX25) (see Table 5.27).

Table 5.27 - Quotes for the theme Taxonomy, Knowledge Spillovers Absorption

2nd Order Theme	Relevant Quotes	Interview	Code
Taxonomy	We could explore; we are developing our processes, so to make it change is quite significant. So you keep an eye on the latest technology, what's happening, what's being discussed, but to make a change, you have to consider new technologies before you make that change. --------Through scientific meetings and also professional networks and publications also. Some we can see from presentations and meetings ---- so there may be some new technology that three out of five companies are using to become accepted, and then it has a proven value. With other companies ---------------------------------- there a lot of intellectual hurdles, so we tend to work independently because your I.P. is of real value, so sharing that free is not going to happen, so there aren't many options in doing that.	1	KS-TX18
	Every time ------ there's always an idea, that in every situation, that somebody says something. It's not a fundamental change of strategy, but it's an improvement, an enhancement, a twitch, a minor realignment, and I perceive ---- into that. I'm always listening to that, that's very hard for certain team members to cope with because what you find in a team is ------ a specific function, -------You told me to this, I have a plan, and I'm doing it. And when you come in and say ----- we need to twitch -------so we are doing X study on X population ------- is that population what we need to focus on. People between that age and that age, so it's a minor realignment, but it's not -----because people like to implement what they said they would, so my job is to make change ----- so we can continue to grow and progress.	3	KS-TX19
	It is a mixture depends on who you ask. Mostly technical, data stands, ---- allow to expand ---- areas of technology that we know that we have to learn, I would say less on the managerial side, understanding the markets' structure was particularly helpful---.	19	KS-TX20

2nd Order Theme	Relevant Quotes	Interview	Code
	I did not because I did not raise capital until after I came out of the accelerator. When I started, I got a little help from the people in the programs, -------evaluating the company and then on grow. … we are showing good growth progression… so you are adding to the portfolio, we have added properties. … most of the time, but the ticketing seems to grow, it shows growth, and that is what investors want to see. …. I only got a 24-hour day.	23	KS-TX21
	Financially yes, but in time …. The knowledge they have built over the years is invaluable; you can't put a price on that. Oh yeah, they charge so much for this and ……………., but typically it is all free. …. And it's the network, for me the network is the most crucial thing if you are asking for advice, getting smarter people around me also helps.	23	KS-TX22
	When you are building a start-up, you go through a customer development process, trying to define a new business model and proving that it works, --- go to a particular that has a lot of Chinese restaurants in his network, so we contact him and can sell to all the restaurants in that area. Sometimes it is useful and sometimes not, depends always on the business. But you are getting useful information on who and when and all sorts of random pieces ---- and they can offer you a particular piece of knowledge useful to you.	27	KS-TX24
Taxonomy	------ it is mostly informal and free, some do it because they are good at heart, they have run a company, they know how hard it is, some people are doing to help, other people are angels, some do it as an exercise looking for jobs, so there is a whole bunch of reasons for why people would provide free data.		
	The force of the company always improves because you are learning; you have an ever-learning curve. It's hard to say that it improved because of the accelerator or not. I think the advantage of the accelerator is that you learn a lot from other people. You try more things, you get more ideas about the things you try, and also if it is a good accelerator, you will spend less time finding people. Chasing people because you have to connect and talk to the right person: It's about management processes, implementation of methodologies, use of technology, sub-contractors, business strategy, selection of technologies, ideas on acquisitions, market penetration, market processes, branding deals.	30	KS-TX25

5.2.5.1.1. Entrepreneurial Knowledge Spillovers

The level of absorptive capacity of the funders and the company's employees requires R&D investment to develop high levels of product and process innovation (Qian and Acs, 2013). The development of new ventures and their capability to generate employment after five years is linked to cities with a high level of economic development (Audretsch, Belitski and Desai, 2015). In this context, regions have formed entrepreneurial ecosystems that enhance start-up's knowledge absorption supported by infrastructure and amenities of cities, entrepreneurial culture, accessibility to the internet, and increased demand for products and services from customers in local markets (Audretsch and Belitski, 2017).

Research on knowledge spillovers at the individual level started with the evaluation based on the type. Such a process considers the effects that incubators and accelerators have on the access to new networks that facilitate the formation of collaborations in entrepreneurial ecosystems (Shu et al., 2014; Cantù, 2017; Spigel and Harrison, 2018). Entrepreneurial knowledge fosters the capabilities of start-ups on identifying information from the market and customers, and the exchange of knowledge between new ventures and experts in the field (Ko and Liu, 2015b; Schmidt, 2015). Furthermore, entrepreneurial experience involves tacit knowledge that contains lessons on how to create an initial product to enter the market, undertaking the necessary business processes for the development of the company, and the identification of adequate sources of knowledge to use for start innovating (Amoroso, Audretsch and Link, 2017; Ko and Liu, 2019).

The data suggest that the initial foundations can pivot new entrepreneurial business ideas into the market through funding from Venture Capitalists (VCs) (KS-TX-EKS-FND1; KS-TX-EKS-FND2; KS-TX-EKS-FND3). After the entrepreneurs have a glimpse of the adequate sources, the interest to attend entrepreneurial network events decays (EKS-FND4). On the other hand, experienced entrepreneurs can find that accelerators or incubators' influence is not as significant and can decide to become a source of entrepreneurial knowledge for new start-ups (EKS-FND4). The quotes linked to funding are illustrated in table 5.28.

Table 5.28 - Quotes for the category Funding**.**

1st Order Category	Relevant Quotes	interview	code
Funding	Another kind of knowledge is the funding status, or what you can say, where the start-up. It is funded so you can get these or where the demand is. And that may affect our planning to maybe pivot a little, for something that has more demand on the market.	1	KS-TX-EKS-FND1
	During the program, we had to be there three days a week, and most days, they would bring in people for us to meet. They'd be marketing people. --------they could be ------management people; they could be customers. Several investors, we met a lot of V.C., and we reached the chief scientist that enthusiast you, so they can talk to us. It´s fantastic; it´s exceptional. I'd say it´s probably one of the best accelerator programs that have been run.	4	KS-TX-EKS-FND2
	When you are a young start-up, you got to raise money one way or another when I came to London, I did not know anyone, but I knew every major B.C. in town in two months. The reason is that I could look in SEEDCAM'S portfolio and scan the 150 companies there ---------------- so that made a considerable difference ------------------------------ we are scared as hell for pitching to people you know, the largest companies in the world. The first six months I spent with investors afterwards -----I could do a lot more on the internet than going to these events, I did not go to any industry,---- I just do not do it ------------------ the best use of my time is not having drinks at 6 pm but connecting to knowledge online.	8	KS-TX-EKS-FND3
	When I went to the acceleration academy even then, I was way ahead of the curve. I sort of helped --- difficulties with my business and which even now is in the ----revenue category of one million. We don't have the funding grant. So E.I.S. is a big thing to get a business off the ground. Technically I'm out of time ten years.	27	KS-TX-EKS-FND4
	We are fortunate because we are very experienced, we all have a lot of contacts, and even if you have one contact, they have other contracts which tend to work through our networks, which is when someone comes to me and says I need help with X. I'm more than happy to connect them into that network.	3	KS-TX-EKS-FND5

The source of legal knowledge that entrepreneurs would share and obtain is accelerators and incubator programmes to set up the business (KS-TX-EKS-BK1). However, the interviews suggest that most of the legal knowledge derived from the experts' services and activities in the field facilitated by these programmes (Cohen et al., 2017; Mrkajic, 2017). Also, entrepreneurs are whiling to share business knowledge insights to start fundraising and set marketing strategies and exploit the capabilities of social media (KS-TX-EKS-BK2, EKS-BK3).

This event is a first step stone that facilitates the positioning and the perceived value entrepreneurial products in the market, which are non-technological forms of product innovation (Montoro-Sánchez et al., 2011; Chun Sung-bae; Mun, 2012). Business knowledge spillovers also compromised on setting the adequate strategies that enable the growth of the start-up in the following years through proper management of human capital and the chain of value (KS-TX-EKS-BK4, EKS-BK5). Hence, companies in accelerator and incubator programmes would acquire tacit knowledge spillovers from informal mechanisms such as meetings and presentations from experts in the field (KS-TX-EKS-BK6, EKS-BK7). Quotes related to business knowledge spillovers are illustrated in table 5.29.

Table 5. 29 - Quotes for the category Business Knowledge Spillovers

1st Order Category	Relevant Quotes	interview	code
Business knowledge	It's a kind of agricultural, commercial ----- challenges that small companies face with their projects, so the regulations, your expectations, and guidelines are changing all the time The last people we integrated with have the best knowledge and also a kind of commercial landscaping, so the challenge of manufacturing your products and to establish contacts with manufacturers.	2	KS-TX-EKS-BK1
	I have interactions with other entrepreneurs, with other seniors, sharing insights, significantly when I was raising money for the business. ------- You know it's important to share ideas into how about going to raise money. Entrepreneurs what they fundamentally to do is raise money. If there´s no money, there's no business, and the whole process of fundraising is quite challenging -----, and they're sharing war stories with different C. O's ensures the process is essential ----. I spoke to 2 or 3 established seasoned entrepreneurs who have been remarkably successful in getting insights from them about raising money to make the start-up Attractive. That's very valuable.	3	KS-TX-EKS-BK2
	There have been some standard in generic information that is shared among people that are starting a business, and those things are legal, how you settle a -----------------, also there has been some knowledge and guidance that cannot contextualise with my activity. But I did receive training and advice on what you should do as a small business; having a business plan, market strategy ----, being on social media and finally I came away from there feeling I was doing a lot of things wrong because I did not have any, not even a web site ---- and yet I was doing ok in my business, I was getting work, I had a pipeline of work. ----and if they ask me for advice, I will tell them," do not be intimidated if you are not doing ALL the thing stipulated.	7	KS-TX-EKS-BK3
	--- Rarely about managing the company, more about how to build the business from a model perspective and growth perspective, how in the value chain-----different captured values.		

1st Order Category	Relevant Quotes	interview	code
Business Knowledge	Yeah, through the accelerator there was a participating company with who we made good relationships telling about challenges and successes and sharing information among us .that proved very useful,	16	KS-TX-EKS-BK5
	During the process, I interacted with first my old clients, a friend from the university, ------ in my manufacturing Master's I could see the thing presented --- my consulting work was around the space --- German company where I met our people ----- that is when I started to understand the scope. In the accelerator, it went deeper. We are seven companies working side by side so which led to a relationship with these people.	19	KS-TX-EKS-BK6
	Two ways; there were various people around so ---- there are many ways to do this, and having people around from where to sound off and bounce ideas was beneficial informal mentor lectures.		
	What knowledge do we share? While we are in the incubator it is very enriching to share other people's experience, many of the companies that are now in business started with these programs, and a lot of us know each other for a long time. The great thing of the Master that we did was so diverse. Still, with a strong common denominator …. . So we often have lunch together every day which is the time we share the most, in terms of networking events outside the incubator, yes we always talk about ------------------ secretly because of the nature of our product. ----- Yes, from R.C.A. it was more on a management point of view, in terms of ----- it was everything from technical to other aspects of running a business.	25	KS-TX-EKS-BK7
	The force of the company always improves because you are learning; you have an ever-learning curve. It's hard to say that it improved because of the accelerator or not. I think the advantage of the accelerator is that you learn a lot from other people. You try more things, you get more ideas about the things you try, and also if it is a good accelerator, you will spend less time finding people. Chasing people because you have to connect and talk to the right person:	32	KS-TX-EKS-BK8

Incoming knowledge spillovers have evaluated the classification of information depending on the source (Veugelers, 2016). Access to knowledge flows can come from building collaboration with customers, suppliers, competitors, individuals, and research institutions (Veugelers, 2016; Qiu and Yang, 2018). However, disruption of access to information can be considered harmful to start-ups (Squicciarini, 2009). Hence, they can end up perceiving outcoming knowledge spillovers to cause problems of appropriability (Arrow, 1972; Nieto and Quevedo, 2005).

The data suggests that start-ups that share business knowledge with other entrepreneurs set a limitation on the type of information shared (KS-TX-EKS-LMT1, EKS-LMT3). Therefore, the knowledge that enables a competitive advantage of the company is not discussed in informal conversations. Hence, knowledge spillover filters can be formed when experienced entrepreneurs perceive informal meetings with early entrepreneurs to return low value compared to the endeavour taken to be part of networking events (KS-TX-EKS-LMT2, EKS-LMT4). Thus, networking events gradually evolve from a source of knowledge spillovers to obtain funding and expand on the network capital of the start-up (KS-TX-EKS-LMT5). The quotes related to knowledge filters are shown in table 5.30.

Table 5.30 - Quotes for the category Knowledge Filters

1st Order Category	Relevant Quotes	interview	code
Knowledge filters	That is an excellent question. I think there is a cloak around what an interaction should be. Half of the people share, and the other half keeps things to themselves. They want to feel that their ideas are secret, and they should not tell because someone could steal their ideas. I think that being very open has more value --------------------, so the network effect only comes about if you are open and interacting with other entrepreneurs.	9	KS-TX-EKS-LMT1
	I think everybody is more interested in the funding, you become strong as a group, potentially in some cases you are making the whole industry faster and more efficient by spreading your knowledge. Still, you have to be careful, or you could lose your advantage. Maybe some knowledge is not to be shared!	13	KS-TX-EKS-LMT2
	There is a lot of information shared between these networks. A lot of the stuff was focused on first-time founders, which I am not one so things like ------- we're not as relevant to me as they would be to someone else. Another thing is that I am not that big on networking with new founders. I have had bad experiences in my businesses. So my exposure to that was limited.	10	KS-TX-EKS-LMT3
	I don't think they are doing it (job) because they are obsessed with it, some people are doing it because it is cool or it sounds fun, and this journey is extremely stressful, it´s not like joining a bank and getting like a fancy job and a fancy --- and getting lots of money. No, it just does not work this way. So many think they can apply that to entrepreneurship, but it does not work like this. Some are admired because they are stubborn, ambitious, and have a vision, they don't just want to make money, they don't want fame, all they want is to create and help. As a side comment, I would like to say that I don't have much chance to hang out with entrepreneurs mainly because I don' have A lot of the time I work. For example, this evening will be a drinking gathering; there will be several investors and tracking companies.	29	KS-TX-EKS-LMT4
	I would say no knowledge, ZERO knowledge. Because I don't believe that what gives me value these days is necessary knowledge, I think it's meeting people--my company. So it's not like they told me a story and I learned something from that, it's more they introduced me to someone, or there is some way we can cooperate with that or even if there is no way to cooperate maybe we are in the same space and we share the same contacts. So it's the network that is valuable. When you work in the travel business, everybody will talk about you and are going to mention you. That is the value we get. Not so much on knowledge.	32	KS-TX-EKS-LMT5

Companies that engage in networks development are more likely to gain access to knowledge through collaboration and co-operation (Connell et al., 2014). Accelerator and incubator programmes support this endeavour by providing physical installations and virtual platforms (Nicolopoulou et al., 2016). These factors support the formation of alliances and collaborations that can lead to the development of Entrepreneurial Joint Ventures (EJVs) (Montoro-Sánchez et al., 2011; Shu et al., 2014).

The data suggest that high-tech companies would most likely decide to collaborate and alliances with companies for the following reason. The first is to exchange knowledge spillovers on regulations and business processes that facilitate the enhancement of products' operations and development (KS-TX-EKS-A&C1, KS-TX-EKS-A&C2). After formal agreements between parties are set into place, joint projects enable access to knowledge spillovers (KS-TX-EKS-A&C3). Foremost, alliances and collaboration are sets and conditions that provide start-ups with the credibility and exposure to enter the market and gain funding. The quotes related to alliances and partnerships are illustrated in table 5.31.

Table 5.31 - Quotes for the category Alliances and Collaborations

1st Order Category	Relevant Quotes	interview	code
Alliances and Collaborations	We provide side security solutions for their inflight entertainment system, so the passenger ------ in the planes. So it is the same; I knew nothing about aviation; what we do is find partners. We go to the main exhibitions, the first one we did was in Hanover. It´s the Airline passenger experience exhibition, where you got all the key the ten providers of those services: Panasonic…etc. And I got to talk to them, my colleague and I can offer you this. It´s an extra salary for you -----. There are a new law recent network information security regulations, which is critical to driving us now.------ So we talk to them.	4	KS-TX-EKS-A&C1
	They shared a lot, they gave us a lot of time from senior executives, well organised by the….. so we….. for their organisation. They want to show to their staff that they are working with start-ups. They said to us that they wanted to learn as much as how you work, as what you are doing. So They wanted to learn about how start-ups work, how do we work fast……So that I hadn´t expected that this was such an important reason for them doing the incubator. It was for them to learn and also get some ideas. To show to their staff that we are innovating…and a big thing to show to headquarters, nobody had ever done this before in the whole group, so for the U.K.R…… it was a very high profile….for the whole group. All eyes all around the world on this thing, so they wanted to make sure it worked well, and I´d say…….so that's the history of it.	5	KS-TX-EKS-A&C2
	We are the ones that put the effort and collaboration ---- then after --- is received we work for partners --- so in practice, we set up an operational model and contracts in place, those contracts---- ---. Then we collaborate open and free. I do not know how you would apply that in terms of being free.	6	KS-TX-EKS-A&C3
	Alliances are suitable for young tech companies to gain credibility for customers. ----- if you want you can buy CENTRUM from ------------ people tend to think “well if they work with this guy, it is good”.it is essential, we are targeting a large enterprise the managers need that kind of signals to trust you. We are members of a government-approved agency to be trusted, and we have the right product, which is innovative.	21	KS-TX-EKS-A&C4
	I don't think they are doing it (job) because they are obsessed with it, some people are doing it because it is cool or it sounds fun, and this journey is extremely stressful, it´s not like joining a bank and getting like a fancy job and a fancy --- and getting lots of money. No, it just does not work this way. So many think they can apply that to entrepreneurship, but it does not work like this. Some are admired because they are stubborn, ambitious, and have a vision; they do not just want to make money; they do not want fame; they want to create and help. As a side comment, I would like to say that I don't have much chance to hang out with entrepreneurs mainly because I don' have A lot of the time I work. For example, this evening will be a drinking gathering; there will be several investors and tracking companies.	29	KS-TX-EKS-A&C5

A foundation set on physical and virtual space for enabling flows of knowledge spillovers is entrepreneurial communities (Nonaka, 2008; Gnyawali and Srivastava, 2013). Hence, start-ups would enhance on expanding network capabilities and social interactions that facilitate access to experts on the field (Gnyawali and Srivastava, 2013). Such exposure enables exposure to knowledge spillovers that affect entrepreneurs' approaches to innovate (Ko and Liu, 2015b; Schmidt, 2015). On physical spaces, higher geographical proximity between the community members would increase the opportunities to share knowledge if companies share the same entrepreneurial mindset (Ko and Liu, 2015b). Moreover, companies would break geographical barriers using virtual communities (Petruzzelli et al., 2007; Roberts and Dinger, 2016). Therefore, engagement with communities' end goal can further affect open innovation and product development (Sisodiya, Johnson and Grégoire, 2013; Roberts and Dinger, 2016).

The data suggests that entrepreneurs engage in forms of communities and associations that focus on exchanging technical knowledge spillovers on virtual platforms (KS-TX-EKS-E&C1). However, business knowledge spillovers in physical settings developed through entrepreneurs' direct engagement with mentors (KS-TX-EKS-E&C2). However, access to experts seems not to be influenced by geographical proximity, but to the usage of entrepreneurs' network capital (KS-TX-EKS-E&C3).

Experienced entrepreneurs with companies developed are seed, and growth stages would purposefully attend conferences and fairs to engage in companies and business partners (KS-TX-EKS-ECC4). Hence, start-ups would gain access to business and technological knowledge from experts in the industry. Therefore, entrepreneurs working in the city are aware of networks' importance once they have experienced the potential benefits. The quotes related to expert communities shown in table 3.32.

Table 5.32 - Quotes for the category Expert Communities

1st Order Category	Relevant Quotes	interview	code
Experts & Communities	Oh yes, we are part of the French Deck, which unites all the country's start-ups. Also, a member of an association of software makers and entrepreneurs and our network of contacts Cybersecurity is a small world, no matter where.	21	KS-TX-EKS-KS-TX-E&C1
	Of course, it puts you top; you get an idea from that. I would not say we got the best advice from other entrepreneurs; the best information came from the mentor attached to us that still is our advisor in the company.	18	KS-TX-EKS-E&C2
	I had quite a number of them --- before I started, some of them were college ---- and then when I started one of our senior advisors ---- and he is the C.O.O: of SYNTEC ---- and I have through the cycle of how you build a company ---------------------------------- several -----that I can share---- just yesterday ---------------------------- he has 25 years of experience in the finance industry – and I like to discuss with him as a sounding board --------------------------------- you access to a perfect fellowship of entrepreneurs.	11	KS-TX-EKS-E&C3
	We provide side security solutions for their inflight entertainment system, so the passenger ------ in the planes. So it is the same; I knew nothing about aviation; what we do is find partners. We go to the main exhibitions, the first one we did was in Hanover. It´s the Airline passenger experience exhibition, where you got all the key the ten providers of those services: Panasonic…etc. And I got to talk to them, my colleague and I can offer you this. It´s an extra salary for you -----. There are a new law recent network information security regulations, which is critical to driving us now. ------ So we talk to them.	4	KS-TX-EKS-E&C4

However, interviewees' perspective on unintended knowledge spillovers coming out of the company has to be protected. In this case, the start-up’s business ideas and technological knowledge value are perceived as sources that provide an advantage in the market (Lau and Lo, 2015). Hence, the initial exchange of knowledge is initially blocked due to the expected negative effect of knowledge leakage that it can have on the company (KS-TS-EKS-LMT1, KS-TX-EKS-LM2). The causes that could enforce this decision include bad knowledge sharing experiences that lead to possible exploitation of knowledge from entrepreneurs (KS-TX-EKS-LM2, KS-TX-EKS-LM3).

On the other hand, early entrepreneurs could be aware of that openness and informal exchange of information in groups and expanded networks (EKS-LM1). Also, a knowledge filter formed due to the low value that knowledge spillovers provide from other entrepreneurs. Causes are inherited due to the restrictive amount of time that CEOs have due to managerial responsibilities (EKS-LM4). Hence, entrepreneurs' focus is to engage with companies or individuals that can offer funding and cooperation opportunities (EKS-LM4, EKS-LM5). The codes of knowledge filers are illustrated in table 5.33

Table 5.33 - Quotes for the category knowledge filters and limitations

1st Order Category	Relevant Quotes	interview	code
Knowledge filters and limitations	That is an excellent question. I think there is a cloak around what an interaction should be. Half of the people share, and the other half keeps things to themselves. They want to feel that their ideas are secret, and they should not tell because someone could steal their ideas. I think that being very open has more value --------------------, so the network effect only comes about if you are free and interacting with other entrepreneurs.	9	EKS-LMT1
	I think everybody is more interested in the funding, you become strong as a group, potentially in some cases you are making the whole industry faster and more efficient by spreading your knowledge. Still, you have to be careful, or you could lose your advantage. Maybe some knowledge is not to be shared!	13	EKS-LMT2
	There is a lot of information shared between these networks. A lot of the stuff was focused on first-time founders, which I am not one so things like ------- we're not as relevant to me as they would be to someone else. Another thing is that I am not that big on networking with new founders. I have had bad experiences in my businesses. So my exposure to that was limited.	10	EKS-LMT3
	I don't think they are doing it (job) because they are obsessed with it, some people are doing it because it is cool or it sounds fun, and this journey is extremely stressful, it´s not like joining a bank and getting like a fancy job and a fancy --- and getting lots of money. No, it just does not work this way. So many think they can apply that to entrepreneurship, but it does not work like this. Some are admired because they are stubborn, ambitious, and have a vision, they don't just want to make money, they don't want fame, all they want is to create and help. As a side comment, I would like to say that I don't have much chance to hang out with entrepreneurs mainly because I don' have A lot of the time I work. For example, this evening will be a drinking gathering; there will be several investors and tracking companies.	29	EKS-LMT4
	I would say no knowledge, ZERO knowledge. Because I don't believe that what gives me value these days is necessary knowledge, I think it's meeting people--my company. So it's not like they told me a story and I learned something from that, it's more they introduced me to someone, or there is some way we can cooperate with that or even if there is no way to cooperate maybe we are in the same space and we share the same contacts. So it's the network that is valuable. When you work in the travel business, everybody will talk about you and are going to mention you. That is the value we get. Not so much on knowledge.	32	EKS-LMT5

5.2.5.1.2. Technical Knowledge Spillovers

Technology knowledge spillovers have linked to the improvement of innovation (Verspagen, 1997). Hence, knowledge spillovers have led to measure the advancement of technology from the generation of patents, and the exchange of knowledge between different industries (Zvi Griliches, 1992; Verspagen, 1997). The data suggests that entrepreneurs that held tacit technological knowledge from their previous experiences sometimes lead an initial advantage to develop a prototype before starting the company (KS-TX-TKS-FTK1, KS-TX-TKS-FTK2). The effect of tacit knowledge spillovers is materialised on the companies’ capability to create new knowledge within the company's boundaries (KS-TX-TKS-FTK3). The quotes linked to tacit knowledge are shown in table 5.34.

Table 5.34 - Quotes for the category Founders tacit Knowledge

1st Order Category	Relevant Quotes	Interview	Code
Founders tacit knowledge	They look at several things; the team members have a passion for the projects. My C.O. knows the automotive industry like the back of his hand; my other co-founder has been working in automotive sales for six years. One aspect is knowing the industry, and another is delivering your solution. It is VERY technical, and if you do not have anybody technical on the team. ------------------- so advancement will be more sales-oriented they look at the skill set as well as the solution you deliver depending on the industry.	9	KS-TX-TKS-FTK1
	Yeah, a lot of the work I have done in the past has been about technology, enhancements, and implementation on launching new products and processes. A lot has been about enhancing existing products or adding new features or functionality. Yes, I have a lot of experience doing it, innovating in that way and leading teams and being the touchpoint between the business and the technical. The team is something that I have had quite a lot of experience in it. - I would say that experience helped develop the company differently if I did not have these experiences. I would not have approached the business the same way.	31	KS-TX-TKS-FTK2
	So this is the knowledge that we created, so it comes internally that this company's establishment was based on new knowledge from 2or 3 individuals from the scientific family. So that’s where the intellectual knowledge comes from, so we used the initial founding knowledge, and then we develop, but we rarely take additional key knowledge from outside. I want to establish that intellectual funding or intellect.	2	KS-TX-TKS-FTK3

Interestingly, the managerial approaches taken by CEOs and founders of start-ups towards technological knowledge spillovers absorption is dependent on the companies type of industry. The implementation of IP rights protects the company’s involvement in big pharma and biotechnology. The start-up's team focus on developing a technological solution until more knowledge is required to keep innovating (KS-TX-TKS-P1). Hence, entrepreneurs would seek advice and guidance by establishing formal partnerships or asking experts in the field (KS-TX-TKS-P1, KS-TX-TKS-P2). Sources of knowledge are found outside the company's boundaries to provide specialist feedback to develop projects (KS-TX-TKS-P2, KS-TX-TKS-P3). The development of patents guides this channel of knowledge to improve the company's base knowledge (KS-TX-TKS-P4, KS-TX-TKS-P5). The quotes related to patents shown in table 5.35.

Table 5.35 - Quotes for the category Patents

1st Order Category	Relevant Quotes	Interview	Code
Patents	We have an example ------where we did a study, and the drug worked very well, but the formulation, which is the medicine, the tablet, wasn't with ok. But it wasn't good enough to commercialize, we needed to improve the formula ----- to go to the next clinical step ----- so we identified potential partners, mainly through our board because we have an excellent ----- and she recommended a few people to speak to -------we selected a ------. That ------- helped us because they have expert expertise in a specific type of formulation, so we worked with them to optimize our drug. Still, the whole basis of the relationship was commercial, and from the very start that they would not have any I.P. rights, the I.P. rights belong to the start-up. ------ so we filed a patent based on that interaction, a new patent, and they had assigned their rights of the patent to us because it's a commercial relationship and not an academic ------- collaboration -----depend on third parties to improve our business.	3	KS-TX-TKS-P1
	Yeah, well, the technical skills, the functional expertise tends to come from functional experts and not necessarily in this building but in other places ----- we take additional advice -----. We locate an I.P. specialist firm, we've taken advice from top psychologists, located specialists' top firm that regulates trade or C.M.C., and partners connect ants we work with. Still, they aren't entrepreneurs. They are people who are providing skills and experience ----- entrepreneurs themselves.	3	KS-TX-TKS-P2
	Some of the best insights come from people outside the company, and I think one of the skills of the C.O. is to be an alchemist. I'm not an expert on anything, but I know a good idea when I HEAR IT. And I'm quite happy to help with someone's else's idea, which isn't mine ----- so the way I've always led this company is I have an idea I want to achieve. Still, I find I get a lot of insights from other people ----------------so for example, if you are designing a clinical study, you know you want to get a -------- study that. But to have the best clinical study, that advice will come from medical experts or statistical experts.	3	KS-TX-TKS-P3
	Patents are the very epicentre of here. Without patents, there's nothing. So patents are critical to what we are doing. And I think actually, something like the F.B.C. would be better served to provide specific support, specific expertise required to ------- a start-up. Like patents, like manufacturing, like good design and critical study. So those are some of the critical things that make or break a company. Though spend, our C.S.O. is focused on continually updating our patents.	3	KS-TX-TKS-P4
	So I know those people and can go to them for advice on direction, so consulting these people and inviting them to meet our team or my research team------- The processes we are going, the changes, our decision process, and just getting their opinion to challenge our position, seeking to improve the knowledge.	2	KS-TX-TKS-P5

High-tech start-ups that feel a gap in their technological capabilities can decide to build their base knowledge from hiring new capital and not acquiring the technology. Hence, initial R&D is considered an investment that companies spend on recruiting high skilled capital. For example, CEOs and founders seek scientists with a background in biotechnology or biochemists in companies that operate in the biotechnology sector (TKS-HUC-1).

Companies operating in the city are most likely to be involved in IT provision and use (Stam, 2013). Hence, the primary skills of programming, using virtual platforms and software and coding languages such as JAVA, machine learning, and data mining (TKS-HUC4, TKS-HUC6; TKS-HUC7). Hired experts from start-ups to come from an engineering background with experience in the industry (TKS-HUC3, TKS-HUC6). Hence, in this case, the hiring of experienced human capital is used as a mechanism to access technological knowledge spillovers (Audretsch, Dohse and Niebuhr, 2010; Korosteleva and Belitski, 2017).

Furthermore, employees can be motivated to attend external workshops and events to enhance their skill set during their employment (KS-TX-TKS-HUC6). In these cases, the initial CEOs may not need to be proficient in technological knowledge to start a company (KS-TX-

TKS-HUC2). However, one of the founders, the entrepreneur, needs to understand various forms of technical, marketing, and managerial knowledge to run the company's operations. Hence, the development of the company also depends on how skilled the team is. Not only that, but the capabilities of the CEO can also be an essential factor that facilitates and supports the R&D process towards innovation (KS-TX-TKS-HUC1, KS-TX-TKS-HUC4, KS-TX-TKS-HUC5). The quotes mentioning the process of hiring human capital are shown in table 5.36.

Table 5.36 - Quotes for the theme of Hiring Human Capital

1st Order Category	Relevant Quotes	Interview	Code
Hiring human capital	Well, we create our knowledge, the critical thing is recruiting the right people, with the right experience and the right knowledge ---- were developing a ------- manufacturing process, I can't buy that technology I can't go out and buy that technology, you develop it yourself, and you need people, skilled individuals, to be able to do that. You have to equip these people. They are biologists or biochemists ------, and they are experienced in G.F.P. manufacturing and process research. So, the majority is experienced in developing and manufacturing a process from scratch, from the start.	1	KS-TX-TKS-HUC1
	A bit of both. I do not write any code myself. I am more of a developer. But in business, you must dominate expertise in every area. In no matter what area. ------------------------------------- and encourage them and support them.	10	KS-TX-TKS-HUC2
	At this point we have ------ engineers ---- the average span of experience is about 10. The thing we are really after is ----- skill and understanding knowledge of how this works ----- so intimate knowledge is advantageous. As we grow, we are going to start looking for more junior people.	11	KS-TX-TKS-HUC3
	We have a very skilled and educated team; doctors. We look for hardcore technical skills: programming, software development, and implementation. Around the angular framework, evolving platforms. So we are looking for maximum skill. You have to know algorithms, On the work side we are looking for experience understand tech problems ------- interpersonal skills as well, be able to communicate, in the sales world we are looking for people who can build complex value propositions and turn them into transactions in the shortest time possible.	20	KS-TX-TKS-HUC4
	HUGE. I've got a brilliant scientist, a brilliant C.T. officer. You know the company cannot exist without their skillsets; it needs my drive. I'm head of sales --- we have a small company, so I have the business, but they can't survive if we don´t sell our products, and we have good science that depends on it, so you know. You can get so far on your own, but you need to build a reliable team, as necessary, how vital, no matter how you want to say it: your team is everything. A 10 to 20-minute talk would be better, so I pulled out our expert. If you get a long way in some areas, but you have to have them --- if you are selling a science product --- and then it's luck because another 100 people are doing it, and then it's marketing money to get yourself. Our business is a bit different. I would say that without the height of the skills, our competence --- areas, we would be in a less good place if we are just doing --- If you know what I mean. Yeah. So, I've got a P.H.D., C.S.O. I got a C.T.A... He's worked precisely down to start-ups. Thirty years at Cambridge in natural science, now statistic research shows how to build an architectural system. If we didn't have that we wouldn't be able to win the business, we are now winning	24	KS-TX-TKS-HUC5
	We have about 12 engineers when they have a problem. They use a series of the----------- knowledge base; they might even attend workshops outside to re-skill themselves. ------------------------------ deeper and deeper into this knowledge sharing. Right now, it has been about using new technology -------- ERLANG or using machine learning infrastructure and Google ---- competitive platforms to build our own. ---------------------- structure and methodologies, ----------------------- monistic devices to ------------------------ based on innovation enabling us to what we do much faster and become a leader in our industry	12	KS-TX-TKS-HUC6
	It's both, there is very deep scientific learning it is wiser more to scientific exploration rather than market R. and D. no this is scientific work cryptographers. Specialist data scientists, these are people that are in our R. and D. department.	26	KS-TX-TKS-HUC7

The effects of gaining knowledge from these sources would boost technological knowledge spillovers and innovation performance (Lau and Lo, 2015; Ritala et al., 2015). In some instances, high-tech start-ups would purposefully seek to obtain a set of advice to gain technological knowledge. Some knowledge sources include talking to individuals with experience in the area, customers, or institutions such as the government (KS-TX-TKS-CO1, KS-TX-TKS-CO2).

Further exchange of knowledge between individuals enables companies to access a similar experience from clusters (Koo, 2005; Expósito-Langa, Molina-Morales and Tomás-Miquel, 2015). Moreover, engaging with consultants is to expand the base knowledge of the company and to expand technological applications from different industries (KS-TX-TKS-CO3, KS-TX-TKS-CO4). Gaining access to experts in the field and building networks enables the CEOs to build a reputation and cover knowledge gaps (KS-TX-TKS-CO5). The quotes linked to consulting are shown in table 5.37.

Table 5.37 - Quotes for the category Consulting

1st Order Category	Relevant Quotes	Interview	Code
Consulting	It´s a small start-up, mainly it is getting customers in all the time. Probably two a week, we get customers and do testing. So, we build something, test it with them, get feedback, and change it. That´s how. It´s customary engagement rather than…. mostly it´s directly with customers. It was technical, and their opinions, what they like, what they do not, what I can change. Why can't I do this or that? So we take all this, and we film them so we can…..	6	TKS-CO1
	Knowledge on what is planned for my specialist area about a particular sector so it could be what the local authorities are planning to do in the next 12 years ------------------- and I need relevant projects.	7	TKS-CO2
	The reason I do it is that I learn from them ------------- it helps me to think out of the box, I learn different industries --------------------- I learn about new emerging technologies all those are the critical perceptions.	12	TKS-CO3
	It is a mixture depends on who you ask. Mostly technical, data stands, ---- allow for expanding---- areas of technology that we know that we have to learn, I would say less on the managerial side, understanding the markets' structure was particularly helpful.	19	TKS-CO4
	Like I said, my background was not cybersecurity, but when I participated in cyber London, you know our golden bonus was building that fabulous network of experts in that field. Having their support and challenging our ideas and getting ---- from advisors that were getting familiar with the topics, it made possible to have a new conversation to them as well for items that were not much considered, until now, because cybersecurity is a hot topic. There are new---- coming up. But participating in that helped us to build ----- from the industry.	25	TKS-CO5

5.2.5.1.3. Information and Technology knowledge spillovers

Understanding knowledge spillovers has been extended from uncovering the transference of knowledge on cognitive and virtual platforms (Nonaka, Toyama and Konno, 2000; Bandera, Bartolacci and Passerini, 2016). From one point, IT knowledge spillovers dealt with the usage of appropriate hardware and software to boost productivity (Huang et al., 2012). All type of knowledge obtained from the usage and investment of R&D on information and technology mechanisms to capture knowledge spillovers from sources outside of the company (Santarelli and Vivarelli, 2007; Huang et al., 2012). Start-ups use these software tools to engage in constant product innovation that can be revolutionary, or exploitative (Santarelli and Vivarelli, 2007; Bouncken and Kraus, 2013).

The data suggests that the sources of knowledge can vary from the usage of e-mails to the identification of relevant magazines (KS-TX-ITKS-MCH1, KS-TX-ITKS-MCH3). Moreover, using these sets of mechanisms would influence entrepreneurs' decision to reduce the attendance to networking events (KS-TX-ITKS-MCH2, KS-TX-ITKS-MCH3).

Entrepreneurs would seek to direct human capital to set the first setting stone to engage in innovation and engagement with the market (KS-TX-ITKS-MCH6). This focus would seek to start utilising virtual platforms and ICTs, which are higher technological tools than search engines and e-mails (ITKS-MCH5, ITSK-MCH6). In this case, participants' responses propose that entrepreneurs in the first one to three years start to discover and engage with information and technology knowledge spillovers. Quotes related to mechanisms are shown in table 5.38.

Table 5.38 - Quotes for the category Mechanisms

1st Order Category	Relevant Quotes	Interview	Code
Mechanisms	I get much more information from my research. Maybe once a week, I might get a piece of e-mail information that I ignored. But it is not something that a base is providing me with. It is a little bit one-sided.	7	KS-TX-ITKS-MCH1
	I kind of learned by myself there is so much information on the internet -------------------------- that is how I learned just by reading and learning, then when you start creating you start meeting people as well after the learning phase you can do it by yourself, everything is ready.	8	KS-TX-ITKS-MCH2
	Like I said, It depends when I say magazine, I mean the online version. It is essential, without those we cannot function, or go to conferences. We would be searching for that information online.	13	KS-TX-ITKS-MCH3
	We have 65----- dividers that provide the information ---- then draw on algorithms and quantum, it's a video game company, ---- so all in a single stack----. We get the information from data providers, then we do the pipeline process ---- but more is gathering ourselves.	15	KS-TX-ITKS-MCH4
	Yes, a lot of developers will publish thing they have learned. When you build all the modules, it is core practice to connect to ----- is not so difficult to build from what I have been told. We get a lot of knowledge; if you are in a software space, you will get a lot from reading books and materials and things like that. There is a lot of knowledge of the websites.	17	KS-TX-ITKS-MCH5
	Working with platforms like that gives a lot of knowledge, and they help you a lot ----- they would want to keep you as their client. So, they kind of invest in you, give you that knowledge to get you started.	18	KS-TX-ITKS-MCH6

High-tech start-ups involved in developing virtual services for companies or individuals would enhance inter-collaboration in the organisation by implementing R&D (Huang et al., 2014). Data suggests that teams of entrepreneurs in the company initially identify the knowledge and proceed to exchange the findings through the usage of internal ICTs (KS-TX-ITKS-OS1). Afterwards, the team decided to arrange the information to determine what knowledge can be accessible to other parties (KS-TX-ITKS-OS1, KS-TX-ITKS-OS3).

Thus, knowledge spillovers can be considered initially a source of information that can be regarded as favourable for innovation or an opening for hazards that can compromise the start-up's normal operations (Narula and Santangelo, 2009). Once, the security concerns are lifted, start-ups preference source of knowledge comes in the forms of free codes and libraries (KS-TX-ITKS-OS2, KS-TX-ITKS-OS3, KS-TX-ITKS-OS4). Hence, the direct source from IT knowledge spillovers is the web that is not secure; or uses virtual suppliers that can provide a constant flow of reliable knowledge (KS-TX-ITKS-OS2). The open-source quotes are shown in table 5.39.

Table 5.39 - Quotes for the category Open-source

1st Order Category	Relevant Quotes	Interview	Code
Open-source	The knowledge hits a team member from there. It is dispersed anywhere. I read ----- digest; I get letters with informative papers; I do a lot of scouting in that way-----. The first level; here is a bit of information for the team. ---- that usually happens on our chat apple, ---- we capture bits of information that later turn into tasks. I know we have a bunch of information scattered around; e-mail, That's it.	19	KS-TX-ITKS-OS1
	Libraries and the internet that we pay and maintain their service. We also pay ---- for the knowledge they share, and we pay license fees to other organisations. So yes, we use open source and also pay.	20	KS-TX-ITKS-OS2
	Yes, it is about free knowledge, it's free code more than free knowledge, but there is some free knowledge. We don't use as much open source as perhaps we should, that is large because there are security implications, and also open-source programs are not too much controlled so you can get a relief that can mess up all your core. Someone's update could affect your --- rollout. So, you have to be very pragmatic about the management source, and you have to have excellent management to see the place because it could cause an overhead.	27	KS-TX-ITKS-OS3
	You have your library and magazines.	32	KS-TX-ITKS-OS4

5.2.5.1.4. Public Knowledge Spillovers

The critical component of this knowledge is made exogenously, which in the KTSE is assumed to be available to everyone and automatically transferred to economic agents (Qian and Jung, 2017). Sources of public knowledge spillovers include publications, articles, and internet platforms and tools (Ho et al., 2011; Huang et al., 2012). However, high level of absorptive capacity is required to appropriate the knowledge spillovers and engage in constant innovation (Nieto and Quevedo, 2005; Qian and Jung, 2017).

The data suggest entrepreneurs gain access to public knowledge spillovers that are accessible through virtual platforms built from alliances between companies or created on entrepreneurial community channels from accelerator or incubator programmes. Hence, the nature of public knowledge spillovers and main characteristics remain, as entrepreneurs post information that CEOs can obtain. Furthermore, public knowledge spillovers are accessible through social channels and publications available on the web. The data suggests that the identification of public knowledge spillovers conducted by employees. Afterwards, knowledge is shared, analysed and implemented in the start-up. Academic publications are also available to entrepreneurs exposed to academic research from their previous experience in academia and research institutions (KS-TX-PKS1, KS-TX-PKS12 KS-TX-PKS3, KS-TX-PKS4, KS-TX-PKS5, KS-TX-PKS6, KS-TX-PKS7). Quotes related to public knowledge spillovers are shown in table 5.40.

Table 5.40 - Quotes for the category Public Knowledge Spillovers

1st Order Category	Relevant Quotes	Interview	Code
Public documents	We have academic citations and academic papers, we have ---- and we have used those. We just published in an academic journal that will be published in -----, so that is relative---- so yes we have	6	KS-TX-PKS1
	There were a few of them, and we could choose the one we were more comfortable with the community as a whole has gotten very good at sharing -------------------- that shared their insights and knowledge ---------------------- and our industry changes so quickly that you cannot use knowledge like that to educate yourself.----- So it is a vital part of what we do a stacking channel were we share with the whole company articles that are important to read or books so that type of personal development I am doing for investment. A few here and there in the specific area we are interested in --------------------------- whatever is on Google. We do not have a depositary for particular papers, just whatever is online.	10	KS-TX-PKS2
	Entrepreneurs are not guarded in the sense of their knowledge of their product or how you got that knowledge ----, but there is information that is quite public knowledge and is shared.	17	KS-TX-PKS3
	The knowledge hits a team member from there it is dispersed anywhere. I read ----- digest; I get letters with informative papers, I do a lot of scouting in that way-----. The first level; here is a bit of information for the team. ---- that usually happens on our chat apple, ---- we capture bits of information that later turn into tasks. I know we have a bunch of information scattered around; e-mail, That's it.	19	KS-TX-PKS4
	While you do research, you look for open sources. It is quite reasonable when you are researching.	21	KS-TX-PKS5
	Talking to other people in the industry, but not so much the airport partners, to be honest, all the airports and their people are thinking about their own business, everyone is thinking about maximizing their product, they are not trying to share their knowledge with us, they are not trying to help us, they are trying to make money, and they don't care if we live or die. We have gotten some knowledge from them, but it did not change the world for us.	29	KS-TX-PKS6
	Our network of people we know, across the team members, doing labs, reading Twitter, and things like that.	32	KS-TX-PKS7

Patent applications and implementations have been viewed as developing products and prototypes using previously established knowledge (Kostopoulos et al., 2011; Tufool and Gerard, 2016). However, capturing and implementing technological knowledge requires an understanding of how to adapt and implement various forms of technology. However, the application of patents and trademarks can have a second use, which is to act as a form of the control system and legal application to prevent knowledge leakage to third parties (Spithoven and Teirlinck, 2015). Entrepreneurs have highlighted that patents are useful in the case of industries that use them to generate new products, which is the case of biotechnology and manufacture. On the other hand, start-ups involved in software consider that creating patents can raise the credibility of the company, and the level of protection new technology developed. For companies in other industries such as software development, patent creation and usage its usage is considered to be awkward and uneasy to be implemented in the early stages, while trademarks are viewed as a more viable option (KS-TX-PKS8, KS-TX-PKS9, KS-TX-PKS10, KS-TX-PKS11, KS-TX-PKS12, KS-TX-PKS13, KS-TX-PKS14, KS-TX-PKS15, KS-TX-PKS16, KS-TX-PKS17, KS-TX-PKS18). Quotes linked to patents and trademarks are shown in table 5.41.

Table 5.41 - Quotes for the theme Public Knowledge Spillovers, usage of Patents and Trademarks

1st Order Category	Relevant Quotes	Interview	Code
Patents and Trademarks	No, not yet because we are in a phase ----- so we can't get ---------------- manufactured somewhere else, but there is a potential to do much in the future. We have investigated exploiting ------------- because through the open innovation, they have a group that collaborates with small biotech start-ups. In that science park, but you can establish through contracts, you can establish the options to use ----- on technology --------- and it benefits small start-ups, so you can use it and later the data they need--- and they make the decisions buying equipment.	1	KS-TX-PKS8
	In biotech or biochemical. It is tough to move forward without a patent. ------ we have a patent-pending, but it is not ------- but it helps your credibility say: yes, we have a patent, it is like a stamp of approval, right? It may not help you with sales, but it could if your company was getting acquired. Big companies can enforce their patents; a small company can't.	13	KS-TX-PKS9
	We take feedback on the pattern itself, so if they particularly like a feature and see how it works, we can relate it to develop it and tweak it. ---- People are trying to steal our algorithms.	41	KS-TX-PKS10
	As part of a more robust I.G. --- I think copyright is essential in software ----- security and certification are crucial ----- later it will be a valuable tool, we are in a point where we are working hard on that. -------------------------- is to deploy patents carefully.	20	KS-TX-PKS11
	Yes, we --- a patent on our ---- device with new identification, it's already granted in the U.K. and pending in the U.S. that was our first step into this industry. It is long and expensive progress, but at the same time, it ------- to the company, helps to build our credibility in the sector ---- so for us, it's been beneficial to have the opportunity to ---- look into something like this.	25	KS-TX-PKS12
	Trademarks but no patents, brand-wise we are ok.	23	KS-TX-PKS13

1st Order Category	Relevant Quotes	Interview	Code
	Not yet, but it is something we are working on.	22	KS-TX-PKS14
	If I had a patent, I could earn a royalty. Still, thousands of companies using what I created what I did not understand was the impact of trademarking and back in that day we created --- overfeed ---- but stupidly we sued them for using our trademark. If we had not sued them, we would have been the photo roof.	27	KS-TX-PKS15
	Not quite, no. We want to, but I have heard that software is tough to patent, and costs money so you can try with someone to “help” but who you can’t sue later, so that is why.	29	KS-TX-PKS17
	IT IS VERY HARD FOR A STARTUP to get a patent, If you create software technology that you can patent, great going, or this is likely to happen in an industry that is not software.	32	KS-TX-PKS18

Entrepreneurs that work on start-ups can also gain access to technological knowledge spillovers from the web (Sisodiya, Johnson and Grégoire, 2013). The first level of analysis comes from CEOs and founders, which use primary search engines that lead to the curiosity to expand on technological knowledge (KS-TX-ITKS-OS1). Knowledge can also be shared among entrepreneurs in the start-up using ICTs (KS-TX-ITKS-OS2).

Companies that are more focused on software development use highly skilled human capital to capture IT knowledge spillovers (Huang et al., 2012; Autio et al., 2018). In this case, companies seek to gain access to libraries that enable entrepreneurs to use open coding (KS-TX-ITKS-OS3, KS-TX-ITKS-OS4). However, knowledge does require to be managed and control accordingly to prevent the company's overload of resources (KS-TX-ITKS-OS3). The quotes linked to digital and virtual information is shown in table 5.42.

Table 5. 42 - Quotes for the category Digital and Virtual Information

1st Order Category	Relevant Quotes	Interview	Code
Digital information	The knowledge hits a team member from there it is dispersed anywhere. I read ----- digest; I get letters with informative papers; I do a lot of scouting in that way-----. The first level; here is a bit of information for the team. ---- that usually happens on our chat apple, ---- we capture bits of information that later turn into tasks. I know we have a bunch of information scattered around; e-mail, That’s it.	19	KS-TX-ITKS-OS1
	Libraries and internet that we pay and maintain their service. We also pay ---- for the knowledge they share, and we pay license fees to other organisations. So yes, we use open source and also pay.	20	KS-TX-ITKS-OS2
	Yes, it is about free knowledge, it’s free code more than free knowledge, but there is some free knowledge. We don’t use as much open source as perhaps we should, that is large because there are security implications, and also open-source programs are not too much controlled so you can get a relief that can mess up all your core. Someone’s update could affect your --- rollout. So, you have to be very pragmatic about the management source, and you have to have excellent management to see the place because it could cause an overhead.	27	KS-TX-ITKS-OS3
	You have your library and magazines.	32	KS-TX-ITKS-OS4

5.2.5.2. Knowledge Spillovers Sources

5.2.5.2.1. Explicit knowledge spillovers

Explicit knowledge is transferred through the exchange of documents and information. Tacit knowledge spillovers are shared on interactions between individuals from previous experiences (Wang and Wang, 2012; Ritala et al., 2015). Hence, the absorption and introduction of knowledge spillovers have enabled the implementation of new technologies that can be traceable and identified (Schmidt, 2015). The intake of explicit knowledge by entrepreneurs gathered through the evaluation of incumbents' reports and the interaction of entrepreneurs with incumbents ad customers (Schmidt, 2015; Korosteleva and Belitski, 2017).

Entrepreneurs with an academic background that previously used patents and developed academic papers would use explicit knowledge spillovers as a valuable source of information for the development and evaluation of the new idea (Woodward, Figueiredo and Guimarães, 2006; Markovitch, O'Connor and Harper, 2015; Tufool and Gerard, 2016). Unless the founders are involved in an industry that requires the development of patents, the capture of explicit technical knowledge spillovers can be limited to information gathered from surveys (KS-S-EKS1, KS-S-EKS2, KS-S-EKS3, KS-S-EKS4, KS-S-EKS5, KS-S-EKS6, KS-S-EKS7). The quotes indicating sources of explicit knowledge spillovers are shown in table 5.43.

Table 5.43 - Quotes for the theme Sources, Explicit Knowledge Spillovers

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Sources - Explicit Knowledge Spillovers	I had a lot of industry reports that this would be a product in demand, so I decided to develop it.	14	KS-S-EKS1
	A little maybe through reports, academia not. However, I would be open to it.	22	KS-S-EKS2
	Before we formed the company, we had a customer, a small contract to develop the technology we kind of formed the company on the back of that. In the accelerator, we did quite a bit on market research. We had indication classes and segments of customers, especially government, financial services, and costs, so from the start we knew it was something worth. for the first two months, we did more research and digging to build our financial globe.	19	KS-S-EKS3
	How do you mean, in terms of money? We did research and interviews to validate our idea the value of the ----- if there was an actual demand for such service, the results were positive and encouraged us to go forward. And with the investors, we said: OK. Let's give it a try.	25	KS-S-EKS4
	And how did you identify this brilliant idea to start a company worked in the industry for large companies, so I saw the need forehand, head of sales operations mostly? Within my position, it was evident that the need was there. ----- I looked at the number of people affected by the problem, the revenue from the number of transactions, I can make the market size based on the people who have this need. Get the average volume for each transaction, and you know: multiplication over three.	30	KS-S-EKS5
	The idea of using metacromifilia to solve the sensing of the glucose problem comes from us, so we have patents about this idea. Yes, while I was in Academia, I was not into product development. I was more of an academic. The way they work there is: you have an idea, you put it on paper, and then you go to the next idea. That is one form of innovation if it is interesting you publish a paper. But you are not forced to push the product across the finish line and make it work. My experience has opened the last seven years the product I mention now. NON-EVASIVE GLUCOSE MONITOR is one of them, so we have in the CIA. At least five more. So experience in developing all these products has been beneficial for only the past 5 or 6 years.	1	KS-S-EKS6
	Patents are the very epicentre of here. Without patents, there's nothing. So patents are critical to what we are doing. And I think actually, something like the F.B.C. would be better served to provide specific support, specific expertise required to ------- a start-up. Like patents, like manufacturing, like good design and critical study. So those are some of the critical things that make or break a company. Though spend, our C.S.O. is focused on continually updating our patents.	3	KS-S-EKS7
	We take feedback on the pattern itself, so if they particularly like a feature and see how it works, we can relate it to develop it and tweak I,t. But in terms of storing data, it is something we------ do. We have 65----- dividers that provide the information ---- then draw on algorithms and quantum, it's a video game company, ---- so all in a single stack----.	15	KS-S-EKS8

The approach taken for the capture and implementation of explicit knowledge spillovers towards product innovation is dependant on the level of investment on R&D and the level of the high-skilled human capital of the new venture (Narula and Santangelo, 2009; Spithoven and Teirlinck, 2015). Start-ups that are not involved in alliances would use search engines and software that facilitate knowledge sharing between the organisation members. A couple of examples gathered from the data include google, slack, and blog (Audretsch, Keilbach and Lehmann, 2006).

The level of technological knowledge spillovers at some point, can increase its level of complexity. In such a scenario, start-ups are motivated to use current technical tools and platforms to extract information such as machine learning and Artificial Intelligence (KS-S-EKS9, KS-S-EKS10, KS-S-EKS11, KS-S-EKS12, KS-S-EKS12, KS-S-EKS13, KS-S-EKS14, KS-S-EKS15, KS-S-EKS16, KS-S-EKS16, KS-S-EKS17, KS-S-EK18). Quotes mentioning the focus on technological development are shown in table 5.44.

Table 5.44 - Quotes for the category focus on technological development

1st Order Category	Relevant Quotes	Interview	Code
Focus on technological development	Depending on the virtual market we are addressing, we will protect the monitor. ---- the way we could deploy the information --------------------------------- security camera in the building we do that in the industrial machine networking ----------------------------- if I can generalise, that is the kind of thing we do.	21	KS-S-EKS9
	That is a significant struggle that every early-stage company will have. To answer your question, the value proposition is there. Sometimes it's a feeling and a direction that you take, luck, or maybe focus on the recruitment of and the value proposition, and then we work everything else out. You have to agile, understand what the pinpoints are, and plan to be sticking around. This is what we are building, and if you research the market to be in the right place at the right time. Now people understand machine learning, performance. Providing insights is becoming a much more major --- in another ten years no company will be looking at C.O.'s only you have to look at a more much set of variables --- so we want to destroy the C.B. That's what we are all about. It's a lousy way to make a fortune.	24	KS-S-EKS10
	Well, we have a classic structure I suppose we have a C.S.O. We have several types of research, some of it is focused around the customer their needs, so it is more management account --- you know "can we understand our civilisation---- so our research team would apply its methodology around it, and the other part is working with Bath or Westminster. Amsterdam, in Amsterdam, we tracked about-----------. So, I would say it is most internal R.D. what new products need to be developed, and I think 30% of the R&D. is internal.		
	I get much more information from my research. Maybe once a week I might get a piece of e-mail information that I ignored. But it is not something that a base is providing me with. It is a little bit one-sided.	7	KS-S-EKS12
	so I kind of learned by myself there is so much information on the internet -------------------------- that is how I learned just by reading and learning, then when you start creating you start meeting people as well after the learning phase you can do it by yourself, everything is ready	8	KS-S-EKS13
	A few here and there in the specific area we are interested in --------------------------- whatever is on Google. We do not have a depositary for particular papers, just whatever is online.	10	KS-S-EKS14
	Yes, could be BLOG, could be videos, and all types of resources are online. There is such a wealth of knowledge online; you only have to approach it.	11	KS-S-EKS15
	Yes, a lot of developers will publish thing they have learnt. When you build all the modules, it is core practice to connect to ----- is not so difficult to build from what I have been told.	17	KS-S-EKS16
	All the time. --------- libraries and internet that we pay and maintain their service. We also pay ---- for the knowledge they share, and we pay license fees to other organisations. So yes, we use open source and also pay.	20	KS-S-EKS17
	Usual corporate tools like E-mail, slag, google documents, and you have a briefing after every board session, once a month, the whole team will do a client show and tell.	32	KS-S-EKS18

Start-ups involved in the process of technological innovation of products within alliances focus on establishing common mechanisms with companies, which facilitates the sharing knowledge spillovers. The aim is to either enhance or learn from internal processes on running the company or set an integrated mechanism that enhances product innovation (Bouncken and Kraus, 2013; Srivastava, Gnyawali and Hatfield, 2015).

The data shows that start-ups in a seed or growth stage do not consider that knowledge sharing hurts alliances. Knowledge spillovers from incumbents to start-ups are explicit; in the form of documents related to the development of products. Moreover, the constant sharing of knowledge through platforms encourages meetings that promote the exploration of technological opportunities and potential investment in R&D (KS-S-EKS19, KS-S-EKS20, KS-S-EKS21). The quotes regarding the sharing of knowledge in alliances are shown in table 5.45.

Table 5. 45 - Quotes for the category Sources, sharing of knowledge in alliances

1st Order Category	Relevant Quotes	Interview	Code
Sharing of knowledge in alliances	They gave us documents to read. What we did was to listen and build a prototype and took it down to show.	5	KS-S-EKS19
	At this stage yes, we have started some alliances with similar platforms, our system rides on Amazon Web so --- they come and help you, they give you credit they give you a lot of things.------------- will flag us the premium provider of all T.v. Trailers, or we work with other platforms that want US to help THEM. ----- it is all a connected system; it becomes like a market place, so yes we do that now more than any before. Do you use any platforms or tools to obtain free knowledge from these other web sites to innovate or add value to your products? No, we have not used platforms --- I am in the business creating the contents. Hence, there is an area where we can interact complementary, it is not precisely knowledge, but you never know, the best ideas come from conversation.	18	KS-S-EKS20
	Not suppliers but like partners. We talk to them on slack also. And we share information on slack. But with documents and codes, we use the software for that. And we also meet them in person, I guess. Because they are like a good friend, if they are not good with the innovation so slack is as for them as for us, and it is helpful, but for them, it is not a tool, it is more like a culture thing. Example: last week I sent them a concise and essential document that describes the links between various of our tools to read, (takes about 30 minutes) on what we are doing right now and need a rapid response to build it. It has been a week already with no response. It is a kind of culture with them. It helps us decide what direction to move in, and that is where we capture the information sharing bull sheets ---- and something like a breakdown for our customers for last month, all the data, how much they spend, help us decide on what to do. Every Monday at 11;00 we have a ---- all of us as a team talk together for about an hour, talk about what everyone did during the last week, and go into some of the analytics, there is the knowledge, the information. We look at that, talk and decide what we want to do, like focus on this, let's prioritise this and forget about that, it helps us make decisions every week.	29	KS-S-EKS21

5.2.5.2.2. Knowledge Spillovers from the Chain of Value

5.2.5.2.2.1. Customer Knowledge Spillovers

The development of the formal capture of customer knowledge spillovers has been expanded and considered a source for the innovation of products and processes in companies (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Research has analysed the development of quality procedures conducted by suppliers and firms to reassure the relationship with the supply chain actors (Qiu and Yang, 2018). In this context, The capture of information depends on companies' engagement towards innovation speed and enhancement on the quality that focuses on delivering value and benefits from the development of products (Wang and Wang, 2012; Bouncken and Kraus, 2013).

The data suggest that the development of the initial business idea and the consolidation of the market requirements require purposeful tacit customer knowledge spillovers absorption from start-ups. Interviews indicate that it is necessary to embrace agile methodologies to understand the expected features expected from the products. In this case, the Product Life Cycle (PLC) attained through a constant exchange of knowledge between customers and start-ups. Therefore, the capture customer knowledge spillovers are the first stepping stone on the product conceptualisation process of new ventures in the seed stage (KS-S-CV-CKS1, KS-S-CV-SCK2, KS-S-CV-CCK3, KS-S-CV-CKS4, KS-S-CV-CKS5, KS-S-CV-CKS6, KS-S-CV-CKS7) (Zedtwitz, 2003; Cantù, 2017). The quotes regarding customer knowledge spillovers are shown in table 5.46.

Table 5.46 - Quotes for the category Customer Knowledge Spillovers interactions with customers

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Customer Knowledge Spillovers – Interaction with customers	Well, let me talk about ELEMENTOR because I did not start the other one. It came out of our experience in the--accelerator. When we were there, we talked about a particular customer problem. We saw ourselves in the perfect place in time and stumbling on that particular problem we realised we could help.	19	KS-S-CV-CKS1
	Mostly through customer development, ---- talking to people and understanding their needs in investing in ---- markets. ----- at the start a lot of time was spent on customer development ---- hosting events and understanding our customers. It is more quality than the quantity we discovered that more and more people need help in investing, financial advice in a way that can be more accessible and that I found through conversations and events and with a little more industry research ---------------------- there was a gap in the market with the opportunity to the advice in investing more successfully.	22	SK-S-CV-CKS2
	That is what we did with my partner, go into companies and help them to find better ways, so we have always been involved with the change side of the organization --- in a static operation ------------------------------ you are helping like a consultant – the product, and then the product takes over that was very useful to know the client paid--- change your product, all of that. THAT EXPERIENCE WAS FUNDAMENT ------ early discussions better face to face; then you pick up all the best answers. ------------ The management team, and meet clients on a very regular basis.---- Where we have better understand the market, road maps for our products, go back to the product making sure it works very well, all that is R+D. and we sit with the client and do ours.	32	SK-S-CV-CKS3
	I believe in agile process ---- building something for five years and then something your clients don't want. I believe in communication, so the better you communicate, the better your clients will feel that you want to communicate with them and build the products they DO want to use. ---- a nice to have a tool, but it is not what I paid you for. And they have to quit because they have to build the product in 6 months.	18	SK-S-CV-CKS4
	When you are building a start-up, you go through a customer development process, trying to define a new business model and proving that it works, --- go to a particular that has a lot of Chinese restaurants in his network, so we contact him and can sell to all the restaurants in that area. Sometimes it is useful and sometimes not, depends always on the business. But you are getting useful information on who and when and all sorts of random pieces ---- and they can offer you a particular piece of knowledge useful to you. ------ it is mostly informal and free, some do it because they are good at heart, they have run a company, they know how hard it is, some people are doing to help, other people are angels, some do it as an exercise looking for jobs, so there is a whole bunch of reasons for why people would provide free data.	28	KS-S-CV-CKS5
	The S.W. business is an exciting one because to produce quality software is very expensive and very time-consuming. To be prepared to pay for it, you have to find a solution they can afford. So you have to pay close attention to your clients and see how these problems are manifesting, how the opportunities are manifesting and see the opportunity to monetise on them.	20	KS-S-CV-CKS6
	We do that from our customers all the time, and we do it ourselves wherever we can. We have an almost zero supply chain. We have a tiny supply chain. CUSTOMERS I say that because --- at the start, we do not need big holders, we need tons of small and medium holders. I have some clients on the net, but they are doing the research to see. This is good --------------------- well your market is not mature, call me when you reach a 10 million revenue.	21	KS-S-CV-CKS7

The exchange of market and customer knowledge spillovers occurs by utilising virtual platforms (Connell et al., 2014; Scaringella, Miles and Truong, 2017). Knowledge sharing between start-ups and customers on Business to Business (B2B) is based on partnership and collaboration that are considered informal with access to free knowledge (Ritala et al., 2015; Scaringella, Miles and Truong, 2017). The exchange of customer knowledge spillovers enforces radical, explorative or exploitative innovation (Limaj and Bernroider, 2017; Scaringella, Miles and Truong, 2017). Also, the exploration of customer knowledge spillovers from clients uses IT from search engines such as google analytics, surveys and video conferences. In this case, start-ups can be considered a source of entrepreneurial knowledge spillovers captured by incumbents (KS-S-SV-CKS8, KS-S-SV-SCK9, KS-S-SV-SCK10, KS-S-SV-CKS11). The quotes related to customer knowledge spillovers are illustrated in table 5.47.

Table 5.47 - Quotes for the category Customer Knowledge Spillovers, search engines and platforms

1st Order category	Relevant Quotes	Interview	Code
Customer Knowledge Spillovers	No, no I´ve known them for some time, and they started just as a supplier, and then I thought,” hang on a minute” There´s more to this------we can work together more, much closer, partnership, a strategic partnership. I´ve always been very keen on strategic partnerships, work well for both parts. So yes, that is what we did and then going back before the internet business I had my start-up. Doing two things, one was distributing car parts; we had about ten outlets doing that.	12	KS-S-CV-CKS8
	But we share a lot of information with our customers, and that is our main BOLGG and passport ----------------------- for the process of publishing a book and sharing that information is our way of doing marketing. It is something that customers reward us with because we create high-quality contents free, and they can access it, which is why they are more confident in paying for the product. We do not have suppliers; however, but the knowledge we get is feedback from our customers occasionally connections. They also contribute to our marketing because they become partners.	19	KS-S-CV-CKS9
	Knowledge would be about E-marketing ------ so in the program we everything from a marketing funnel ---------------- web site how you draw people in. Using, sharing their knowledge you can get it from GOOGLE -------------------- all this is knowledge from the people that have used it, and now they are sharing it with all of us. One start-up that did not even know the existence of these portals can now access; this is shared knowledge.	20	KS-S-CV-CKS10
	It is part and parcel to the way we work, so if I have an idea, I encourage the team on this or a new way, then we discuss them as a team. Then we start to discuss it with potential customers, so we get the feedback and do some experimenting, yes, very positive R&D. I'm not sure we have got any from suppliers, but we don't have many suppliers you see, we are a tech company, the more time you spend with customers, the more feedback you get like a spillover product, that's always useful.	44	KS-S-CV-CKS11

5.2.5.2.2.2. Supplier Knowledge Spillovers

The source of supplier knowledge spillovers can be attained by analysing products or parts that can generate the development of new ideas (Koo, 2005). Suppliers have been considered one of the essential sources of knowledge spillovers that can facilitate access to information from similar or different industries about the start-up (Ghio, Guerini and Rossi-Lamastra, 2016; Amoroso, Audretsch and Link, 2017). The literature suggests that the development of early prototypes and reengineering processes from start-ups can lead to the discovery of knowledge spillovers by reverse engineering on goods or materials (O’Gorman, Byrne and Pandya, 2008; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Schmidt, 2015).

However, the data suggest that high-tech start-ups engaged in the development of software are limited to supplier knowledge spillovers since companies do dot produce manufactured products. Companies in this category develop software tools and applications. Also, the behaviour entrepreneurs are linked to the company’s headquarters' location, where software development requires proximity to customers. In contrast, manufacture companies need to locate near suppliers to reduce the costs of transportation. Furthermore, start-ups deek to become suppliers of technology for incumbents (S-CV-SKS1, S-CV-SKS2, S-CV-SKS3, S-CV-SKS4, S-CV-SKS5, S-CV-SKS6, S-CV-SKS7, S-CV-SKS8, S-CV-SKS9). The quotes related to supplier knowledge spillovers are shown in table 5.48.

Table 5.48 - Quotes for the category, Supplier Knowledge Spillovers

1st Order Category	Relevant Quotes	Interview	Code
Supplier Knowledge Spillovers	No, no I´ve known them for some time, and they started just as a supplier, and then I thought,” hang on a minute” There´s more to this------we can work together more, much closer, partnership, a strategic partnership. I´ve always been very keen on strategic partnerships, work well for both parts. So yes, that is what we did and then going back before the internet business I had my start-up doing two things: distributing car parts; we had about ten outlets doing that.	4	S-CV-SKS1
	We do not have suppliers; however, but the knowledge we get is feedback from our customers occasionally connections. They also contribute to our marketing because they become partners.	8	S-CV-SKS2
	We do not have much transportation of products; we got a supplier in China, we would import from them ----------------------- we learnt how companies in another part of the world work, having relationships with them.	9	S-CV-SKS3
	Mm, let me think, during the Lafayette program there were things we found out that we did not know and were not sure they were significant at the time, like a specific type of suppliers, ----- like ---- he is now a chief officer in our company she invested and then she joined us, from my perspective the matrix sessions there I was looking at it from the point of view; I want retailers, I want retailers. I was meeting someone who at the end, turned out to be very useful to us. We don’t have a supply chain as such, but I would say that, if you say within our industry and from things that come, yes, we can obtain knowledge.	13	S-CV-SKS4
	We have not developed our supply chain yet. I do not think it is a relevant question here.	18	S-CV-SKS5
	We have a hardware part in our product we are software maker but need some hardware to run our products up; we do not build it, we rely on contractors, a Taiwan company, -------------- because they are building some kind of share platform ------------------- we can develop better products based on that hardware more than if we were making it ourselves.	21	S-CV-SKS6
	No, because the supplier would not waste his time giving feedback information. ----- the power of data is impressive, so we ask and…. And asking questions and getting information,	23	S-CV-SKS7
	There hasn’t been any I can think about; everything is digital.	25	S-CV-SKS8
	We have a supply chain of hardware but don’t collect any knowledge from them. That is a very, very small part of our business. ---.	31	S-CV-SKS9

5.2.5.2.2.3. Competitor Knowledge Spillovers

The development of competition in the research of knowledge spillovers has been expanded to understand the firm's process to capture knowledge generated by rival companies (Nieto and Quevedo, 2005). Hence, high-tech start-ups involved in innovation seek to maintain high levels of protection on sensitive knowledge. However, knowledge protection reduces if companies are involved in informal collaborations (Spithoven and Teirlinck, 2015). The data suggests that high-tech start-ups are not fully aware of current competition. The reason is that CEOs that the market size is significant in the industry were the new company is involved. Thus, research and gathering of competitors knowledge spillovers are not realised directly from entrepreneurs but unintentionally obtained from experts' advice in the field (Hervas-Oliver, Lleo and Cervello, 2017).

Moreover, entrepreneurs do consider competitors as potential partners that can enhance the performance growth process of the company. Hence, start-ups, SMEs and incumbents can decide to engage in creative construction (Tufool and Gerard, 2016). Therefore, start-up's competitors can be a supportive source of knowledge spillovers and potential candidates for developing future partners (S-CV-. COKS1, S-CV-.COKS2, S-CV-.COKS3, S-CV-.COKS4 (See table 5.49)

Table 5.49 - Quotes for the category Competitor Knowledge Spillovers

1st Order Category	Relevant Quotes	Interview	Code
Competitor Knowledge Spillovers	Other companies are developing technologies; it's difficult to assess the competition because it was quite cagey about their doing. I believe we are ahead; it's quite difficult to assess our competitors; they will not share. Yes, we are being quite protective and all that. In the industry, not much competitors, other companies. Are developing similar projects. -----------, this is a rapid area, and there seems to be quite a lot of investment ---- several opportunities for companies to grow very quickly with a kind of exciting technology. I think we've got a unique product.	9	S-CV-COKS1
	One of our keys to teaching new partners is that I've always got along well with them, even though they were competitors. When we raised ---- security, I said right it´s through card ship because we are a small start-up. And they are a big company; they got their kick on three and a half thousand trains, 25.000 buses, all of which need side security. So I said we need to have these people as partners so we can sell by them, so when we get big orders, the procurement team of the team that is buying the software, they don´t have to worry about us because we are behind their existing contract (Do you see what I´m saying?) ……………. If it's something our competitors are doing, we need to know, to be aware of that so that we can learn from that. So we do always interact with the market, customers and conferences. We do a lot of speaking; we want to raise the profile, to be seen as the leaders, so people ask us to speak.	12	S-CV-COKS2
	Another part is processing data, and that overlaps --- so there is some vertical integration there. Still, it is not -----, so that is the space we are playing in, it is pure people three people are trying to do the same with the same tools and procedure as us, and on a larger scale, there are a dozen or so. The competition is not very big. ------ so, there is a gap there. Security experts are hard to find. So to sum it up in the particular segment that we are there are not many because it is relatively new, ------------------ we are not in direct competition. On the other hand, the market is growing fast, and the skill gap makes for less competition in our space.	32	S-CV-COKS3
	Market size is still minimal, but it will grow a lot pushed by the ------- other industry opportunities, our competitors know this, so there is a lot of activity, investments in other companies, ---- so we are in a race to grow as fast as possible to match the different requirements of the market.	34	S-CV-COKS4

5.2.5.3. Spatial Knowledge Spillovers

5.2.5.3.1. Cluster and Intersectoral Knowledge Spillovers

The core of the absorption and transformation of knowledge is facilitating access to a constant stream of technology that supports innovation. Clusters are also formed on the necessity of start-ups to maintain geographical proximity to sources of knowledge such as network events, companies, and academic institutions (Koo, 2005; Acosta, Coronado and Flores, 2011). The critical factors to uncover on start-ups in this process is to discover if local knowledge spillovers are attached to the existing agreements with customers and suppliers or to the development of the current links that start-ups form experts in similar industries (Verspagen, 1997; Greenstone, Hornbeck and Moretti, 2010). Hence, it is expected that companies exposed to knowledge spillovers access information from related industries without considering current R&D investments in the region (Fritsch and Changoluisa, 2017).

In the case of start-ups, access to local knowledge spillovers through the incubator and accelerator programmes' attendance is the connections to experts in the field (Ko and Liu, 2015a; Mrkajic, 2017). Thus, entrepreneurs would support develop networks to support innovation (Petruzzelli et al., 2007; Spithoven and Teirlinck, 2015). However, this factor has not necessarily led to companies located in the region, but to access to companies located in different cities or neighbourhoods. The decision to engage with sources of knowledge influenced by the network capital developed by the start-up (KS-SKS-CIKS1, KS-SKS-CIKS2, KS-SKS-CIKS3, KS-SKS-CIKS4, KS-SKS-CIKS5). Quotes related to intersectoral knowledge spillovers illustrated in table 5.50.

Table 5.50 - Quotes for the theme Cluster and Intersectoral Knowledge Spillovers

2nd Order Theme	Relevant Quotes	Interview	Code
Cluster and Intersectoral Knowledge Spillovers	No, not yet because we are in a phase ----- so we can't get ---------------- manufactured somewhere else, but there is a potential to do much in the future. We have investigated exploiting ------------- because through the open innovation, they have a group that collaborates with small biotech start-ups. In that science park, but you can establish through contracts, you can establish the options to use ----- on technology --------- and it benefits small start-ups, so you can use it and later the data they need--- and they make the decisions buying equipment.	2	KS-SKS-CIKS1
	In general, yes. As it happens, we have two more locations, one in Canada and one in the U.S. They don't work in the same projects but collaborate with other branches, other offices, and also this office, even in their projects. We also work mostly with local community start-up. I would say not so much with startups what we work with. More like the need for services, we have to reach out to get some job done or built, or design is done. In general, yes. As it happens, we have two more locations, one in Canada and one in the U.S. They don't work in the same projects but collaborate with other branches, other offices, and this office and their projects. We also work mostly with the local community of start-ups. I would say not so much with startups what we work with. More like the need for services, we have to reach out to get some job done or built, or design is done.	1	KS-SKS-CIKS2
	You see what other people are doing. It helps you know where you are in relative to what other people are doing. For example, the glucose sensor, we know from the gatherings that two or3 groups are working on similar ideas, but differently. So you also know that no one has the product yet. That is only in the research and development stage so that you can gather information on the status. I did not have to. I was getting so much knowledge already that I could rely on, and that was enough. We started working in a co-working space where they tried to involve us, but the level was not the same. There are a lot of people trying to build ecosystems that they think will work out, ------------------------------------ they have a kind of an advantage. When you are a young start-up, you got to raise money one way or another when I came to London I did not know anyone, but in two months I knew every major B.C. in town. The reason is that I could look in SEEDCAM'S portfolio and scan the 150 companies there ----------------- so that made a considerable difference -------------------------------- we are scared as hell for pitching to people you know, the largest companies in the world.	8	KS-SKS-CIKS3
	Like I said, my background was not cybersecurity, but when I participated in cyber London, you know our golden bonus was building that fabulous set of experts in that field. Having their support and challenging our ideas and getting ---- from advisors that were getting familiar with the topics, it made possible to have a new conversation to them as well for items that were not much considered, until now, because cybersecurity is a hot topic. There are new---- coming up. But participating to that helped us to build ----- from the industry.	25	KS-SKS-CIKS4
	When you are a young start-up, you got to raise money one way or another when I came to London I did not know anyone, but in two months I knew every major B.C. in town. The reason is that I could look in SEEDCAM'S portfolio and scan the 150 companies there ----------------- so that made a considerable difference -------------------------------- we are scared as hell for pitching to people you know, the largest companies in the world.	8	KS-SKS-CIKS5

5.2.5.3.2. Local Knowledge Spillovers

Start-ups are purposefully looking to capture knowledge spillovers that are part of the technological spectrum. Hence, entrepreneurs mention the similarity of local knowledge spillovers presented on events in an entrepreneurial ecosystem (Tsvetkova, Thill and Strumsky, 2014; Colombelli, 2016). This type of knowledge spillovers is not restricted to a specific technological industry and seeks to break geographical barriers. For that matter, the primal mechanisms that enable the flow of tacit knowledge are the engagement with entrepreneurs, the engagement and exchange of knowledge on physical location, networking events, and human capital mobility (Nonaka, Toyama and Konno, 2000).

On the other hand, the capture of explicit knowledge spillovers is attained through the internet using search engines, open innovation, and virtual platforms. The quotes shown in table 5.51 illustrate the mechanism used by start-ups as a bridge for exposure to international knowledge spillovers (KS-SKS-LKS1, KS-SKS-LKS2, KS-SKS-LKS3, KS-SKS-LKS4, KS-SKS-LKS5, KS-SKS-LKS6, KS-SKS-LKS7).

Table 5.51 - Codes for the theme Local Knowledge Spillovers

2nd Order Theme	Relevant Quotes	Interview	Code
Local Knowledge Spillovers	We have subscribed to various science magazines ----- as tourist, we watch. And when there is something relevant, we also sometimes participate in events ------------- and it is always an excellent opportunity to exchange information, Our E-mail, for example.	25	KS-SKS-LKS1
	Another kind of knowledge is the funding status, or what you can say, where the start-up. Is funded so you can get these or where is the demand. And that may affect our planning to maybe pivot a little, for something that has more demand on the market.	1	KS-SKS-LKS2
	The reason I do it is that I learn from them ------------- it helps me to think out of the box, I learn different industries -------------------- I learn about new emerging technologies all those are the critical perceptions.	12	KS-SKS-LKS3
	Yes, there was an event three months ago from ELEVATE, which is a sports health industry. It was over open data, and how it affects the industry --- the core drivers, that was interesting --- other people interested in the subject and came to speak to me.	16	KS-SKS-LKS4
	We have subscribed to various science magazines ----- as tourist, we watch. And when there is something relevant, we also sometimes participate in events ------------- and it is always an excellent opportunity to exchange information, Our E-mail, for example.	25	KS-SKS-LKS5
	Yes, some of what I do is linked to economics, and that is something that is not connected to my knowledge base ----------------------- making an economic case for a project in Scotland ---- can transfer from all the sectors or industries into what I need.	7	KS-SKS-LKS6
	The reason I do it is that I learn from them ------------- it helps me to think out of the box, I learn different industries -------------------- I learn about new emerging technologies all those are the critical perceptions.	12	KS-SKS-LKS7

5.2.5.3.3. International Knowledge Spillovers

The extension of the capture of knowledge spillovers develops from networks as a mechanism that enables the exchange of information between regions and countries (Huggins and Thompson, 2015). Further exposure to international companies and institutions through international knowledge spillovers through networks leads to collaborations and alliances (Hayter, 2013). However, international knowledge spillovers have defined how entrepreneurs can understand global markets, learn from diverse cultures, and understand regulations (Bouncken and Kraus, 2013; Cantù, 2017).

The data highlight that developing a high standard of products to compete in international markets; start-ups tend to work with human capital and receive advice from experts in different countries that come from technical backgrounds. It is important to note that culture is not heavily mentioned, due to its passive characteristic in employees that understand the international markets and regulations (KS-SKS-IKS1, KS-SKS-IKS2, KS-SKS-IKS3). The quotes related to the themes of international knowledge spillovers are illustrated in table 5.52.

Table 5.52 - Quotes for the theme International Knowledge Spillovers

2nd Order Theme	Relevant Quotes	Interview	Code
International knowledge spillovers	These alliances are critical to us because they will take their knowledge and learning and build on top of the BOXCAR platform and deploying that to our alliance clients. They do all their work on top of our platform. This is critical to the BOXCAR model, and I think it is a perfect example of the question about spillover and alliances. ----- Both, so we have a formal global alliance, signed partner's agreement with all of them, we have mutual non-disclosure and confidential agreements. -------------------------- sharing with I.P. but there is also informality. Of course, we have our knowledge all locked up through copyrights.	20	KS-SKS-IKS1
	We are the first --- to go through it in 2014; it was the first in London. They got ten: Seattle, San Francisco, Berlin etc. I think about 500 companies applied, ten were accepted. I think it was good. It was sort of the thing you did. I was the oldest founder by 25 years there, but it is very useful for me to take a step back, engage with a different kind of founder. Getting to Microsoft, they are the most significant business to business --- customer in a software company. They were an instrumental partner for us, and I had just come back from Seattle (touch wood) rolling out an education program. So if you play the game with the host accelerator Microsoft and you take advantage of everything --- you can make that relationship work well. You know it is six weeks or twelve weeks.	24	KS-SKS-IKS2
	A lot of my friends are from China. Chinese people always get their tax refund at the end, there are many tourists here in the U.K: they study here, shop here and then go back to China but they do a lot of shopping for them, for their families and it is also fortunate for them to be able to get their taxes back if you spend a lot of money and you can get a lot of money back but could not. So I went with them through the process, and I wondered why it has to be this way? So when I worked for Delloyd, it was interesting, but I started thinking: I want something with more impact, more meaning. I guess it is the market opportunity. And the market size, the number of people, the second is how much a person spends, and what they can get back. And that relates to: How important is it to them ---- and there are about 370.000 Chinese tourists that came last year, each one spends about 2.000 pounds, then we got several tourists, we got the spend for each one.	29	KS-SKS-IKS3

More substantial forms of international knowledge spillovers are supported through alliances with customers to collaborate in taking advantage of the technological opportunity and attempt to expand the start-up in multiple countries (De Clercq, Hessels and Van Stel, 2008; Narula and Santangelo, 2009). Thus, high-tech start-ups focus on implementing virtual platforms that enable the exchange of knowledge between companies. Also, exposure to international knowledge spillovers starts exponential growth for the company (Hervas-Oliver, Lleo and Cervello, 2017; Mrkajic, 2017). The attendance supports this process to incubation and accelerator programmes, or by the CEO's intentional or unintentional decision to enter a foreign market (KS-KSK-IKS1, KS-KSK-IKS2, KS-KSK-IKS3). The quoters related to international knowledge spillovers are illustrated in table 5.53.

Table 5.53 -Quotes for the theme International Knowledge Spillovers, development of alliances.

2nd Order Theme	Relevant Quotes	Interview	Code
International knowledge spillovers	These alliances are critical to us because they will take their knowledge and learning and build on top of the BOXCAR platform and deploying that to our alliance clients. They do all their work on top of our platform. This is critical to the BOXCAR model, and I think it is a perfect example of the question about spillover and alliances. ----- Both, so we have a formal global alliance, signed partner's agreement with all of them, we have mutual non-disclosure and confidential agreements. ------------------------- sharing with I.P. but there is also informality. Of course, we have our knowledge all locked up through copyrights.	20	KS-SKS-IKS1
International knowledge spillovers	We are the first --- to go through it in 2014; it was the first in London. They got ten: Seattle, San Francisco, Berlin etc. I think about 500 companies applied, ten were accepted. I think it was good. It was sort of the thing you did. I was the oldest founder by 25 years there, but it is very useful for me to take a step back, engage with a different kind of founder. Getting to Microsoft, they are the most significant business to business --- customer in a software company. They were a beneficial partner for us, and I had just come back from Seattle (touch wood) rolling out an education program. So, if you play the game with the host accelerator Microsoft and you take advantage of everything --- you can make that relationship work well. You know it is six weeks or twelve weeks.	24	KS-SKS-IKS2
	A lot of my friends are from China. Chinese people always get their tax refund at the end, there are many tourists here in the U.K: they study here, shop here and then go back to China but they do a lot of shopping for them, for their families and it is also fortunate for them to be able to get their taxes back if you spend a lot of money and you can get a lot of money back but could not. So I went with them through the process, and I wondered why it has to be this way? When I was working for Delloyd, it was interesting, but I started thinking: I want something with more impact, more meaning. I guess it is the market opportunity. And the market size, the number of people, the second is how much a person spends, and what they can get back. And that relates to: How important is it to them ---- and there are about 370.000 Chinese tourists that came last year, each one spends about 2.000 pounds, then we got several tourists, we got the spend for each one.	29	KS-SKS-IKS3

5.2.6. Innovation

5.2.6.1. Facilitator

Start-ups focus on improving existing products or services depending on the company's absorptive capacity to engage on technical innovation through the utilisation of resources and networks (Qian and Acs, 2013; Srivastava, Gnyawali and Hatfield, 2015). Hence, companies depend on entrepreneurial and technical knowledge held by the CEO and founders. Thus, the entrepreneur's professional background set the development of the company and the type of knowledge spillovers attained (Zedtwitz, 2003; Wang and Wang, 2012; Nicolopoulou et al., 2016).

The first critical situation to notice from data is that CEOs are focused on the innovation of products, and not engaged on process innovation (Wong, Lee and Foo, 2008; Kostopoulos et al., 2011). Furthermore, the understanding on change from entrepreneurs is not focused on engaging on disruptive innovation, but on revolutionary innovation that seeks to exploit existing technological knowledge to satisfy the market (Yan, Khoo and Chen, 2005; Bouncken and Kraus, 2013).

Companies in these early stages consider that starting with the development of the product facilitates openness to sharing knowledge (Bouncken and Kraus, 2013). Entrepreneurs stated highlighted that accelerator programmes provide the required resources and information to set the company's foundation (Zedtwitz, 2003; Mrkajic, 2017). However, the emphasis for start-ups on innovation has been pronounced not to be highly dependant on the accelerator, but the potential that the company has to combine different types of knowledge from various industries, and to form alliances other companies (Bouncken and Kraus, 2013; Colombelli, 2016). Thus, the start-up's focus is to be able to use open innovation or virtual platforms as enables of innovation and access to knowledge spillovers (IN-FA1, IN-FA2, IN-FA3, IN-FA4). Quoters of facilitation of innovation are shown in table 5.54.

Table 5.54 - Quotes for the theme facilitator and combination of knowledge

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Facilitator	I would say not from the incubator process itself. We know not because we are part of the incubator. Where we are, serves the needs of the landlord rather than the innovation process itself.	1	IN-FA1
	No, not yet because we are in a phase ----- so we can't get ---------------- manufactured somewhere else, but there is a potential to do much in the future. We have investigated exploiting ------------- because through the open innovation, they have a group that collaborates with small biotech start-ups. In that science park, but you can establish through contracts, you can develop the options to use ----- on technology --------- and it benefits small start-up, so you can use it and later the data they need--- and they make the decisions buying equipment.	2	IN-FA2
	We get all our revenue from the tax authorities, but they are not the client, so they don't pay us like for a service; it's like a law. The airport guys are not paying us anything, they are just a stakeholder that has a contract with the gov. and has to work with them, now we don't have a contract with the tax authorities, but we rely on one of their policies to reclaim the money, in order to reclaim the money from them, so they are not our clients and don't pay us. Still, we are trying to make their lives a little bit easier because they work with us. And we are trying to make the tax authority make things a little easier for us also looking into their policies. They have been the major obstacle in the innovation process. They just say no to technology. They say "technology, good but later." So we have to work together so we can go to them sometime shortly and say to them" HEY GUYS, IT IS TIME TO INNOVATE!"	29	IN-FA3
	At this stage yes, we have started some alliances with similar platforms, our system rides on Amazon Web so --- they come and help you, they give you credit they give you a lot of things.------------- will flag us the premium provider of all T.v. Trailers, or we work with other platforms that want US to help THEM. ----- it is all a connected system; it becomes like a market place, so yes, we do that now more than any before.	18	IN-FA4

Unlike the development of start-ups that decided to locate on universities or science and technology parks, companies working on incubators, accelerators, open spaces, or private properties would share knowledge with more prominent organisations. In this case, start-ups capture knowledge spillovers from incumbents' experience to continue improving internal operational processes (Wang and Wang, 2012; Bouncken and Kraus, 2013; Nicolopoulou et al., 2016). On the contrary, knowledge spillovers generated from start-ups enable SMEs, incumbents, and multinationals attain insights and engage in product innovation to enter the market (IN-FA5, IN-FA6, IN-FA7) (See table 5.55).

Table 5.55 - Quotes for the theme facilitator, acquisition of knowledge through incubators and accelerators

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Facilitator	Yes, some of what I do is linked to economics, and that is something that is not connected to my knowledge base ----------------------- making an economic case for a project in Scotland ---- can transfer from all the sectors or industries into what I need.	7	IN-FA5
	Technical development expertise comes from working in clinical ----------- so we are bringing in very specific functional experts—for example, C.M.C. manufacturing lead. And we're targeting, targeting on people who have worked in manufacturing for some time and have expertise in the area or have worked in big drugs, in big projects. So, we're not looking for academics. We were with academics ---- are---- as experts. In clinical trials design, for example, we have a number of expert panels in ---- cross, and it's populated with experts, global experts. We've got a panel in PIRATES, again with global experts and again it's also with four experts, two from the U.S and two from the U.K. That's wher5e we get our academic -----, and they are all academics.	3	IN-FA6
	I would say not from the incubator process itself. We know not because we are part of the incubator. Where we are, serves the needs of the landlord rather than the innovation process itself.	1	IN-FA7

5.2.6.2. Product innovation

The development of product innovation is directly initially supported by angel investors. As such, start-ups would gather resources by establishing alliances and collaborations through former networks, or through pitching events (Zedtwitz, 2003; Cohen et al., 2017). However, participants have not highlighted that creating such alliances links to a type of seed leverage, even though it is a practice implemented in accelerator programmes. The decision to develop the product focuses on innovation that enables to enter the market through the constant interaction with customers (Nieto and Quevedo, 2005; Wang and Wang, 2012).

The data suggest that product innovation depends on the access to technological knowledge from experts in the field, and technology-oriented CEOs (Vivarelli, 2004; Santarelli and Vivarelli, 2007). Hence, start-ups use technological knowledge to differentiate from existing services and products. Thus, constant data collection is critical to the process through access to customer knowledge spillovers (IN-PI1, IN-PI2). The quotes related to product innovation are illustrated in table 5.56.

Table 5.56 -Quotes for the theme Product Innovation

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Product Innovation	It depends on what you are trying to do. We are science-heavy, so we face a lot of competition. They don't do science as well as we do, and it looks as though they have the right product. But mainly when you uncover it when you peel back the layers, there is not much substance. We have taken a very European look, not an American view, in that we build the science foundation well. American companies are all marketing. Rapid ---. We haven't had the catch to do that as a resource the --- product very well and now --- so the Americans would scale and monetise--- so my --- has to be incredibly high. I haven't needed a C.F.O. till now. I've been able to do that, but I don't have that skill set. I've managed to pull that off just --- you know, I can do the numbers --- it becomes more sophisticated and more pitches. A 10 to 20-minute talk would be better, so I pulled out our expert. If you get a long way in some areas, but you have to have them --- if you are selling a science product --- and then it's luck because another 100 people are doing it, and then it's marketing money to get yourself. Our business is a bit different. I would say that without the height of the skills, our competence --- areas, we would be in a less suitable place if we are doing --- If you know what I mean. Yeah. So I've got a P.H.D., C.S.O., I got a C.T.A., he's worked precisely down to start-ups.	24	IN-PI1
	We mix knowledge of what is going on, how they are using our web sites and what they generate in terms of lead generation, in our market place specific --- even When we can show them what. There are many measures: how many people are printing, of details, of the web page, how many times do we --- a property. So there are many ----- to report from, and we do that feed some knowledge to our business. How we feed that to our business, and how do you scale more rapid, get more flakes and so get back to your product, so we do feedback --- to some extent, we mix good analytics with our data to get a slightly better picture, it's quite hard to combine it, but we do to some extent. That has to show our lives.	27	IN-PI2

The innovation process consists of using technological knowledge to implement specific features and characteristics in products that would fulfil a requirement in the market. For that matter, entrepreneurs seek to use platforms that allow product design and conceptualisation to adapt appropriate customer and technical knowledge (Nieto and Quevedo, 2005; Yan, Khoo and Chen, 2005). Explicit knowledge spillovers attained through the interaction that start-ups have with customers through virtual platforms.

In the face of perceived competition in the market, start-ups seek to develop a product that offers features and functionality that is different from the competition, but that is not technologically disruptive. In such a case, start-ups focus on setting a B2B strategy, rather than a business to customer adoption (IN-PI3, IN-PI4, IN-PI5, IN-PI6). The quotes related to product innovation are illustrated in table 5.57.

Table 5.57 - Quotes for the theme Product Innovation, prototypes

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Product Innovation	We think that our real completive strong is our diversified backgrounds, there was no security in the beginning ----------------- and that is where the innovation comes in, it is not about inventing that is entirely new, you offer it in a digestible way then you add some more features in it. Yes definitely, diversity was the element that helped me most in this venture.	25	IN-PI3
	Much of the work I have done in the past has been about technology, enhancements and implementation on launching new products and processes; a lot has been about enhancing existing products or adding new features or functionality. Yes, I have a lot of experience doing it, innovating in that way and leading teams and being the touchpoint between the business and the technical. The team is something that I have had quite a lot of experience in it.	30	IN-PI4
Product Innovation	They gave us documents to read. What we did was to listen and build a prototype and took it down to show. Yeah, some feedback on the shape of it, went to work it, then we had a final day when all the guests were there….shared all 5 of the concepts on stage.	13	IN-PI5
	We learnt different things in the various programs, Berkley's textile we looked at a prototype of a product, so we learned about ------------ in terms of security requirements in the innovation lab we learned about the sales process and clients	31	IN-PI6

Entrepreneurs would start this product conceptualisation by capturing a form of knowledge spillovers or information explored through experiments. This process involves a critical sharing of vertical knowledge among the company members, and horizontal knowledge spillovers obtained with other organisations (Backman and Loof, 2015; Amoroso, Audretsch and Link, 2017). Thus, CEOs who make new ventures escalate from the seed stage to the growth stage continue engaging third parties and clients located internationally (Cantù, 2017; Kuratko and Hornsby, 2018). Thus, start-ups survival, performance and innovation depend on introducing the product in the market (IN-PI7, IN-PI8, IN-PI9). The quotes linked to product innovation are shown in table 5.58.

Table 5.58 - Quotes for the theme Product Innovation, engagement with the market and strategy

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Product Innovation	I listened to a postcard last October, and I came to the office and said let's try this experiment, and it took four weeks to try it, and it proved to be a great success. Experiments are the main mechanism that we use; we have a control team to match the result with the experiment, according to results we see if we proceed.	10	IN-PI7
	I did not learn innovation in my previous jobs I learnt ----------------------------- we could not grow fast enough to have enough supply because we were linear model and became a market place model and THAT was an innovation in our industry, how we source products ---- and being in 200 different cities can only be done with innovation.-------------------------- that was the 2nd level of strategic innovation that we made ------------------------- from a 10 million dollar company to a 50 or 100 million dollar company.--------------------------- We are using a lot of tech for quality control, distribution ------------------------ to be able to ---------------- to others as well.	12	IN-PI8
	…..a major put up in our business strategy because by learning from them and seeing how much value we can bring to them, we realise that working with big start-ups. Was going to be better than standing on the street and maybe trying to build our branch. Our focus has changed from B to C, to B to B to C. the whole business probably has to change because of our strategy.	5	IN-PI9

Entrepreneurs focus their attention on developing a form of relationship to share information with customers, which is required to conceptualise a product and satisfy the quality and feature expected from products (IN-PI10, IN-PI11) (Yan, Khoo and Chen, 2005; Schmidt, 2015). As such, start-ups focus on maintaining or expanding the revenue attained from selling the developed product multiple times on an incremental basis (IN-PI13). As such, the start-up would grow a reputation and continue to increase the percentage of sales with every new product enhancement (IN-PI10, IN-PI11).

Start-ups perceive product development as a mechanics to increase increased benefits for the start-up (IN-PI14). The process is conducted in continuous cycles that enable to improve human capital and resources from revenue. Therefore, companies that can enter the market quickly can grow faster and eventually become an SME (IN-PI13) (Audretsch, Sanders and Zhang, 2017). As expected, companies that engage in international markets would strengthen the ties with customers and increase human capital that can continue developing the product (Santarelli and Vivarelli, 2007; Audretsch, Sanders and Zhang, 2017). However, new ventures can find themselves in fanatical turmoil if there is no revenue generated from participating in the market too late (IN-PI12). The quotes related to product innovation are illustrated in table 5.59.

Table 5. 59 - Quotes for the theme Product Innovation, engagement with the market and strategy

Base 2nd Order Theme	Relevant Quotes	Interview	Code
Product innovation	As I said in SEEDCAMP, there is an extensive set of contacts that we can consult. In return, they may or might consult us, as well as entrepreneurs in other businesses which has been very valuable -- but we share a lot of information with our customers, and that is our main BOLGG and passport ----------------------- for the process of publishing a book and sharing that information is our way of doing marketing. It is something that customers reward us with because we create high-quality contents free, and they can access it, which is why they are more confident in paying for the product.	8	IN-PI10
	My co-founder James is head of products, so he used to make games, apps, and websites in his background, so he is ---- integrated into our product fans, so you have to keep an eye on things. Yeah, so we have a partnership with our data department ---- so we share industry information all the time. ---- and we that for product or time decisions.	16	IN-PI11
	Mostly the financial role of any start-up is the huge problem for the first couple of years,-----------------------, in February we decided to drop the funding and concentrate on the product, I had to use the plan B because we had run out of money. However, we are still around, thanks to me. In September, I prepared the ground for the hard landing.	18	IN-PI12
	Once you have sold the product, you have a 50% chance of selling it again if you sell the product you have a 60% chance to keep on that and a 70% chance on your third product. You build 5, 10 or 20-pound products. That is why I built the PROPERTY PAGE. You have a customer --- long lead time, it's a much more complex sale, but if you remove some of the complexity barriers, you don't have a ready customer, so productisation was vital. I did not learn this at an academy.	27	IN-PI13
	We have to be sure the product is relevant, so we put an enormous amount on project development first, you build your development centre. Your development team, then your sales team, ----------------------------------- so you make sure that cycle after cycle your product gets better and so receiving more benefits, as you grow appropriately.	31	IN-PI14

5.2.6.3. Process Innovation

Process innovation has been evaluated from the perspective of enhancing the company's tasks and procedures (Hashi, 2013). Process innovation has been evaluated from the perspective that organisations can increase productivity and automatization to increase efficiency in manufacturing companies (Liao, Fei and Chen, 2007; Montoro-Sánchez et al., 2011). However, process innovation conducted in Knowledge-Intensive business (KIBS) evaluate processes that undertake knowledge absorb knowledge (Tseng, Pai and Hung, 2011; Hashi, 2013). Research has linked knowledge spillovers on SMEs on the involvement of alliances with universities that lead to the constant development of companies' internal innovation procedures (Dyerson and Pilkington, 2005; Shu et al., 2014; Hájek and Stejskal, 2016).

The data highlights that start-ups are passively involved with companies. Moreover, incumbents seem to actively engage in a collaboration agreement to learn how to innovate constantly. On the other hand, start-ups are more likely to provide employees with all the resources and freedom to explore opportunities for the company. On the other hand, start-ups engaged with companies can decide to switch their strategy to Business to Customer (B2C), or B2B (IN-PD-DA1, IN-PD-DA2, IN-PD, DA3). See table 5.60 for quoters related to decisions and approach.

Table 5.60 Quotes for the theme Process Development, Decision and Approach

Second-order theme	Quote	Interview	Code
Decision and Approach	So that I hadn´t expected that this was such an important reason for them doing the incubator, it was for them to learn and get some ideas. To show to their staff that we are innovating…and a big thing to show to headquarters, nobody had ever done this before in the whole group, so for the U.K.R…… it was a very high profile….for the whole group. All eyes all around the world on this thing, so they wanted to make sure it worked well, and I´d say…….so that's the history of it.	5	IN-PD-DA1
	…..a major put up in our business strategy because by learning from them and seeing how much value we can bring to them made us realise that working with big companies. Was going to be better than standing on the street and maybe trying to build our branch. Our focus has changed from B to C, to B to B to C. the whole business probably has to change because of our strategy.		
	It depends on the company, for us, at first, we started investing in it, but later realised that the income of revenue would delay a long time, so you divert the money to product development.	9	IN-PD-DA2
	I have been in a company with a lot of processes and --, and it is about giving them the freedom of giving them pretty much what they want. As many proofs and processes as you can.	11	IN-PD-DA3

High-tech entrepreneurs at the seed and growth stages are inclined to acquire technological knowledge spillovers through the use of ICTs (Doloreux, 2004; Stejskal and Hajek, 2015). Hence, it is expected that the enhancement of processes is not entirely intentionally directed to enhance the company's performance (PD-TR1). Start-ups aim to keep strengthening the technological knowledge base through hiring and training human capital (PD-TR2).

Furthermore, lessons learned from entrepreneurial experience can prove to be an invaluable type of tacit knowledge for start-ups (PD-TR2). Also, entrepreneurs seek to implement IT and ICTs practices used by other companies to improve start-up performance (PD-TR3). Hence, technological tools, such as machine learning and search engines, are used to gain knowledge from virtual spaces (PD-TR4). The quotes for the training are shown in table 5.61.

Table 5.61 - Quotes for the theme Process Development, Training and ICT skill development

Second-order theme	Quote	Interview	Code
Training and ICT skill development	The commerce is not really what we do ..-------- so I was optimising a lot of resources in the company, that type of things.	18	PD-TR1
	I'm a big believer in continuous professional development -------- everything is constantly changing, and you have to keep refreshing your skills and expertise then you have to listen. You have to learn, learn from your mistakes. That is the best you can do, LEARN FROM YOUR MISTAKES!	20	PD-TR2
	We see what the need is. We make educated guesses on … in the industry. So, we see what we think, look at what everyone is doing, so I need innovation …. If there is anything to improve, we can do it ourselves ---- one of the things we want to get into here is machine learning. We should be using it, but we have a google paper around the corner, yeah.	23	PD-TR3
	Other tools are HARDJAR that allows you to gather information about web site traps.	9	PD-TR4

5.2.7. Creative Construction and Creative Destruction

5.2.7.1. Objectives of the company

Companies that started development in high growth countries, such as the UK, would have more access to regional knowledge spillovers (Ács et al., 2016; Abubakar and Mitra, 2017). However, at a specific level, it is questioned that new ventures' product life cycle can affect the company's performance (Audretsch, Sanders and Zhang, 2017). Notably, the Leigh and survival rate of high-tech start-ups influenced by knowledge can determine the level of innovative performance and exposure of the company on international markets in seven years (Laursen and Salter, 2006; Tseng, Pai and Hung, 2011; Audretsch, Sanders and Zhang, 2017).

CEOs' goals and aims can lead to processes of creative destruction or creative construction of companies (Agarwal et al., 2010; Tsvetkova, Thill and Strumsky, 2014). In such a case, the founders of companies can have different sets of intentions on the company's future aims. Start-ups focus on testing and developing an original product that can guarantee a contract with a potential customer or enter the market to gain revenue (CD-OC-PD1, CD-OC-PD3, CD- OC-PD5). This process is linked directly to enhancing the technological and visible features of prototypes (CD- OC-PD2, CD- OC-PD4). The data initially suggest that biotechnology and big pharma companies would direct their attention to realise tests before commercialisation. At the same time, high-tech start-ups developing platforms aim to increase its capability and performance to satisfy the market’s needs. The quotes related to product development are illustrated in table 5.62.

Table 5.62 - Quotes for the theme Objectives of the Company, Product Development

2nd Order Theme	Relevant Quotes	Interview	Code
Product development	To develop our products, ------ efficacy on humans, take it through late phase clinical trials and commercialise it. That is our objective.	2	CD-OC-PD1
	The objective of the start-up. We want to build a beautiful product that customers like, and that will change the industry. And we are 2/3 missionary and 1/3 mercenary	5	CD-OC-PD2
	Our goal is to close our--contract within the year and get to the point where people can take out their phone and localise the object they could not find in the store with us.	13	CD-OC-PD3
	In the next, few months put out our product. In a couple of years, translating to various languages, starting to follow up on institutional demand start talking to banks, the department for international trade, sharing revenues and making it happen a lot faster.	17	CD-OC-PD4
	We are building a providence product-- tracking diamonds and other precious stones from the market of origin to the market of sale. That’s our goal.	26	CD-OC-PD5

Start-ups require to engage in planning that habilitates start-ups to decide how to participate in the market (De Clercq, Hessels and Van Stel, 2008). This event is influenced by the selection of knowledge spillover sources that facilitate the exploration of entrepreneurial opportunities (Foss, Lyngsie and Zahra, 2013; Amoroso, Audretsch and Link, 2017). Hence, the initial spatial condition to access knowledge spillovers on an entrepreneurial ecosystem facilitates business survival and cooperation (De Clercq, Hessels and Van Stel, 2008; Tsvetkova, Thill and Strumsky, 2014).

The data suggests that start-ups in the seed stage develop more partnerships to facilitate the company's everyday operations (CD-OC-PL1, CD-OC-PL4). Afterwards, companies decide to develop a plan that can enable to scale continuously in the following years (CD-OC-PL3). Hence, companies must keep building formal alliances that facilitate the company's expansion on the number of employees, and business locations (CD- OC-PL1, CD- OC-PL3, CD- OC-PL4). The objective is to provide start-ups with a constant stream of revenue that can support the company's future growth (CD- OC-PL2, CD- OC-PL4). The quotes related to planning are illustrated in table 5.63.

Table 5.63 - Quotes for the theme Objectives of the company, Planning

2nd Order Theme	Relevant Quotes	Interview	Code
Planning	Growth, building a corporation, and selling, we want more ticketing. More finance, more insurance, more events, I want to get to 5 or 6 venues in the surrounding area, ---- so we can do it all at once.	23	CD-OC-PL1
	In the short term, we got some scale concerns, in the midterm, I would say in the years 7 to 10 we want to be a substantial leader in our area, we build the foundation strongly, we have 2 or 3 hundred customers of a recurring basis, and I think after ten is when it becomes exciting as a company, align with other business' align with other views, I'm not obsessed with the money thing or with how big we get I think those things will come as a direct relation to a good foundation.	24	CD-OC-PL2
	Plan A is keeping it the same mainly because the property market is real --- and I have been doing it for a long time. I don't have access to ---- don't have a good business plan for the future because there are several unknowns for what I can scale---. Plan A is to sell, Plan B is to reactivate and plan C ----- to grow in business, but I don't have any more plans.	27	CD-OC-PL3
	In the short term, what we are trying to do is achieve more hotel partnerships. ------------------, the hat has held us back is that we don't have the partnerships with those post companies and integrate MAGIC TAP, and that is what we focus on in the short term,	28	CD-OC-PL4
	In the middle term is to increase revenue so it can support us and then not have to rely on investors, and once that is done, that we are established in the market; safe and comfortable, then we will be looking on becoming THE PLATFORM------ later there will be a focus on change,		

The KSTE mentions the effects that start-ups have on incumbents' displacement through creative destruction (Agarwal, Audretsch and Sarkar, 2007; Santarelli and Vivarelli, 2007).In such cases, start-ups that engage in competitive markets in the urban core can lead established companies to leave the market a period before seven years from the start-up's foundation (Tsvetkova, Thill and Strumsky, 2014; Audretsch, Belitski and Desai, 2015). The process can be disrupted when incumbents use resources to prevent the start-up's development (Dyerson and Pilkington, 2005). However, entrepreneurs can decide to further engage in formal alliances to participate in creative construction (Shu et al., 2014).

In both cases, it has been evasive to mention a specific indicator for survival and growth of start-ups to evaluate the phenomenon of creative construction and destruction across disciplines (Vanderstraeten, Matthyssens and Campus, 2004). However, high growing high-tech start-ups often involve a rapid growth in revenue and employment of human capital (Abubakar and Mitra, 2017). The data suggest that companies do not seek an alliance with incumbents but compete on local and international markets (CD-GR2, CD-GR5). Hence, the start-up's strategic alignment is to establish a system that enables data capture and the expansion in the market (CD-GR1, CD-GR4, CD-GR5). All companies following this mentality fall in the range of three to seven years of operation.

The KSTE also includes a high level of emphasis on the evaluation of the business idea. The initial problem started with the knowledge that can change based on individuals' perception (Arrow, 1972; Audretsch and Stephan, 2006). Once start-ups start operating and developing transactions in the market, it can generate an estimated evaluation of the company (Agarwal et al., 2010). The start-up's valuation also increases due to the investment in R&D, and by developing collaboration with reputable companies (Audretsch and Belitski, 2019).

The data mentions that companies operating for more than ten years seek to dominate the market with revenues of more than one million pounds per year (CD-VL1, CD-VL2). Furthermore, the initial founders aim to obtain an estimated valuation of the start-up in the market (CD-VL2). In contrast, entrepreneurs operating bellow three years would not have a precise monetary figure to reach (CD-VL3). Due to limited responses, it is sensible to stipulate that high-tech start-ups give more attention to developing the product and entering the market. The quotes related to the growth of the company shown in table 5.64.

Table 5.64 - Quotes for the theme Growth and Valuation

2nd Order Theme	Relevant Quotes	Interview	Code
Growth	Our one-year objective is to have developed our ---- and getting hard data for our business case ---- our company. Our five year is to have conquered the U.K. public sector and started our international expansion ---- to the U.S. market; we see it as a horizon ----- the market.	19	CD-GR1
	To gain market share in the U.S. and abroad and become a dominant bear in the market.	30	CD-GR2
	We have a detailed system of what we are going to do and where we are headed. We need to be able to communicate effectively to the whole company and our stakeholders. We use A.K.R. to do that and review them and send the findings to everyone.	10	CD-GR3
	We are growing 600% a year and will continue to grow very fast.	12	CD-GR4
	We want to expand a range of markets we are now exploring, to cover more of Europe and the U.S.A. and to scale up------ more scope getting more media coverage and new markets, that is the main focus	15	CD-GR5
Valuation	We want to be a ------------- TITAN; we want 100.000 pounds per month, ---------------- 12 million a year would be very lovely --- a million pound per year per employee. That is a very lovely and clean objective. --- I can see making 30 or 40 million a year with the same number of employees. It is a very ambitious target. I would LOVE to achieve that! I would say that is our long-term objective.	20	CD-VL1
	We would want to be the start-up to be worth 100 million.	4	CD-VL2
	Build a massive business with hundreds of millions in revenue	8	CD-VL3

5.2.7.2. Teams and Business Survival

Survival of start-ups can be determined by the founding member's background and the starting human capital working in the company. The CEO's ability to engage in active learning or gain access to funding enables start-ups survival (Santarelli and Vivarelli, 2007). Furthermore, the locations that provide human capital and training from universities and companies offer sufficient skillset to absorb and implement knowledge spillovers (Tsvetkova, Thill and Strumsky, 2014).

It is questionable that the capture intended and unintended knowledge spillovers occur from interactions with teams of entrepreneurs (Fallah, Howe and Ibrahim, 2004). However, the barrier that determines what leads the difference and identification of knowledge spillovers is disputable. From one point, entrepreneurial intention to gain tacit and explicit knowledge spillovers from individuals, customers and suppliers is a valid form of acquiring knowledge spillovers (Fallah, Howe and Ibrahim, 2004; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Tufool and Gerard, 2016). Hence, the setting of a group in the company can lead to exploiting and carrying out product innovation focused on constant technological change and entering an international market (Shu et al., 2014; Abubakar and Mitra, 2017).

Interviewees strongly suggest how the starting team must be clear on the company's strategic direction and on the type of product that would cover the needs of the market (SU-P&T1, SU-P&T2, SUP&T3). Thus, it is essential to have a founding team that can recognise the adequate time to enter the market (SU-P&T4). Hence, start-ups continuously seek to remain competitive by utilising a minimum amount of resources and maintaining lower costs than incumbents (SU1-P&T1, SU-P&T3). Therefore, it can be stated that the founding team has to be able to state clearly the type of product and industry to tacked in the following years to come. The quotes related to products and teams are illustrated in table 5.65.

Table 5. 65 - Quotes for the theme Survival, Product and Team

2nd Order Theme	Relevant Quotes	Interview	Code
Product and team	They identify an opportunity that's not being satisfied or not satisfied very well—or doing something very different as we were. -----they have been around for ages, doing renting office space, doing it in a very boring way. ------we work a value ten times lower than they are. They are worth 20 billion. The two things are that you got to have the guy in charge, must have a very clear vision, and then good people around him.	4	SU-P&T1
	The most important thing is: are you building a product that people will buy, and is there a market, is it commercial can you see a profit that is the most important ---- of any business you want to build. The next thing is you need a strong ecosystem -- the type of people that surround you is also one of the most critical factors. If you have outstanding people around you, it increases your chance for success.	22	SU-P&T2
	We have been alive for several years, we had quite a strong founding team, so management, funding and the service that will sell for itself. Validation, looking for a specific market, the market is not ready, or-----, those are.	25	SU-P&T3
	Timing, the timing of the challenge that exists within an industry and the team's timing to be able to recognise it and build a product, in time for the challenges to be solved.	26	SU-P&T4

Survival high-tech start-ups also depend on the company's capability to adapt to technological and market turbulence (Debrulle, Maes and Sels, 2014). The ability to adjust depends on the level of absorptive capacity that enables a continuous process of exploring, transforming and exploiting knowledge (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Su and Yang, 2018). As a result, companies can extract high levels of knowledge spillovers that enhance open innovation and business performance (Sisodiya, Johnson and Grégoire, 2013; Su and Yang, 2018). Therefore, the founder intends to spend R&D budget towards product or process innovation (Hájek and Stejskal, 2016).

Entrepreneurs and founders recognise that the founders' internal capability and resilience to solve problems and gain funding are indispensable for business survival (SU-P&T2, SU-RE1). Moreover, economic resources and sustainability of the high-tech start-ups on software are considered a top priority to keep the company in business (SU-FU1, SU-FU2, SU-FU3). The seed stages of the company centre R&D budget towards developing the product that covers its needs (SU-FU1). If the endeavour fails to be established, the company's founder has to set an adequate plan to seek the process of creative destruction (Tsvetkova, Thill and Strumsky, 2014).

Thus, funding is used to cover the market's needs and solve internal production processes and activities undertaken by the entrepreneurial team in the start-up (SU-FU2). The challenge is to maintain normal operations and keep the customer engaged with the product while preserving and acquiring alliances and informal collaborations that facilitate the access to funding from Venture Capitalists (SU-FU3). Hence, start-ups providing services and software actively engage in product innovation and gathering of the financing towards business survival. The quotes related to funding and resilience are illustrated in table 5.66.

Table 5. 66 - Quotes for the themes Survival, Funding and Resilience

2nd Order Theme	Relevant Quotes	Interview	Code
Funding	Essentially the financial role of any start-up is the huge problem for the first couple of years,----------------------, in February we decided to drop the funding and concentrate on the product, I had to use the plan B because we had run out of money. However, we are still around, thanks to me. In September, I prepared the ground for the hard landing.	18	SU-FU1
	Funding is number 1, --------------, definitely, that is the number one variable. What could make us fail: the service was not responding to the demand, ---- or maybe problems inside the management team,	25	SU-FU2
	NOT RUNNING OUT OF MONEY ------------------------------------ if you can't show revenue, then you have to show traction in some other manner. What companies are doing is using vanity matrix to survive. , so you have to find your reputable sustainable work model, we work differently, looking for investors that understand what we are doing and why and when they evaluate their investments they evaluate it based on -- by the end of the month you could have perhaps a thousand venues on the platform, ------------------------- and that can help you stay alive.--- but it is a tough thing to do.	28	SU-FU3
Resilience	The essential skill that you need to build a company is to solve ANY problem, like with your couple, you want the relationship or the company. I have been doing, solving problems we had with our cofounders that is the most significant barrier. People give up just because they didn't like their co-founder or because they can't find the solution. The problem in solving the problems of the world is that people give up too soon.!!!	29	SU-RE1

5.3. Second Qualitative Analysis – Development of Empirical Model

This section is focused on developing a conceptual model based on the first analysis conducted in section 5.2. Following the process of theory building established by Eisenhardt, and described in the Research Methodology on Chapter IV (Eisenhardt, 2016). The data collection and analysis were conducted with the initial open coding, following the focused coding in the primary and secondary themed dimension discussed in the previous sections. The first order themes illustrated in the model KST-QLEM1 section led to the setting of codes that would enable to identify pattern matching between the themes (Gräbner and Eisenhardt, 2007; Saldana, 2015). Hence, the objective was to sharpen the case studies' comparison with the relevant literature in the field (Yin, 2003; Saunders, Lewis and Thornhill, 2016). The final stage of the qualitative analysis is to establish a set of propositions, and a model is illustrated in figure 5.2

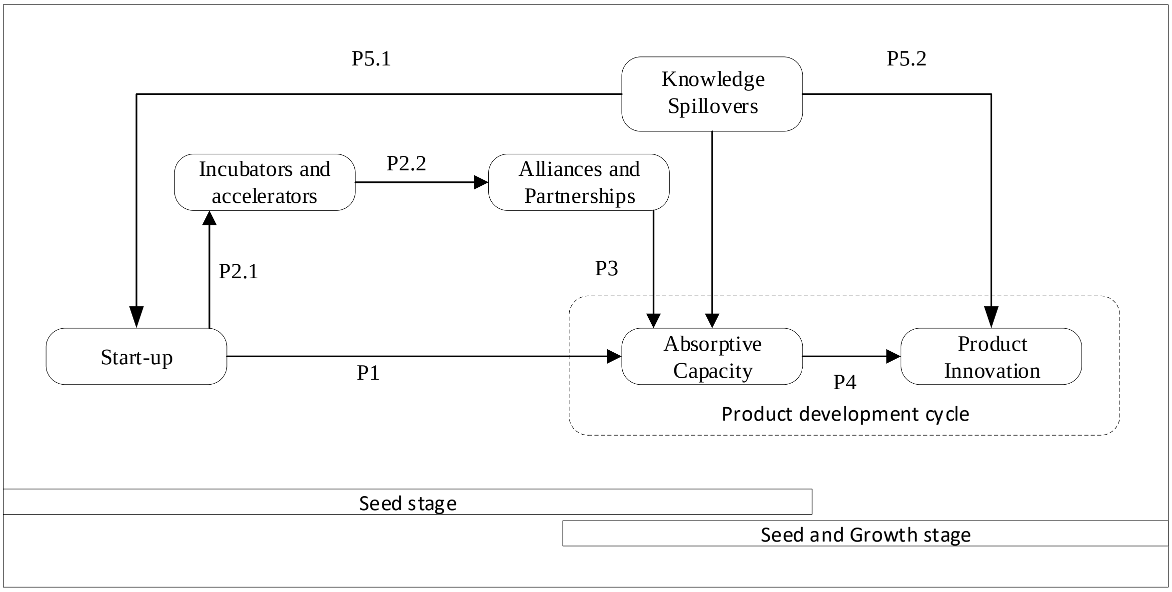


Figure 5.2 - Second Qualitative Empirical Model (KST-QLEM2)

5.3.1. Start-up

The initial primary themed code of the data sets the collection of experiences in the initial years of the start-up's formal registration (Dey, 2016). As such, the previous experience of entrepreneurs before the new venture creation sets the pace for the managerial decision to occur in the following years of operation. As such, the first effect of knowledge spillovers influences identifying the business idea (Cantù, 2017). Entrepreneurs in the biotechnology and pharmaceutical sectors base the initial product development on academic and research skills to set an initial base of knowledge to create a product (SU1, SU2).

T**acit knowledge spillovers** are materialised through the potential value that the idea holds for creating a new company. Indirectly, **institutional knowledge spillovers** generated from the experiences that entrepreneurs held from the process of doing academic research from academic publications and possible access to funding for research (O'Gorman, Byrne and Pandya, 2008). The main reason entrepreneurs break the knowledge filter is to engage in possible access to future rewarding companies, involving a high level of risk**.** Hence, this type of entrepreneurs' secondary theme code holds as "Academic Background" (E. Porter, 2000). Therefore, most entrepreneurs in this industry would hold a PhD degree as their highest qualification.

On the other hand, entrepreneurs coming from the industry would seek to collaborate with another entrepreneur from a similar industry. In this case, the company's founders would have identified an opportunity to exploit knowledge spillovers to enter the market and grow in the future (De Clercq, Hessels and Van Stel, 2008; Lasch et al., 2013). In these cases, entrepreneurs would evaluate the business idea based on their industry experience and their perception of the customer's needs (SU3, SU4).

The confirmation of knowledge spillovers' uncertain value is checked from conducting market research with customers (SU5, SU6). The objective is to obtain a base knowledge to apply for funding and to start the new venture. Hence, this is are the primary source of **tacit and explicit knowledge spillovers.** In these cases, the initial insights on these cases set entrepreneurs to break the knowledge filter by developing a company based on consultancy or product development. Hence, the secondary themed code for entrepreneurs that use knowledge spillovers from the industry is "industrial background".

There is a third source of knowledge spillovers coming from entrepreneurial experiences (Cantù, 2017). The sharing of founders' experiences leads to developing a product or service not covered in the market (SU7, SU8, SU9). This source of **tacit knowledge spillovers** would originate from identifying missing features of products or services that serve as an opportunity for a business idea. On the other hand, previous experiences on creating a new venture provide an invaluable initial edge. In this case, entrepreneurs' capital network, access to funding, and technological knowledge support the entre of start-ups to the market (SU10, SU11). Therefore, previous experience fosters incentives to break the knowledge filter (Hayter, 2013). These **tacit entrepreneurial knowledge spillovers** provide an understanding of the company's required human capital and adequate location to start a new business. Therefore, the initial proposition of the model is enabled as follows:

Proposition 1. Tacit knowledge spillovers of entrepreneur founders set the development of the business idea. The development of product innovation depends on the mediator effect of the start-up's absorptive capacity, the individual alliance between the founders and co-founders, and their ability to exploit knowledge spillovers from the market and companies.

The themes and the theoretical dimension of the construct "Start-up" are illustrated in table 5.67.

Table 5.67 - Theoretical Dimension "Start-ups" and Second-order themes

Theoretical dimensions	Second-order Theme codes	Relevant Quotes	Interview	Code
Start-ups	Academic Background	So this is the knowledge that we created, so it comes internally that this company's establishment was based on new knowledge from two or three individuals from the scientific family. So, that's where the intellectual knowledge comes from, so we used the initial founding knowledge, and then we develop, but we rarely take additional key knowledge from outside.	2	SU1
		For example, the glucose sensor, we know from the gatherings that there are two or three groups working on similar ideas, but differently. So, you also know that no one has the product yet. That is only in the research and development stage so that you can gather information on the status.	1	SU2
	Industrial background	It was an idea of my cofounder --- he was a creative director for many T.V. stations, and he realised that a lot of the trailers that he and his team created never got out, so it is a waste of work. He said why don't we create a tech platform where the users are on a mobile base, used with tablets, ---- we presented the idea to senior vice president of -----------, and within 10 minutes he validated the idea and was sold. He also said he would pay as well for the development.	18	SU3
		We knew in 2014 that cybersecurity was going to be big according to market trends. We are cybersecurity experts for years, so we know it was important etc., so we decided when we founded the company to focus on that kind of topic without really knowing the value proposition. And what we do for almost one year to conduct interviews with possible customers because we had nothing to sell at that time.	21	SU4
		our first step coming from cybersecurity is that we are trying to develop a device that would help us maintain our identity.---We Did research and interviews to validate our idea the value of the ----- if there was an actual demand for such service, the results were positive and encouraged us to go forward. And with the investors, we said: OK. Let's give it a try.	25	SU5
		I saw the opportunity to build a product in technology that would make a difference to many people.... worked in the industry for large companies, so I saw the need forehand, head of sales operations mostly. Within my position, it was very clear that the need was there. I looked at the number of people affected by the problem, the revenue from the number of transactions; I can make the market size based on the people who have this need.	32	SU6
	Entrepreneurial background	I got together with my co-founder, we both shared experiences of how our used cars caused problems, and at that point, the idea was born that we wanted to try free trust for a used car market. That is how it came about.	9	SU7
		We saw a gap in the market. We saw ------- residential apartments in London. We thought that we could pitch this value and profit, enabling them with high-quality furniture and letting large corporate travellers use them as an alternative to a hotel. We looked at the supply-demand chart in key cities, looked at the time required to set up --- we looked at the rise of ---- and using these three key models judge where the price.	10	SU8
		When I went to the university I saw it was an issue to get tickets; there was no efficiency I had a friend that run events and sometimes they could not find a printer, So I said **** I will do it myself. So I got a business going and strived to be as efficient as possible... so anyone could buy a ticket, you could do it on your phone, and then the ticket company will charge you. After that, it grew and grew and grew.	23	SU9
		We provide image-tracking solutions for the diamond industry, for the market, we go to a ---platform to enable those diamonds to be tracked, so customers, when they purchase a diamond, know where the diamond comes from. We use blockchain --- got a contract for artificial intelligence to identify and track a diamond ---. The diamond industry is a five-hundred-year-old industry. It has some mass challenges that represent billions of dollars of challenges ----- slice--and we knew you had to combine different technologies to provide a different way of trade.	26	SU10
		One colleague lived in Canada, and he needed the internet to his house, he lived in the countryside. And this guy came along and installed a ------- station on his house that transmitted the internet signal about 10 miles. That got him thinking: where is the only place that you can't get an internet connection? On trains. So they did some tests with this technician guy who came to do the trial, so we did an initial trial that worked. So the first project we did was we managed to persuade --------------- to do a trial, ----- I made some of the IT in my workshop, and some of it is still around. Then we won huge contracts like Dutch Trains, a 30 million pound contract, then -----, many U.K. business projects around the world, and one of the things that helped us, as I set up a deal with one of our main suppliers…..rail cables and antennae.	4	SU11

5.3.2. Incubator and Accelerator Programmes

The company's initial development and the location of the accelerator and incubator programme can enable access to mentorship, human capital, and access to the market (Markman et al., 2005; Markovitch, O'Connor and Harper, 2015). The data suggest that what sets the difference between excellent and inadequate programmes is the provided support and guidance obtained from mentorship and exposure to the market (AC1, AC2). High-tech start-ups also acknowledge that the further effects of engaging in the market, networks, training, and credibility that supports new ventures in the early stages (AC3, AC4). However, companies and CEOs from different industry types can have different motives to participate in an incubator or accelerator programme (Pauwels et al., 2016; Cohen et al., 2017). In some instances, experienced entrepreneurs prefer to select incubators, which are viewed as locations that facilitate the business's required infrastructure (AC7, AC8).

As expected, accelerator and incubator programmes have demanding entry requisites for start-ups (Pauwels et al., 2016). However, once the companies are part of the plan, entrepreneurs have access to **tacit and explicit knowledge spillovers** obtained from the exchange of reports, and pitching events (AC9, AC10). Therefore, all types of interactions in the programme are informal "collaboration" between individuals. Services from incubators and accelerators set by the curriculum can unintentionally lead to the exposure of unintentional knowledge spillovers (Hallin and Holmstro, 2012; Cantù, 2017). However, entrepreneurs may be gaining knowledge to enhance the processes of the company passively.

Moreover, entrepreneurs may not choose to engage with entrepreneurs due to a perceived low value of future formal alliances. However, access to **explicit knowledge spillovers** is available on virtual platforms and networks formed from entrepreneurs in the programme (AC11, AC12). In this case, start-ups have access to documents, books, and journals that support the company. Also, communication channels enable entrepreneurs to raise any queries used to access any form of information.

High-tech start-ups also have access to different forms of technological knowledge spillovers from the entrance to one-to-one meetings with mentors, potential customers, venture capitalists, and investors (AC13, AC14, AC15). These interactions are linked to international knowledge spillovers by engaging in international audiences that enable them to understand the market and participate in projects with companies. Therefore, accelerator programmes can facilitate access and exposure to markets beyond the geographical proximity of the start-up's location (AC6). Moreover, the influence of incubator and accelerator programmes can set initial stepstones to foster formal alliances that improve the absorptive capacity of start-ups (Shu et al., 2014; Audretsch, Belitski and Desai, 2015; Nicolopoulou et al., 2016).

Companies that can gain access to joint projects with companies create opportunities for learning ICTs and IT through **technological knowledge spillovers in alliances** (Bouncken and Kraus, 2013; Shu et al., 2014). Despite all the apparent difficulty on entry to these programmes, entrepreneurs do not perceive a high level of the competition once it has set off (Bouncken and Kraus, 2013; Pauwels et al., 2016). Therefore, it is possible to propose the following propositions relating to the effects that accelerator programmes have on knowledge spillover identification:

Proposition 2.1 High-tech start-ups seek access to mentors and clients. Failure to obtain these initial requests affects high-tech start-ups capability to access funding and knowledge from companies.

Proposition 2.2. High-tech start-ups' attendance to accelerator and incubator programmes facilitates access to markets and entrepreneurial knowledge spillovers that create the formation of partnerships and alliances.

The themes and the theoretical dimension of the construct “Incubators and Accelerators” are illustrated in table 5.68**.**

Table 5.68 - Theoretical Dimension "Accelerators and Incubators" and Second-order themes

Theoretical dimensions	Second-order Theme codes	Relevant Quotes	Interview	Code
Accelerators and Incubators	Mentorship and access to market	It helped me a lot; it helped me with my actual position, a phenomenal experience getting to that level and introducing me to everything. It is like an M.B.A. in some ways, fast-tracking everything you need to get started, giving me a great mentor, it set me up to continue, there are a lot of accelerators out there. I was lucky to do this, focus on that go there, and we did, and it helped us grow.	17	AC1
		I think they are great, all the ones I have been involved in have had a very rigorous curriculum, ---- I think that every entrepreneur should attend sessions where he is comfortable, and I also think that having a mentor is also useful, you can hold their hand while they are in the program, ------- so the importance is that it helps you get your first customer, your first case study, and that is where I think those programs are very useful.	31	AC2
		I find this problematic because it has helped me a lot; they are doing something interesting. They are working hard to do it. I don´t have any other opportunities to meet them, because I don't know where I would meet them, so like if you come to London from a different country or a different continent. You want to start a company here, and you don´t have a network, it is going to be EXTREMELY hard.	29	AC3
		There is a huge difference between a good and a not-so-good accelerator. Some have great mentors, access to investment, are very focused on how they form and train their start-ups and have these very many informal programs that do not have. Often their curriculum is enforced by a big sponsor, they help, but there is a large quantity that is not so good. In my opinion, only 5 out of 10 do it right.	22	AC4
		It has not changed. I will tell anybody that these programs should be avoided at all costs. It distracts you from the important things ----- for developing survival skills because, you spend a lot of time on theory focusing on stuff that is not really ---- ., and developing things that are only on books. You can't execute it, and you wind up working for someone else because nobody has a clue to what the market needs.	14	AC5
	Collaboration	Again, in this part of the incubator, we aren't active. This particular incubator is more focused as a landlord, but not as much as a collaborator with other CEOs. Does not work as an accelerator--------, but these are outside the incubator, so they are organized independently.	1	AC7
		I am very well into collaborating ----- to assist them; we are not collaborative, we're very focused on what we have to do and willing to help others if we can, in an exact fashion.	3	AC8
		We had very structured days. Our time was very well managed. We had to do weekly reports and weekly videos. I'd say my general thought is that incubators are very helpful, a place for start-ups and new CEOs to meet if they are run well. So, I think it's a very useful technique, for knowledge transfer, for networking, for stimulating business structures.	5	AC9
		We were competing among entrepreneurs --- build relationships because they had been through the process before it was challenging because you would pitch in front of 500 investors --- in Berlin or Paris or London, so the whole experience was ---- challenging and helped us build some connections we would not have built otherwise.	8	AC10
	Virtual entrepreneurial platforms	So it is a key part of what we do a stacking channel were we share with the whole company articles that are important to read or books so that type of personal development I am doing for investment.	10	AC11
		Whenever I need to learn or have a question, ------------- has a network community called ---------, where you can find anything in the ----------- community. Then the message will be sent to all the founders quickly. It is precious for all types of information.	8	AC12
	Local and international market engagement	During the program, we had to be there three days a week, and most days they would bring in people for us to meet. They'd be marketing people. --------they could be ------ management people; they could be customers. Several investors, we met a lot of V.C., and we met the chief scientist that enthusiast you, so they can talk to us.	4	AC13
		So it was a very good opportunity to start in Germany at an early stage, we were only six months old and had done various activities understanding French requirements, but as we are in England ----reach the requirements of the German market, so we said we do not want it France we want it in Germany. We have German program managers, which connected us to the German ecosystem and it a great way to understand both markets in France and Germany.	21	AC14
		Getting to -------------, they are the most significant business to business --- customer in a software company. They were a very useful partner for us, and I had just come back from Seattle (touch wood) rolling out an education program.	24	AC15
		Workshops have people who have worked on large and ambitious projects, that sometimes come from the other side of the planet to share knowledge and help you solve problems.	8	AC16

5.3.3. Alliances and Partnerships

The consistent interaction of high-tech start-ups engagement with accelerator and incubator programmes resulted in collaborations and partnerships through networking. Such activities should further orient new ventures to seek to engage in the process of creative destruction or construction (Dyerson and Pilkington, 2005; Agarwal et al., 2010). One of the first objectives is to gather feedback that would improve products' development and increase exposure to the market (AL1, AL2, AL3).

Hence, early interactions with customers and suppliers can lead to knowledge spillovers from “customers and suppliers” (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Schmidt, 2015). high-tech start-ups with experienced CEOs seek to engage in alliances and partnerships that offer win-win situations. Therefore, entrepreneurs try to gain reputation and increase technical capabilities to remain competitive (AL4, AL5, AL6, AL7). These types of formal alliances are also evaluated as forms of partnership with incumbents that facilitate access to knowledge spillovers.

Start-ups are exposed to various services provided in accelerators and incubators to improve the future development of entrepreneurial ecosystems and engagement with a community (Mrkajic, 2017). In such case, possible future extension of partnerships extended to collaborations in suppliers, clients, competitors, universities, consultants, and other research institutions (Sedita et al., 2017; Good et al., 2018). Initially, interactions with entrepreneurs in the early stages facilitate access to **entrepreneurial knowledge spillovers** that set on how to set the necessary processes to develop the company and gain funding. However, companies in the early stages have the drive to increase the company’s chances to survive by getting access to technical knowledge that facilitates innovation (AL8, AL9, AL10). Hence, we can state that start-ups seek to engage in formal alliances with incumbents and gain informal collaboration with entrepreneurs.

Further exposure to networking and pitching events are sources of knowledge to identify opportunities for start-ups to obtain insights from **competitors' technological knowledge spillovers** (Fallah, Howe and Ibrahim, 2004; Lhuillery, 2011; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). As such, literature presents the possibility for entrepreneurs to cooperate with start-ups competing in the same market (Spithoven and Teirlinck, 2015; Hájek and Stejskal, 2016). High-tech start-ups with previous links with academia seek to form partnerships with leading professors and board members that provide funding, and inclusion to Research Joint Ventures. Collaboration with universities also include internships for graduate students that would provide the necessary technological knowledge to develop product prototypes and complete contracts (AL11, AL12, AL13). Likewise, universities can provide the required infrastructure and spaces. The second-order theme “universities” include alliances formed between high-tech start-ups and academic or research institutions to develop a research project.

On the other hand, the development of projects with academia defined from entrepreneurs is formed based on CEOs' capital network before start-ups creation (Rothaermel and Ku, 2008; Link and Sarala, 2019). One of the reasons for this is that universities are not aligned with the fast-pace and timing necessary to innovate, and do not engage in a direct endeavour to form alliances with start-ups (AL14, AL15). In this case, the secondary theme code “barriers” is developed as a form of knowledge filter that prevents entrepreneurs from engaging in alliances due to the perceived unjustified resources and time required to obtain value out if agreements are made. Hence, the following proposition for the model can be stated as:

Proposition 3. Alliances and partnership enhance start-ups absorptive capacity through the exchange of knowledge spillovers. These exchanges of knowledge are conducted through the engagement of start-ups with companies and universities.

The themes and the theoretical dimension of the construct “Alliances and Partnerships” are illustrated in table 5.69**.**

Table 5.69 - Theoretical Dimension "Alliances and Partnerships" and Second-order themes

Theoretical dimensions	Theme codes	Relevant Quotes	Interview	Code
Alliances and Partnerships	Customers and Suppliers	We host events to bring in suppliers, we work with them ----------------- we try to elevate their processes --------------------------- it is essential to us to improve our supply chain constantly-------- in terms of quality, we can start working on them.	12	AL1
		We do not have suppliers; however, but the knowledge we get is feedback from our customers occasionally connections. They also contribute to our marketing because they become partners.	8	AL2
		Yes, we have started some alliances with similar platforms, our system rides on Amazon Web so --- they come and help you, they give you credit they give you a lot of things. ------------- will flag us the premium provider of all TV. Trailers, or we work with other platforms that want us to help them.	18	AL3
	Firms	Yeah so we have a partnership with our data department ---- so we share industry information all the time. ---- and we that for product or time decisions.	16	AL4
		We do, we have quite a lot of partnerships which are pretty important for us, We work with guys that have 7 or 8 ---- on their list, and we work on their hospitality tablet, so we are small and don't have a jet team, it makes sense to work with a company that is larger in a partnership because we get to share leads	28	AL5
		Essential for us because a great part of us is in partnerships, this has been very useful for us, surely if you can build partnerships where both parties have something to gain if only one is gaining it will break. But if both parties have gains, you have to have an alliance; the market is very competitive. They have to have at least a department that has the same industry. Otherwise, there is no value in that alliance.	13	AL6
		Alliances are good for young tech companies to gain credibility for customers. ----- if you want you can buy ---- from --------- people tend to think "well if they work with this guy, it is good".it is important, we are targeting a large enterprise the managers need those kinds of signals to trust you.	21	AL7
	Start-ups	To be honest, I don't have many interactions with entrepreneurs. I am very focused to do ourselves, so you know we have so much work to do, our full time is spent with our head ---- just delivering. We probably don't act as collaborators in this building on what we need to do, as many people would like us to be. We are not here to collaborate.	3	AL8
		In my incubator, there was nobody else that did what I did -- in my work there is more collaboration than competition.	7	AL9
		Sometimes within, you don't build alliances with other start-ups, you do it with bigger companies. As a start-up, you want what you do not have a site and scaling credibility with a more prominent company. It can happen in the incubator when the partner is a large company if those companies benefit from building an alliance with you.	13	AL10
	Universities	University and ---university, beyond that we are partners ---------------------- so we are partners there, we have been working with ---- which is an agricultural research university, we also received--- energy tablet --- a contract we have worked on a partnership with ---- and other innovation within the agricultural industry --- through them we have contracts with other animal feed companies.	6	AL11
		There are several universities we work with, including Crampton, -------- where I sit on the board of advisors, University of Bristol and U.C.L. so we are doing that, and we get value out of it. We are also taking interns and graduates ----------- also, we have an academic initiative ---- for academics to use in their institutions.	20	AL12
		We collaborate with Imperial college -----------research and engineering, that is one part of our service that we are looking into, so we have a strong R&D stream and a locking chain, so it is something we worked on together so ---- a prototype. However, we are still in ---- study --- working with students from the science departments.	25	AL13
	Barriers	A company like ours is highly judged when it goes on stage, we are in a very richly -------- in the broader sense of the word in a university but smart, clever people, who are not necessarily linked to an academic environment. But they academics, scientists or innovators, so the work we do is highly scrutinised, so you can't approach it naively, but to approach it in a highly intellectual way	3	AL14
		I think they should do a better job of marketing for this community; we do not interact with any university in the U.K. not because I do not want to, but because the great amount of time and resources involved. I can work with AMAZON they come out and offer solutions, that is what the universities should do here.	10	AL15

5.3.4. Absorptive capacity

The start-ups absorptive capacity refers to the company's ability to capture and implement new knowledge (Qian and Acs, 2013; Qian and Jung, 2017). Factors that increase the effects of absorptive capacity include the skillset of employees and the founders' skills (Cohen and Levinthal, 1990; Liao, Fei and Chen, 2007). Thus, it can be envisaged that accelerator and incubator programmes would enhance the start-up's absorptive capacity through knowledge transfer (Bandera, Bartolacci and Passerini, 2016; Cohen et al., 2017). First, CEOs are exposed to unintentional **tacit knowledge spillovers** that can explain how to realise small improvements or enhancements applicable to the company (AB1). Secondly, high-tech start-ups also prove to offer a source of knowledge that can support the company's development (AB2, AB3).

However, the complete absorption and implementation of expertise are restricted to the company's current level of absorptive capacity (AB3). In the early stages, entrepreneurs seek to sell refined products in the market and develop partnerships to close deals in common open spaces (Assenza, 2015). Hence, the process focuses on the development of maintaining openness with customers.

Third, accelerator and incubator programmes can influence CEOs' decision to allocate R&D budget to facilitate the absorption of technological knowledge spillovers and further engagement on product innovation (AB4, AB5). Start-ups can decide to integrate project management methodologies such as agile. Also, the inclusion of human capital embedded marketing and business knowledge that indirectly on start-ups development. Thus, it can be stated that start-ups on the seed stage of their lifecycle seek to capture **customer knowledge spillovers** to support the development of technological product innovation (Zedtwitz, 2003; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Cantù, 2017). Hence, the secondary themed dimension "knowledge absorption" is defined as the active capture and implementation of technological and customer knowledge. The dimension includes all enhancement and possible strategic alignments taken by entrepreneurs to adopt the new venture's production processes.

The founder's first decision is to increase explorative technological capability through training or hiring human capital (Forés and Camisón, 2016; Shafique and Kalyar, 2018; Audretsch and Belitski, 2019). Therefore, companies purposefully seek to gain **technological knowledge spillovers** to replicate machinery, ICTs, and IT (AB6, AB7). Also, the R&D budget is allocated to attracting potential clients through technological visualisations such as roadmaps (AC8, AC9). The hired human capital needs to have the required skill set and knowledge to support a constant innovation process. Hence, the secondary dimension “human capital” as hired employees of the start-ups engaged in R&D and product innovation (Narula and Santangelo, 2009; Spithoven and Teirlinck, 2015).

High-tech start-ups tend to focus their resources and research to engage in active product development. From one point, companies would actively seek to gather knowledge from formal alliances with companies (Lee, Johnson and Grewal, 2008; Martín-de Castro, 2015). However, the direct engagement with the market and relation with customers can prove crucial for enhancing the performance of high-tech start-ups (Calantone and Rubera, 2012; Tzokas et al., 2015).

The interviews suggest that high-tech start-ups' main driver is to seek and develop an initial prototype that enables the company to conduct continuous testing with customers and engage on Product Development Cycles (AB10, AB11, AB12). However, entrepreneurs with academic experience will research to develop a product with commercial value (AB10). On the other hand, entrepreneurs with industrial and entrepreneurial backgrounds seek to gather knowledge spillovers from the market to engage in exploitative innovation (AB11, AB12).

Moreover, high-tech start-ups use ICTs to set and use virtual platforms to maintain a channel of communication with customers and start-up communities from the accelerators. These technological tools act as a mechanism to continuously gather **explicit knowledge spillovers** (AB13, AB14, AB15). The technical complexity of the ICTs and IT tools used depends on the types of industry that the start-up is involved in (Lasch et al., 2013). The data suggest that CEOs do not necessarily use high IT engines to gain access to knowledge (AB13, AB15). However, the exchange of knowledge is limited to the level of openness and trust necessary between both parties. It is good to mention that the second-order theme “virtual platforms and search enginers” compile all the actions taken by the entrepreneurs to gain access to explicit knowledge spillovers using ICTs. Therefore, the

Absorptive Capacity proposition is stated as follows:

Proposition 4. High-tech start-ups hire skilled human capital to increase entrepreneurial absorptive capacity directed to identify technological knowledge spillovers. The new venture competence using IT and ICTs are destined to engage in ongoing product innovation.

The themes and the theoretical dimension of the construct "Absorptive Capacity" illustrated in table 5.70.

Table 5.70 - Theoretical Dimension "Absorptive Capacity" and Second-order themes

Theoretical dimensions	Second-order Theme codes	Relevant Quotes	Interview	Code
Absorptive Capacity	Knowledge Absorption	Every time ------ there's always an idea, that in every situation, that somebody says something. It's not a fundamental change of strategy, but it's an improvement, an enhancement, a twitch, a minor realignment and I perceive ---- into that. I'm constantly listening to that, that's very hard for certain team members to cope with.	3	AB1
		Yeah, Microsoft would be one ----- but all the team absorbs knowledge, especially the younger graduates. I do tell them to go on courses ----stuff, sign up to these broadcasts, get as much information so we can short cut or create shortcuts, no point in developing something that has already been developed, you use that absorption of knowledge to mousetrap what we do	24	AB2
		I did not have to. I was getting so much knowledge already that I could rely on, and that was enough. We started working in a co-working space at some point they tried to involve us, but the level was not the same. There are a lot of people trying to build ecosystems that they think will work out, ----------------------------------- they have a kind of an advantage.	10	AB3
		I believe in agile process ---- building something for five years and then something your clients don't want. I believe in communication, so the better you communicate, the better your clients will feel that you want to communicate with them and build the products they DO want to use. ---- A nice to have a tool, but it is not what I paid you for. And they have to quit because they have to build the product in 6 months.	18	AB4
		What you have now in technology will be obsolete in a year or behind the year's curve advance. Hence, no matter how small you are you always have to have a budget for R&D. The program helps you think in new ways, so you are not only looking at your way, you are happy to see things done differently. You have to have a starting word; our starting word is the word from our customers. --------, we have to see if we can build that feature into our product. ----- We do not do it as a formal service, but we are listening to our customers. That is where it starts from, and then we speed it to the product team, which speeds it to the technical team, the product does the research.	13	AB5
	Human Capital	Well, we create our knowledge, the key thing is recruiting the right people, with the right experience and the right knowledge ---- were developing a ------- manufacturing process, I can't buy that technology I can't go out and buy that technology, you develop it yourself, and you need people, skilled individuals, to be able to do that. You have to equip these people.	2	AB6
		We have a dedicated R&D. Department, which counts with four people and we undertake a series of investigations background scientific research on virgin technology trends. Then we look towards how we can commercialise our ideas.	26	AB7
		We are three major pillars in the company — 1 marketing and sales. We have to explain to potential clients the problems and solutions of their businesses, R&D: engineering and technology. When you build a software company 2/3 of your company are engineers, doing research, looking for new ideas.	21	AB8

Theoretical dimensions	Second-order Theme codes	Relevant Quotes	Interview	Code
	Product development	We have a very strict budget; we divide work, resources, intercourse way for a part; our relief is usually 33 %. So the R&D will be what we need to develop the product we progress on our work, on what we want to deliver at any one time and the impacts it feels now, and then we re-design a road map to work with those directional timelines.	27	AB9
		So the approach you take is: you develop that technology, you develop it to a standard that meets the nature of the requirements basically, so you take something that is purely research-based that may have fundamental issues and the original design and some technology used, and you fix that so it's suitable to a commercial environment	2	AB10
		It´s a small start-up, mainly it's getting customers in all the time. Probably two a week, we get customers and do testing. So, we build something, test it with them, get feedback and change it. That´s how. It´s customary engagement rather than…. mostly it´s directly with customers.	5	AB11
		Mainly by my co-founder James and me. We are in the development stage now, but we have to do a lot of research; customer behaviour, other products that work well in parallel industries -----. Purely for testing purposes, we probably spent 15.000 on that. That is the most we have spent on a project --- which we scrapped and are now starting from scratch.	16	AB12
	Virtual platforms and search engines	Well, I suppose all the classic one: Google researches a couple of universities with free academic tools. One of the criticisms I have of my research team is that they are not very good at discovering stuff.	24	AB13
		We have a data analysis tool; we have various apps, what the people want. And we use GIROB to handle the R&D, project management Q.A., and delivery, we also use confluences, we can media a platform to capture data, and then make sure we don't repeat ---- it is written somewhere where we can have a look.	19	AB14
		We use ------------ to organise anything we do ----------------- that is part of them to do when I come across something interesting on a personal level. I use pinboard to track the possible links.	8	AB15

5.3.5. Knowledge Spillovers

Based on all the theory's conception, it is imperative to distinguish a proposed theoretical taxonomy of knowledge spillovers (Hennink, Hutter and Bailey, 2011). The initial theoretical foundation is to consider the classification of tacit and explicit knowledge (Nonaka, Toyama and Konno, 2000; Bandera, Bartolacci and Passerini, 2016). Also, identifying patterns between knowledge spillovers, and the aggregate theoretical dimensions identified from the data from the interactions between individuals (Okhuysen and Eisenhardt, 2002; Ko and Liu, 2015a; Eisenhardt, 2016). Therefore, the initial focus from uncovering a clear knowledge spillovers definitions is not based entirely on the different types of industry, but to identify and highlight possible effects of knowledge spillovers from research on start-ups (Kaiser, 2002; Schmidt, 2015; Cantù, 2017).

The initial starting foundation is to consider that the entrepreneur's initial background acts as an indicator of the company's initial absorptive capacity. Such an identification process would uncover the interpretation of technical and non-technical knowledge spillovers to increase the new venture's performance (Nielsen, 2015). The business's initial evaluation can come from the tentatively shared experiences of the company founders (Audretsch and Stephan, 2006; Agarwal and Braguinsky, 2015). The entrepreneurs would also have the opportunity to identify entrepreneurial opportunities from knowledge spillovers obtained from entrepreneurial, industrial, or academic experience (Stam, 2013; Guerrero and

Urbano, 2014; Link and Sarala, 2019). As such, CEOs' pre-established network capital sets the conditions to obtain funding and form alliances (Narula and Santangelo, 2009; Huggins and Thompson, 2015).

In academia, the identification of the idea that arises from academic research is considered a form of institutional knowledge spillovers (Hájek and Stejskal, 2016). On the other hand, entrepreneurs coming from the industry rely on technological knowledge spillovers to identify gaps in the market and customer needs. In such cases, entrepreneurs can decide to break the chain and create a new company (Audretsch and Stephan, 2006; Tsvetkova, 2015). In both cases, entrepreneurs may decide to evaluate their business idea by developing meetings with experts in the field, or by issuing tentative surveys and interviews to potential customers (Hallin and Holmstro, 2012). These can be both a form of local or international market knowledge spillover (Hájek and Stejskal, 2016; Cantù, 2017).

There is also a third initial form of entrepreneurial knowledge spillover, which sees entrepreneurs identifying a gap in the market based entirely on their ability to identify a missing product or service that has not been introduced in the market (Cantù, 2017). In these cases, start-ups can prefer to engage the market by developing an original product presented to potential customers. In this case, non-experienced entrepreneurs have to gain insights from experienced and entrepreneurs to set the company and obtain funding from investors related to the second-order theme “funding” (KS-TX-EKS-FND1, KS-TX-EKS-FND2, KS-TX-EKS-FND3).

Next, start-ups exploit their absorptive capacity to increase their exploitative discovery of entrepreneurial opportunities (Pauwels et al., 2016). Hence, during the start-up development, the CEO can decide to enter the accelerator or incubator programme for access to **business knowledge spillovers** from other entrepreneurs. Hence, entrepreneurs undertaking the accelerator programme can access how to set the required documentation and gather insights into governmental regulations to share the market. All these types of knowledge spillovers gathered from the programme and networks are illustrated in the secondary coded theme “**business knowledge**” (KS-TX-EKS-BK1, KS-TX-EKS-BK2, KS-TX-EKS-BK3, KS-TX-EKS-BK4, KS-TX-EKS-BK5). The main effect of this part is to increase the potential increase in the company's capability to set strategic goals. Hence, CEOs can be exposed to **technological knowledge spillovers.** The second-order theme “Funder tacit knowledge” founders with previous experience in this filed would have the technical advantage that facilitates to increase the competitive edge of the start-up (KS-TX-TKS-FTK1, KS-TX-TKS-FTK2, KS-TX-TKS-FTK3). Next, the second-order theme “patents” enables the entrepreneurs to gain specialised knowledge discussed in-depth with expertise in the field (KS-TX-TKS-P1, KS-TX-TKS-P2, KS-TX-TKS-P3, KS-TX-TKS-P4, KS-TX-TKS-P5). However, this form of explicit knowledge spillovers is mostly used for companies in the biotechnology sector.

On the other hand, other sources of tacit technological knowledge spillovers can be funded on individuals' access to experience (Ding, Liu and Song, 2013; Schmidt, 2015). The first primary source is defined in the second-order theme “consulting”. Entrepreneurs gather insights from the industry by interacting with specialised mentors, customers, and networks that discuss and expand on current ICTs and IT (KS-TX-TKS-CO1, KS-TX-TKS-CO3, KS-TX-TKS-CO4, KS-TX-TKS-CO5). The second primary source is defined in the themed code “hiring human capital”. In such instance, CEOs and the founders of the company seek to hire specialised human capital with specific technical knowledge that enhances the company's base knowledge (KS-TX-TKS-HUC1, KS-TX-TKS-HUC3). Notably, the companies involved in software and programming seek human capital that is knowledgeable to the usage of coding languages, search engines, machine learning, and application of virtual platforms (KS-TX-TKS-HUC4, KS-TX-TKS-HUC6, KS-TX-TKS-HUC7).

IT knowledge spillovers is defined in the second-order theme “open source” gathers information by extracting available libraries, virtual magazines, and the exchange of knowledge through ICTs (KS-TX-ITKS-OS1, KS-TX-ITKS-OS2, KS-TX-ITKS-OS3, KS-TX-ITKS-OS4). The application of these technological tools set an adequate pace to enter international markets, breaking geographical proximity boundaries (Baptista and Mendonça, 2010; Lasch et al., 2013). Indirectly, **explicit and supplier knowledge spillovers** is accessible through the utilisation of technologies to maintain constant communication. In contrast, **public and institutional knowledge spillovers** are attainable through the access to content on the web, and access to academic publications. Finally, it has been a clear pattern that exposure to **international knowledge spillovers** is a factor that causes the transition of start-ups from the seed to the growth stage (Cantù, 2017; Kuratko and Hornsby, 2018). Companies engage in international markets and focus on developing scalable products. Therefore, it is suitable to state the following propositions as follows:

Proposition 5.1. Tacit and explicit knowledge spillovers of the CEO and engagement with the market and industry expertise enable the evaluation of initial business ideas that trigger start-ups' creation.

Proposition 5.2. Tacit and explicit knowledge spillovers caused by partnerships and alliances, through virtual platforms and search engines, enable continuous product innovation.

5.3.6. Innovation

The previous analysis of themes has focused on formal networks and formed a collaboration with customers that facilitate the engagement in the product innovation effort in existing markets (Nieto and Quevedo, 2005). However, in many of the cases, CEOs' strategic approach is not to enter directly in the engagement in the activities on a process of disruption, but to engage in the design and development of revolutionary, innovative products that offer a service using technological tools in unexploited markets. The data has suggested that CEOs' primary imperative goals are to sustain funding and product development (Debrulle, Maes and Sels, 2014; Qian and Jung, 2017). Hence, companies do not seek to engage in the innovation of processes, or actively be part of a more prominent company as a process of creative destruction engagement (SU-FU1, SU-FU2, SU-FU3, SU-RE1) (Agarwal et al., 2010; Tsvetkova, Thill and Strumsky, 2014).

On the other extreme, entrepreneurs aim to gain a high valuation of the company and be the absolute leader in local and international markets (CD-GR1, CD-GR5; CD-VL1, CD-VL2). Hence, the possible effect that accelerators and incubators cover for entrepreneurs is valuable collaboration and alliances between companies. Thus, start-ups seek to gather **base technological knowledge** to engage in ongoing product innovation (Wang and Shapira, 2012; Cohen et al., 2017).

The interviews confirmed that product development depends on the age of the company, the entrepreneur's background, and their level of absorptive capacity (Debrulle, Maes and Sels, 2014; Tzokas et al., 2015; Chaudhary and Batra, 2018). For instance, on the company's initial seed stages, early-stage CEOs' perception is that the early engagement on exploratory innovation and alliance formation can end up disrupting and misleading the process of developing the necessary foundation of the company (IN1, IN2, IN3, IN4).

Therefore, the development of informal collaborations and exploitation of current technologies can provide more value for the company (IN3, IN4).

Therefore, innovation can be limited to the potential defined second-order theme "barriers" based on current resources and the company's current development stage. Once the adequate sources of knowledge are established, CEOs would use technological expertise gained from various sources of spillovers to enter the market. Therefore, the data suggest the necessity to engage in "technology adaption" as a secondary order theme, as a process of implementing current technologies to gain a competitive edge in unexploited markets.

Start-ups that decide to engage in alliances or informal collaborations seek to establish learning practices (Gebauer, Worch and Truffer, 2012; Hájek and Stejskal, 2016; Belderbos et al., 2018). Thus, start-ups can obtain business knowledge spillovers when setting the proper strategy to engage with individuals, businesses, or governments, enter the market, and learn how to innovate (IN5, IN6).

Consequently, factors such as acquiring human capital to increase absorptive capacity, establish the formation of alliances, and the resources provided from the accelerator and incubator programmes, lead to the development of product innovation, while the development of processes enhanced through **business knowledge spillovers** acquired from companies (Zedtwitz, 2003; Mrkajic, 2017). Hence, the second-order theme "process enhancement" encompasses the use of adequate implementation of knowledge spillovers during the product development cycle.

The data suggest that the primary mechanisms for engaging in an innovation process are to conduct initial experiments using **knowledge spillovers** acquired from various sources in different formats. The development of the product life cycle incorporates prototypes and constant enhancement of technological features (Ho et al., 2011; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Once in development, the process requires a project team to continually monitor timing and implementation to get to the market efficiently and continue cycling through the process by sharing constant information and data (IN7, IN8) (Nieto and Quevedo, 2005). To keep the innovation process alive, start-ups have to focus most of their financial funding on these projects. However, this factor can also be considered as a significant problem in the long term if it is not managed correctly (IN9, IN10).

Start-ups aim to continue expanding the company further by developing products and services in international markets (Cantù, 2017). Hence, the potential to engage in a constant process of export intensity, or just on based on obtaining feedback from customers on current prototypes, and on the start-up's current stage and engagement with incubators or accelerators (Blind and Mangelsdorf, 2013; Lukeš, Longo and Zouhar, 2018). Hence, start-ups engaged in a constant speed process of product innovation that focus on developing products with a high level of quality are part of the themed code “growth” (IN11, IN12).

The backbone that maintains the company on its development is heavily dependent on the second-order theme “funding” of R&D to develop prototypes (IN9, IN10) continuously. Therefore, it is suitable to state that the dependent variable and first-order theme of the conceptual model is “product innovation”. Thus, the usage of patents is limited to its usage on biotechnology and highly technological high-tech start-ups as an input of **explicit knowledge spillovers** or a protection mechanism that prevents appropriability. Hence, it can be stated that high-tech start-ups are highly motivated to engage initially in product innovation.

The themes and the theoretical dimension of the construct “Innovation” are illustrated in table 5.71.

Table 5.71 - Theoretical Dimension "Innovation" and Second-order themes

Themes	Theme codes	Relevant Quotes	Interview	Code
Innovation	Barriers	No, not yet because we are in a phase ----- so we can't get ---------------- manufactured somewhere else, but there is a potential to do much in the future. We have investigated exploiting ------------- because through the open innovation, they have a group that collaborates with small biotech Start-ups. In that science park, but you can establish through contracts, you can establish the options to use ----- on technology --------- and it benefits small start-ups, so you can use it and later the data they need--- and they make the decisions buying equipment.	2	IN1
		For me to remain focused is more important than to build alliances. It is nice and cute but if you are innovating you have things that none have. And the world's vision on how it should work, you want to keep it to yourself. Unless there is, a commodity derived. I did not look into that too much.	8	IN2
	Technology adaptation	Innovation for us is how we go on the market or the prize we are building for the market. The innovation is not in the technology; it is put together and presented to the World. What we did was look at the problem, the challenges presented, how can we make it better, ok it needs 3 or 4 components, ok, so how we combine those components in one innovator solution and that is pretty much what we have done we have found an innovative way to face that problem and what we have learned is that it is not only for international trade.	27	IN3
		If you look at what somebody else is, doing it could benefit you …spot an idea, or just try something different. So if you look at the music industry, you see how this is and why is that and you can see how to apply it and better your product. If I had a stronger resource, I would probably do that…. Yes, taking inspiration and see how and where you can apply it.	12	IN4
	Process enhancement	They shared a lot, they gave us a lot of time from senior executives, well organized by the…... They want to show to their staff that they are working with start-ups. They said to us that they wanted to learn as much as how you work, as what you are doing.	5	IN5
		A major put up in our business strategy because learning from them and seeing how much value we can bring to them made us realise that working with big start-ups. Was going to be better than standing on the street and maybe trying to build our branch. Our focus has changed from B to C, to B to B to C. the whole business probably has to change because of our strategy.	5	IN6
	Experiments	We once commissioned a project with a formula one engineer, expert in simulation, so taking formula one expertise and bringing it to the used car market is never done before. That was my first experience seeing innovation as a possibility at that time.	9	IN7
		I listened to a postcard last October, and I came to the office and said let's try this experiment, and it took four weeks to try it, and it proved to be a great success. Experiments are the main mechanism that we use; we have a control team to match the result with the experiment, according to results we see if we proceed.	10	IN8
	Funding	Essentially the financial role of any startup is the huge problem for the first couple of years, -----------------------, in February we decided to drop the funding and concentrate on the product, I had to use the plan B because we had run out of money, but we are still around thanks to me. In September, I prepared the ground for the hard landing.	18	IN9
		The funding that we got until now has gone to build our prototype, on further R&D, as we were working with Imperial students, there was no budget allocated. Until now ----- how we invest the money.	13	IN10
	Growth	We would like to grow and move from the U.K. to the U.S. in general terms. But we want to build products that innovate --------- driven more ----- giving the right product to the right people ---------- that is the most important to us than anything else to see an idea grow to an actual product that the people love. Because of it you see the industry change you become a start-up ------------ to see growth in the right way.	18	IN11
		We could not grow fast enough to have enough supply because we were a linear model and became a market place model. That was an innovation in our industry, how we source products ---- and being in 200 different cities can only be done with innovation. That was the 2nd level of strategic innovation that we made from a 10-million-dollar company to a 50 or 100-million-dollar company	12	IN12

5.4. Conclusions

The qualitative analysis chapter's objective was to develop a conceptual model (Ivankova, Creswell and Stick, 2006). This approach enables generalising the data further and covering the replicability of the model with a general population and avoiding bias (Johnson and Onwuegbuzie, 2004; J A Maxwell, 2013). In this case, the multiple case study planned approach was aligned to obtain potential replicability from the transcripts (Gräbner and Eisenhardt, 2007). In this case, the analysis leads to identifying theoretical dimensions and second-order themes that can potentially be used to build the quantitative model (Strang, 2015).

The analysis of the data enabled to identify potential theoretical dimensions and second-order themes. That provides an initial insight developing a Confirmatory Factor Analysis that allows obtaining a generalisation and prediction based on the interpretation of recent quantitative research (Dasgupta, 1990; Blunch, 2013; Creswell, 2014; A P Field, 2018). By stating propositions and identifying the potentially associated variables, the chapter has established a rich grounding for further research of knowledge spillovers at the individual entrepreneur level (Stuetzer et al., 2017). The chapter has also provided a clear initial taxonomy of knowledge spillovers that can be extended for further research.

The research findings also suggest that the founders' network capital is not limited to the cluster of knowledge generated from universities and companies (Audretsch and Lehmann, 2005; Colombelli, 2016). The findings suggest that interactions with entrepreneurs are the primary source of local tacit knowledge spillovers that support the company's funding and the obtention of grants (Hayter, 2013; Cantù, 2017). Also, company founders seek tacit or explicit knowledge spillovers to further validate the business idea (Qian and Acs, 2013; Cantù, 2017). In doing so, they employ mechanisms to remove uncertainty such as conducting market research by testing the product, analysing interviews or surveys, and gaining insights through one-to-one discussions with industry experts.

The model also sheds further light on the available sources of knowledge spillovers and the mitigating impact on start-ups of accelerator and incubator programmes. The findings suggest that general business knowledge spillovers are shared among entrepreneurs during their accelerator programme, which builds a community that can be harnessed as a pool if tacit and explicit knowledge spillovers, forming a previously overlooked entrepreneurial ecosystem (Audretsch and Belitski, 2017; Renski, 2017). However, the findings suggest that high-tech entrepreneurs who have acquired sufficient network capital and a high valuation of their business idea often seek to bypass the entrepreneurial opportunities that can be attained during accelerator and incubator programmes. Also, high-tech start-ups frequently decide to engage in partnerships or further alliances with companies and customers that enable them to gain business and technological knowledge spillovers, as well as a reputation for obtaining contracts and additional funding. Moreover, collaboration gives a constant transmission of tacit knowledge spillovers and tests products via continuous interactions enhancing the product development lifecycle. Also, new in the observation that a selection of technological knowledge spillovers from alliances, collaborations, and international customers is transferred through virtual platforms and start-up communities (Narula and Santangelo, 2009; Audretsch and Link, 2017). High-tech start-ups also use these various technological platforms and search engines to access explicit knowledge spillovers from the public domain (Nieto and Quevedo, 2005). These forms of knowledge transition break the limitations of geographical proximity between companies and entrepreneurs.

The qualitative chapter has provided evidence that high-tech start-ups in the early stages of development focus their endeavours on product innovation, rather than business formation. Companies' emphasis is to allocate funding to R&D to hire human capital with the required technological knowledge to exploit virtual platforms and search engines (Vivarelli, 2004; Santarelli and Vivarelli, 2007). The primary indicator at this stage of development is engagement with customers in local or international environments. This research has illustrated that start-ups focus their attention on using current technologies to innovate by providing products and services that cover a market gap. They will then continue innovation until a new product is developed and introduced in the market. The results suggest that once a start-up has engaged with international markets, there is an increased growth that can be lead to the transmission from the seed stage to the growth stage (Zedtwitz, 2003; Cantù, 2017).

The qualitative chapter has identified critical insights that can be valuable for policymakers on the roles and effects of accelerator and incubator programmes on high-tech start-ups. First, incubators and accelerators are essential in delivering specialised knowledge, and so such programmes must aim to secure for and assist in the economic growth of start-ups

(Mrkajic, 2017; Sedita et al., 2017). Hence, governmental policies should enforce processes that support companies' funding and track the subsequent performance of companies (Sedita et al., 2017). Growth indications in start-ups include increased hired human capital, investment in R&D by the company on technology, and formal entry on the market. Second, the selection should focus on specific criteria for companies attending accelerator programmes. For instance, programmes have to consider the regions, technological background, and the stage of the company (Zedtwitz, 2003). Our data suggests that companies in the growth stage heavily focus on using virtual technologies to gain technological knowledge from product innovation. Further effects require exploration to consider how to maximise high-tech start-ups' exposure in the seed stage to international markets (Cantù, 2017).

6. CHAPTER VI QUANTITATIVE ANALYSIS

6.1. Introduction

This chapter provides a novel model that evaluates formative knowledge spillover dimensions on absorptive capacity and product innovation. This phase's conceptual model is developed in this Chapter from the literature and guidance for the qualitative analysis and the development of model KST-QLEM2 developed in Chapter V that linked potential and realised absorptive capacity with innovative exploration and exploitation. The research also assesses the effect of incubators and accelerator programmes on new ventures. Chapter VI continues the analysis by using the qualitative phase's guidance to define the constructs and hypothesis to test using Factor Analysis and Partial Least Squares Structural Equation Modelling.

The researcher tests and identifies when incoming and network knowledge spillovers are used to support product innovation. The data was collected from 556 entrepreneurs to test the model among high-tech, knowledge-intensive high-technology services (KIBS), and Knowledge-Intensive Market Services (KMS). The analysis was conducted using Partial Least Squares to evaluate the effects of reflective and formative factors.

6.2. Quantitative Model and Definition of Constructs

This section is dedicated to providing definitions and models used in the quantitative phase. The selection of the construct was guided by model KST-QLEM2 developed in Chapter V.

6.2.1. Absorptive Capacity

Absorptive capacity recognises a company or individual's ability to identify new knowledge and implement in towards the generation of economic growth (Jansen, Van Den Bosch and Volberda, 2005; Flatten et al., 2011). The construct of absorptive capacity evaluated from various perspectives, from the assessment of R&D from the company from single or multiple variables to the exposure that employees have with the external environment (Nieto and Quevedo, 2005; Jiménez-Barrionuevo, García-Morales and Molina, 2011).

One of the new approaches is to measure absorptive capacity as a process where companies engage in knowledge acquisition, assimilation, transformation and exploitation.

The absorptive capacity first relation to knowledge spillovers is of a mediator and mediator construct between the companies R&D and competitors spillovers used to generate technological knowledge (Cohen and Levinthal, 1990). Research further extended absorptive capacity usage by taking indicators of employees' education and engagement of R&D projects that improve existing products and protect knowledge (Cassiman and Veugelers, 2002; Nieto and Quevedo, 2005).

Both research papers define the construct of **Incoming spillovers** as sources of knowledge such as conferences, patents, journal articles, meetings, trade shows and seminars (Cassiman and Veugelers, 2002; De Faria, Lima and Santos, 2010). Absorptive capacity extended to solidify R&D intensity is necessary to gather knowledge spillovers through collaboration (Belderbos et al., 2004; Veugelers, 2016). Belderbos et al. (2004), further extend relationships of absorptive capacity to distinguish between knowledge spillovers source.

First, **Institutional knowledge spillovers** include universities, research institutions and research centres as sources to gather information, while **incoming spillovers** extended to companies in the supply chain and individuals (Belderbos et al., 2004; De Faria, Lima and Santos, 2010). Hence, the compilation of an initial taxonomy identified as a customer, competitors, suppliers, institutional and public knowledge spillovers (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). However, the initial restrictions on these variables are restricted to SMEs and analysis using probit models (Belderbos et al., 2004; De Faria, Lima and Santos, 2010). These indicators can act as a proxy for the development of knowledge spillovers.

The interrogator raises to question if the variables used to evaluate start-ups and SMEs. First, absorptive capacity on start-ups starts to depend on the CEOs or founders of the company (Debrulle, Maes and Sels, 2014). Absorptive capacity variables seek to evaluate how the economic agent captures and transfers knowledge to the organisational units of the company (Debrulle, Maes and Sels, 2014; García-Sánchez, García-Morales and Martín-Rojas, 2018). Hence, absorptive capacity is initially evaluated on the processes of knowledge transformation and sharing in the company and comparing it to product and process innovation and identifying opportunities (Shu et al., 2014).

Another approach has considered not to evaluate the operations of knowledge absorption in the company but to assess CEOs and founders' abilities and skills to break the knowledge filter and create a new venture (Qian and Jung, 2017). In particular, let to an initial indication of linking the effect that absorptive capacity can be directly related to product and process innovation (Liao, Fei and Chen, 2007). The extension of research on absorptive capacity effects of change has integrated the moderator of the impact on the access to virtual communities (Roberts and Dinger, 2016). The unidimensional construct proves to directly affect radical, incremental, exploratory and exploitative forms of product innovation (Roberts and Dinger, 2016; Flor, Cooper and Oltra, 2018; Su and Yang, 2018).

The absorptive capacity conceptualisation sought to define it not a single unidimensional construct, but as a multidimensional variable conformed by the two later constructs of Potential Absorptive Capacity (PAC) and Realised Absorptive Capacity (RAC) (Zahra and George, 2002; Limaj and Bernroider, 2017). PAC compromises the company's acquisition and assimilation capabilities and processes to gather knowledge from external sources such as suppliers and customers (Camisón and Forés, 2010; Flatten et al., 2011). RAC refers to the ability of the company to be able to integrate and renew the stocks of knowledge of the company towards a product, process or managerial innovation (Camisón and Forés, 2010; Jiménez-Barrionuevo, García-Morales and Molina, 2011; Ali, Seny Kan and Sarstedt, 2016).

These construct alights to knowledge spillovers evaluation are the variables linked to acquisition and transformation evaluate the exchange of information through informal meetings, reports, and data that are forms of tacit and explicit knowledge spillovers (Jiménez-Barrionuevo, García-Morales and Molina, 2011). Hence, the absorptive capacity construct is used as a single or multivariable construct that is sequential and enables flexibility to evaluate knowledge spillovers (Huang et al., 2015; Lau and Lo, 2015; Forés and Camisón, 2016; Maldonado et al., 2018).

Absorptive capacity also evaluates individuals working in the company (Enkel et al., 2017). The assessment of knowledge depends on the individual capability od learning and implementing an appropriate mechanism that facilitates the development and expansion of the main findings (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Enkel et al., 2017). The multidimensional perspective of absorptive capacity takes three main processes (ACAP) similar to the PAC and RAC (Tzokas et al., 2015).

First, exploratory learning defines the identification of external knowledge from the market and technological environments. The motivation and skillset of employees enhance this technical capability of the new venture. Exploratory learning aligns with the KSTE on the monetary evaluation of knowledge spillovers that enforces the idea of breaking the knowledge filter by starting a new venture (Acs et al., 2004; Audretsch and Lehmann, 2017).

Secondly, Transformative learning or assimilation focuses on the combination and transformation of knowledge in the company between the employees and the new start-up databases (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016). The conversion of knowledge centred on the internal identification knowledge that enables identifying opportunities in the market and the utilisation of new technologies to satisfy the customer's needs (Tzokas et al., 2015). Finally, exploratory learning measures the company's capability to be able to use technological knowledge towards product development and creation (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016).

Absorptive capacity has been direct .in contrast to companies' performance and innovation capabilities (Ying and Liang, 2008; Limaj and Bernroider, 2017; Maldonado et al., 2018). The critical factor that defines which approach to take comes from attempts of previous research on start-ups to use realised and potential absorptive capacity to evaluate effects on organisational performance and product innovation (Jiménez-Barrionuevo, García-Morales and Molina, 2011; Forés and Camisón, 2016; Zobel, 2017; Chaudhary and Batra, 2018).

In this research, the qualitative and literature findings suggest that high-tech start-ups focus on product innovation rather than process innovation in the seed and growth stages. Moreover, the interaction between the multivariable construct of absorptive capacity and product innovation tested with SMEs and start-ups (Forés and Camisón, 2016; Enkel et al., 2017; Limaj and Bernroider, 2017). Therefore, the hypotheses are stated as follows.

H1a: Realised Absorptive Capacity has a mediator effect between Potential Absorptive Capacity and exploratory Innovation.

H1b: Realised Absorptive Capacity has a mediator effect between Potential Absorptive Capacity and exploitative Innovation.

H1c: Potential Absorptive Capacity has a positive effect on Realised Absorptive Capacity

The clear statement that knowledge spillovers are related to absorptive capacity R&D is reflected in the usage of potential and realised absorptive capacity based on the interactions with customers, suppliers, customers, and institutions (Belderbos et al., 2004).

6.2.2. Explorative and Exploitative Product Innovation

Initially, the evaluation of companies' innovation is measured, taking into account the absorption of external flows of information defined as incoming knowledge spillovers (Belderbos et al., 2004). The effect of proper usage of knowledge spillovers reflects on the start-up's capability to remain competitive in the market (Da Rin and Penas, 2017). The clear component that enables constant development of new products while reducing risks to enter a new market is highly dependent on the company's absorptive capacity. Therefore, one of the main variables to assess the phenomenon is the R&D intensity dedicated teams of employees assigned to product innovation (Tsvetkova, Thill and Strumsky, 2014). Innovation can also depend on the number of activities dedicated to conducting cooperation with other companies and institutions (De Faria, Lima and Santos, 2010).

However, innovation cannot just be measured by the number of patents generated at the regional level due to the limitations that start-ups have during the first five years of the seed stage (Tsvetkova, Thill and Strumsky, 2014; Cantù, 2017). Hence, innovation on product development is linked to the company's absorptive capacity to assimilate and implement technological knowledge from cooperation and the internet (Worren, Moore and Cardona, 2002). An initial set of variables that enforce a firm's performance is the clear establishment of business plans to set goals and the entrepreneurial environment that can facilitate how to solve problems

Knowledge spillovers effect on companies has evaluated how companies engage in R&D activities with customers, suppliers, and institutions towards the innovation of products and processes (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Innovation is tested with knowledge sharing through the exchange of documents and the evaluation of the organisation's innovation performance compared to competitors in the same market (Ritala et al., 2015). This process led to initial evaluations on using knowledge sharing through cooperation and the company's absorptive capacity to assess start-ups and knowledge-intensive firms on the product, process, and managerial innovations (Liao, Fei and Chen, 2007). Hence, companies are evaluated from the capability to develop products by means that enhance the company's financial performance (Worren, Moore and Cardona, 2002). In this process, entrepreneurial orientation and exploratory innovation are used as mediators or dependent variables (Worren, Moore and Cardona, 2002; Su and Yang, 2018). The company's direction considers the openness of the company to be open to new ideas through spending time to foster a connection to engage in exploratory innovation (Su and Yang, 2018).

On the other hand, research on firms takes knowledge sharing take it as a form of partnership to evaluate firms' capability to engage in radical and innovation introduced in the previous five years of operation (Bouncken and Kraus, 2013; Roberts and Dinger, 2016). Revolutionary innovations are considered technological breakthroughs and enhancement on the characteristics of products that can create a new necessity for customers.

Radical innovation involves the absorption of external knowledge sources to enhance the company's current production lines to improve on the current characteristics of products (Bouncken and Kraus, 2013; Roberts and Dinger, 2016). However, one of the flaws of using these constructs to evaluate start-ups is the predefined requirement that companies need to be already engaged in the market or have long-established processes to support product innovation. In this research, new ventures in the seed stage attend incubators, accelerators, and science and technology parks intending to build networks and business processes that increase survival chances (Cantù, 2017; Good et al., 2018).

The evaluation of the effects of absorptive and realised absorptive capacity could impact the explorative and exploitative innovation of SMEs and start-ups (Jansen, Van Den Bosch and Volberda, 2005; Enkel et al., 2017; Limaj and Bernroider, 2017). These two constructs, alongside PAC and RAC, provide a more consistent measure to evaluate further effects of tacit and explicit knowledge spillovers in contrast to a continually changing market, exposure to other cultures, and to consider the exposure to international markets (Limaj and Bernroider, 2017; Maldonado et al., 2018).

Exploratory innovations seek to explore new forms of technology that require extending current types of operations and knowledge absorption (Enkel et al., 2017). This endeavours can be attained through knowledge spillovers by developing prototypes, constant communication between the team, connections, and the organisation's motivation to engage in product innovations (Gnyawali and Srivastava, 2013; Assenza, 2015; Hohberger, Almeida and Parada, 2015). Explorative innovation focuses on the possible creation of a new market that can be explored and discovered in the process (Enkel et al., 2017). Therefore, it is possible to establish the following hypotheses of the model:

H2a: Potential Absorptive Capacity has a positive relationship with exploratory innovation on high-tech start-ups.

H2b: Realised Absorptive Capacity has a positive relationship with exploratory innovation on high-tech start-ups.

Exploitative innovation uses existing processes and managerial approaches to modify or enhance products developed in the start-up, or that are already existing in the market (Jansen, Bosch and Volberda, 2006). Moreover, exploitative innovation focuses its attention to satisfy customers' needs through the use of IT tools (Ko and Liu, 2019). The technological dimension of exploitative innovation of products' characteristics and features (Enkel et al., 2017). In this case, the organisation's existing culture and processes influence the current organisational culture and existing operations in the start-up (Limaj and Bernroider, 2017). Therefore, it is possible to establish the following hypotheses of the model:

H2c: Potential Absorptive Capacity has a positive relationship with exploitative innovation on high-tech start-ups.

H2d: Realised Absorptive Capacity has a positive relationship with exploitative innovation on high-tech start-ups.

6.2.3. Knowledge Spillovers

Knowledge spillovers have been considered mainly for its characteristic of being obtaining unintentionally by the entrepreneur. However, knowledge spillovers' meaning extended to a form of exchange of knowledge (Shu et al., 2014; Ritala et al., 2015). This process requires that both parties establish formal appropriability measures to classify information from transferable to protected (Laursen and Salter, 2014). Further knowledge spillovers examination expanded to evaluate companies' value from exchanging information (Shu et al., 2014).

Research has focused on evaluating the effects that clusters of information and proximity to start-ups have on economic growth and new companies' creation (Lasch et al., 2013). In contrast, knowledge spillovers have been evaluated based on R&D investment from companies to engage in innovative effort motivated by technological opportunity recognition (Nieto and Quevedo, 2005). The paradox in this instance is that knowledge spillovers definition can differ based on its source. The main problem with the OECD and CIS indicators that leads knowledge spillovers measurement in doubt is the lack of questions that can be used directly to form the knowledge spillovers construct (Belderbos et al., 2004). However, research has started to formulate incoming knowledge spillovers indicators to measure the effect of sources of knowledge spillover on innovation (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016).

The first main form of knowledge spillovers considers the effects that companies and individuals involved in the chain of value have on companies' innovation process (Kaiser, 2002). The forms of interactions through the supply chain led to the classification of vertical and horizontal knowledge spillovers. Sources of knowledge include companies and individuals that are clients, customers, and suppliers (Amoroso, Audretsch and Link, 2017). Horizontal knowledge spillovers are all types of knowledge gathered from competitors. In some instances, knowledge spillovers' categorisation started to be used based on the companies and competitors involved in the supply chain (Lhuillery, 2011).

Hence, research on manufacturing companies led to competitors' initial definition, customers, suppliers knowledge spillovers (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Institutions such as universities, R&D centres, governments, and innovation centres and consultants are defined as sources of institutional knowledge spillovers (Belderbos et al., 2004; Lhuillery, 2011; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). Knowledge spillovers can also come from flows of knowledge that are not liked by companies or institutions. In this case, the defined public, industry, or incoming knowledge spillovers come from available information generated from conferences, fairs, patents, databases, and publications (Belderbos et al., 2004; Chun Sung-bae; Mun, 2012).

Initially, research has taken all the defined classification into the variable of *incoming knowledge spillovers* (Spithoven and Teirlinck, 2015). However, the clear distinction between companies' importance or institutions and public knowledge towards innovation

(Belderbos, René; Carree, Martin; Lokshin, 2004). Incoming knowledge spillovers and its apparent classification became the key definitions to evaluate informal collaboration and alliances between companies (Blind and Mangelsdorf, 2013; Ding, Liu and Song, 2013; Hájek and Stejskal, 2016). Research initially suggested how adequate acquisition strategies of knowledge from codification and management lead to knowledge spillovers absorption (Ding, Liu and Song, 2013; Prokop and Stejskal, 2016). Further research accounts on internal R&D in the company that facilitates the exchange of knowledge between companies and tracks down on competitors (Stejskal and Hajek, 2015). The common dependent variable affected by the process materialises in product or performance innovation (Blind and Mangelsdorf, 2013; Hájek and Stejskal, 2016).

This research suggests that knowledge spillovers evaluation on high-tech start-ups require a mediator construct not focused on R&D investment. The cause, companies at the seed stage are in an initial process to gain funding from investors and networks located in an entrepreneurial ecosystem to survive (Brinckmann, Salomo and Gemuenden, 2011; Malecki, 2018). Therefore, the adequate initial model to evaluate knowledge spillovers' recognition of innovation is the process of absorptive capacity (Todorova and Durisin, 2007; Tzokas et al., 2015). Research in SMEs' area has evaluated knowledge spillovers external sources of information from the constructs of breadth and depth as a formative construct (Laursen and Salter, 2006; Chen, Chen and Vanhaverbeke, 2011; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016).

On the other hand, sources of knowledge construct have compiled the chain of value as a single evaluator for the importance of suppliers, customers, and competitors for innovation performance (Lau and Lo, 2015). Therefore, It is possible to link from the literature the formal definition of incoming knowledge spillovers to all types of information intentionally or unintentionally obtained from institutions, companies, and individuals. Therefore, it is possible to establish the following hypotheses of the model:

H3a: Incoming knowledge spillovers have a positive effect on the Potential Absorptive Capacity of High-Tech start-ups.

H3b: Incoming knowledge spillovers have a positive effect on the Realised Absorptive Capacity of High-Tech start-ups.

H3c: Incoming knowledge spillovers have a positive effect on High-Tech start-ups exploitative innovation.

H3d: Incoming knowledge spillovers have a positive effect on High-Tech start-ups exploratory innovation.

Incoming knowledge spillovers also establish how information obtained from external sources does not require alliances or cooperation (Lhuillery, 2011; Veugelers, 2016). The process requires entrepreneurial action to gain access to protected or unprotected knowledge generated from patents, trademarks, conferences, academic research, and academic publications (Lhuillery, 2011; Spithoven and Teirlinck, 2015; Amoroso, Audretsch and Link, 2017). The initial definition of public knowledge spillovers separated when the protection methods are informal or null for these sources (Spithoven and Teirlinck, 2015). Evaluating these forms of knowledge spillovers analysed from regional surveys that evaluate various sources of knowledge (Foss, Lyngsie and Zahra, 2013; Amoroso, Audretsch and Link, 2017). The evaluation of public knowledge led to the definition of network spillovers (Chun Sung-bae; Mun, 2012; Sisodiya, Johnson and Grégoire, 2013). The main breakthrough from this constructs lies in the possible access to unbounded knowledge to geographical proximity through open innovation (Sisodiya, Johnson and Grégoire, 2013; Stejskal and Hajek, 2015; Cantù, 2017). Hence, network knowledge spillovers can act as a primary support mechanism to build collaborations that leads to incoming knowledge spillovers. Therefore, it is possible to establish the following hypotheses of the model:

H4a: Network knowledge spillovers has a positive effect on the Potential Absorptive Capacity of High-Tech start-ups.

H4b: Network knowledge spillovers has a positive effect on the Realised Absorptive Capacity of High-Tech start-ups.

H4c: Network knowledge spillovers has a positive effect on High-Tech start-ups exploitative innovation.

H4d: Network knowledge spillovers has a positive effect on High-Tech start-ups exploratory innovation.

Figure 6.1 illustrates the proposed conceptual model that explains incoming and network knowledge spillovers' flow through start-ups absorptive capacity mediation towards exploratory and exploitative innovation.

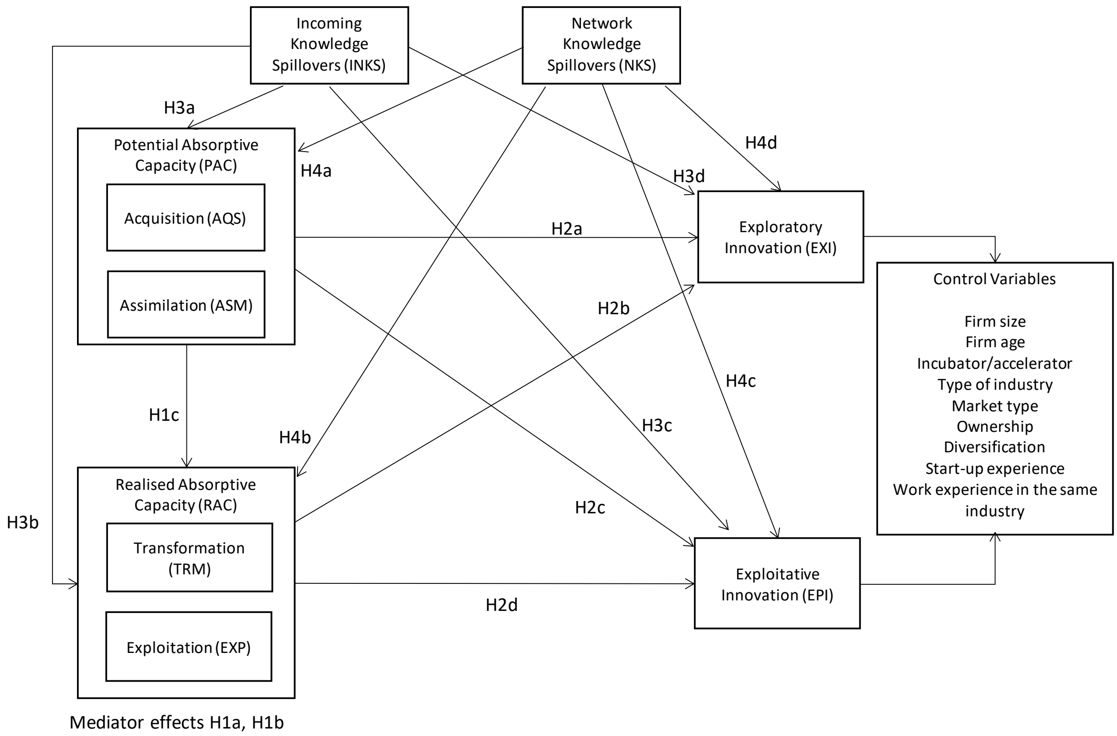
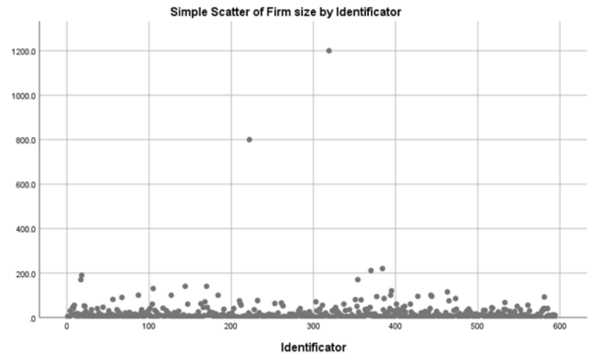


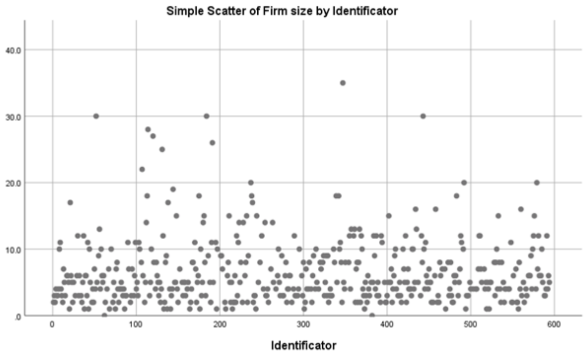
Figure 6.1 - Conceptual Quantitative model (KST-QNCM)

6.3. Data Preparation

The study considered the characteristics of the entrepreneur and the company's background. All the answers were linked to an identification number (ID) to screen the data and analysed initially using the statistical software SPSS. The researcher replaced one response regarding the respondent's age of ninety-nine years with the average and erasing two answers of two companies that had more than eight hundred employees (A Field, 2018). The scatterplot of the respondent's age and company size are illustrated in figure 6.2.



Initial database



After deleting data out of the sample

Figure 6.2 - Scatterplot of data by the age of the company and size before and after correction

A total of thirty-six identified outliers calculated the Mahalanobis distances calculated by conducting a linear regression in SPSS illustrated on column "Mahalanobis distance" illustrated in Appendix C.1**.** (A Field, 2018). Afterwards, the researcher calculated the probability of the data being an outlier using equation number one in SPSS by comparing with the Chi-Square probability distribution and using 42 degrees of freedom based on the number of variables used for the analysis. The identified outliers that had a probability value bellow 0.001 illustrated on column "probability"**.** Finally, the researcher conducted a screening of the data by calculating the skewness and kurtosis. For initial factor analysis, it is recommended that the variables have a value below 3 for skewness, and 10 for kurtosis to probe normality which is illustrated in Appendix C.2 shows that all the variables are within range, supporting the statement that the dataset is reliable to conduct a factor analysis. The final number of 556 reliable responses used in the study.

The sampling included mostly new ventures that operated for ten years, with 84.5% (Jin, Shu and Zhou, 2019). The analysis also considered 15.5% of start-ups in the growth stage with operating beyond ten years of operations (Lau and Lo, 2015; Cantù, 2017; Hervas-Oliver, Lleo and Cervello, 2017). The sample consists of companies with less than 500 employees to classify as a small firm (Audretsch, 2002). The mean of the number of employees enrolled in the companies from the sample was 18.48%.

The survey included the question: "Where is your company, headquartered?" (Abubakar and Mitra, 2017; Su and Yang, 2018). The evaluation highlighted that 98.6% of the companies are in the UK, while 1.4% stated that they are in a foreign country.

High-tech and knowledge intensity technology start-ups were identified with the following question: "Which industry does your company primarily operate in?". The categorical answers followed the classification of the Statistical Classification of Economic Activities (NACE) included: (1) Electrics, electronics, communications and precision (4.9%), (2) Information technology, computer operation service, (3) Computer programming, consultancy and related activities (16.2%), (4) Telecommunications (1.8%), (5) Aircraft and spacecraft (2.3%), (6) Medical, precision, and optical instruments (7.4%), and (7) Pharmaceuticals (8.3%) (European Commision, 2008; Timmermans, 2009; Division, 2011; Song et al., 2017). Entrepreneurs classified their companies as others were categorised manually under the Scientific Research and Development (7.4%), or to other for knowledge-intensive financial services with 23.6%.

The evaluation of the sample included the question "Have you attended an incubator or accelerator programme in the United Kingdom". The research context seeks to evaluate if the training and the mentoring programmes affected start-ups type of innovation (Hausberg and Korreck, no date; Cohen et al., 2017; Eveleens, van Rijnsoever and Niesten, 2017).

About 59.9% confirmed that had attended incubator or accelerator programmes before, while 40.1% of the participants did not seek to gain access to these institutions' knowledge (Rothaermel and Thursby, 2005; Squicciarini, 2009). Finally, the research took into account entrepreneurs who held managerial positions that compromised mostly of Chief Executive Officer (CEO), with 83.5%. The other 16.5% of participants that answered the questions held managerial positions of Chief Operations Officer (COO), Chief Technology Officer (CTO), director, general manager, and engineer (Jin et al. 2018, Amoroso, Limaj, 2019, Nielsen, 2015). The average age of the respondents was of 48.15 years. The summary of the descriptive statistics of the participants is illustrated in Table 6.1.

Table 6.1 - Demographics of the participants

Respondents age (years)			
	20 to 29	32	5.8
	30 to 39	91	16.4
	40 to 49	167	30
	50 and above	266	47.8
Respondents Role			
	Chief Executive Officer (CEO)	466	83.5
	Chief Operations Officer (COO)	14	2.5
	Chief Technology Officer (CTO)	18	3.2
	Director	45	8.1
	Other	13	2.3
Gender			
	Male	491	88.3
	Female	65	11.7
Education			
	Doctor in Philosophy (A)	106	19.1
	Master's degree (B)	177	31.8
	Bachelor's degree (C)	177	31.8
	No qualifications (D?)	14	2.5
	Other (D?)	82	14.7
Previous start-up experience			
	Yes	367	66
	No	189	34
Previous industry experience			
	Yes	360	64.7
	No	196	35.3
Company background			
Type of industry			
	Electrics, electronics, communications and precision (A)	27	4.9
	Information technology, computer operation service (A)	157	28.2
	Computer programming, consultancy and related activities (A)	90	16.2
	Telecommunications (A)	10	1.8
	Aircraft and spacecraft (A)	13	2.3
	Medical, precision, and optical instruments (A)	41	7.4
	Pharmaceuticals (A)	46	8.3
	Scientific research and development (B)	41	7.4
	Other (B)	131	23.6
Age (years)			
	1 to 3	170	3.06
	4 to 6	194	34.9
	7 to 9	80	14.4
	more than 9	112	20.1
Size (number of employees)			
	Less than 1	11	2
	1 to 9	283	50.9
	10 to 49	212	38.1
	More than 50	50	9
Market type			
	International market	389	70
	European market in a neighbouring country	18	3.2
	National market	128	23
	Local market	21	3.8
Ownership			
0	Headquartered outside of the United Kingdom	8	1.4
1	Headquartered in the United Kingdom	548	98.6
Diversification			
1	Start-up has multiple businesses	166	29.9
2	Start-up has a single business	390	70.1
Incubator/Accelerator attendance			
1	Attended an incubator/accelerator programme in the UK	333	59.9
0	Not attended	223	40.1

6.4. Exploratory Factor Analysis

The researcher initially conducted an exploratory factor analysis (EFA) to find the shared variance between variables through a correlation matrix that defines constructs (A Field, 2018). This analysis did not take the continuous variables and the formative variables of network knowledge spillovers and network knowledge spillovers.

The analysis of the formative constructs used a Partial Least Square approach. The research identified relevant variables using factor extraction with *Principal Components.* The type of rotation used was *Promax* with a kappa value of 4. The results show for the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.893, which indicates a good for the model by being a value above 0.7 (Lowry and Gaskin, 2014; A Field, 2018). The model was reduced to use all the variables with communalities with values above 0.3 (See appendix D.1). The proposed six-factor solution explained 67.969% of the variance (See appendix D.2). The initial EFA analysis identified the variables that held absolute eigenvalues above one by suppressing small coefficients with values below 0.3 (A Field, 2018).

Table 6.2 - Component Correlation Matrix

Component Correlation Matrix

Component	1	2	3	4	5	6
1	1.000	.266	.456	.600	.232	.358
2	.266	1.000	.209	.182	.133	.136
3	.456	.209	1.000	.353	.243	.267
4	.600	.182	.353	1.000	.205	.474
5	.232	.133	.243	.205	1.000	.125
6	.358	.136	.267	.474	.125	1.000

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

Overall, the EFA enabled to constructs convergent validity by identifying the Average Variance with a value above 0.5. Also, the data's discriminant validity was checked by making sure that there were no cross-loadings in the pattern matrix. In this case, the small coefficients absolute values suppressed with an absolute value of 0.3. The *Component Correlation Matrix* illustrated in Table 6.2 used to assess discriminant validity by ensuring that all the values do not exceed a value of 0.7 (Lowry and Gaskin, 2014; A Field, 2018).

Finally, a reliability test was conducted on every construct by ensuring that each factor had a Cronbach's alpha above 0.7 with at least three variables (A Field, 2018). The pattern matrix of the suggested constructs for the model with their respective Conbrach Alpha Factor and reliability analysis are illustrated in appendices D.3 and D.4. The exploratory factor analysis proposed grouped the first-order dimensions of Transformation (RAC_TRM) and Exploitation (RAC_EXP) in an expected second-order dimension of Realised absorptive Capacity (RAC). Also, the results proposed for the EFA suggested a separation of the first-order dimensions of Acquisition (PAC_AQS) and Assimilation (PAC_ASM) into different factors. Also, the first-order constructs of Exploratory Innovation (EPI), Exploitative Innovation (EXI), and Technological Turbulence (TUR) were modelled as separated factors. The summary of the variables and statistics obtained from the EFA with the composite reliability (CR) are illustrated in table 6.3**.** The non-applicable variables were not included in the model to increase the loadings of the variables.

Table 6.3 - Standart estimates and Coefficient Alpha

Variables	Names and Items	Loading
	Exploratory Innovation (Alpha = 0.823; CR = 0.831)	
EXI1	We invent and develop new products and services.	0.839
EXI2	We experiment with new products and prototypes that challenge existing ideas in our industry.	0.91
EXI3	We develop new products and prototypes that are completely new to our company.	0.864
EXI4	We explore new opportunities in new markets.	not applicable
EXI5	Our company uses new distribution channels.	not applicable
	Exploitative Innovation (Alpha = 0.840; CR = 0.839)	
EPI1	We continuously extend the offerings of existing products and services.	0.77
EPI2	We implement small adaptations or features to existing products and services.	0.895
EPI3	We continuously launch improved characteristics of existing products and services to the market.	0.891
EPI4	We improve our efficiency in the delivery of products and services.	0.676
EPI5	Our success is based on our capability to optimize existing technologies.	not applicable
	Potential Absortive Capacity (Adquisition) (Alpha = 0.639; CR = 0.651)	
PAC_AQS1	We search for external information for new technologies.	not applicable
PAC_AQS2	Our employees regularly visit other branches or companies.	0.925
PAC_AQS3	We encourage our employees to identify and use external information sources.	0.534
PAC_AQS4	We periodically have meetings with customers or third parties to acquire new technological knowledge.	not applicable
PAC_AQS5	We collect business and technological knowledge through informal means (Example: lunch with industry friends, talks with trade partners).	0.708
	Potential Absorptive Capacity (Assimilation) (Alpha = 0.836; CR = 0.845)	
PAC_ASM1	We regularly organise and conduct internal meetings in the company to discuss new findings.	0.925
PAC_ASM2	We work together across the company to interpret and understand external information.	0.534
PAC_ASM3	External information is shared between employees.	0.708

	Realiced Absorptive Capacity (Alpha = 0.885; CR = 0.887)	
RAC_TRM1	We are proficient at recording and storing relevant information for future reference.	0.76
RAC_TRM2	We quickly analyse and interpret the changing demands of our product development.	0.881
RAC_TRM3	New opportunities to serve our customers are quickly understood.	0.901
RAC_TRM4	We quickly recognise the usefulness of new external knowledge to existing knowledge.	0.803
RAC_EXP1	We can use new technologies in new product prototypes and ideas.	0.726
RAC_EXP2	We constantly consider how to exploit knowledge better.	0.678
RAC_EXP3	We combine external and internal resources into novel configurations (Example: Research and Development, results, products)	0.55
RAC_EXP4	Employees share a common language to refer to our products and services.	not applicable
	Technological Turbulence (Alpha = 0.752; CR = 0.759)	
TUR1	The technology in our industry is changing rapidly.	0.848
TUR2	It is very difficult to forecast where the technologies in our markets will be in the next five years.	0.832
TUR3	A large number of new product ideas have been made possible through technological breakthroughs in our industry.	0.786
TUR4	New customers tend to have product-related needs that are different from those of our existing customers.	not applicable

6.5. Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CFA) was conducted to cross-validate the analysis's findings (Blunch, 2013; A P Field, 2018). Initially, the researcher conducted an initial evaluation of the reflective constructs using SPSS Amos. In this case, the researcher used the Potential Absorptive Capacity (PAC) and Realised Absorptive Capacity (RAC) as the secondary other constructs. The first-order constructs for PAC are the Acquisition (AQS) and Assimilation (ASM). On the other hand, RAC formed from first-order Transformation constructs (TRM) and Exploitation (EXP). The model formed with the first-order reflective constructs of Exploratory Innovation (EXI) and Exploitative Innovation (EPI). The model initially included Technological Turbulence (TUR). The Model Validity Measures show Average Variance Extracted (AVE) in the correlation table are above 0.5.

The analysis showed no validity concerns with the model and supporting discriminant validity. In addition, the model engulfing the reflective constructs produced a good fit (CMIN = 2.720, CFI = 0.937, SRMR = 0.060, RMSEA = 0.056, and PClose = 0.042, and Chi-square = 587,5) (Bentler and Hu, 1998; Hu and Bentler, 1999b). The model validity and cut-off criteria and interpretation of the indicators are illustrated in table 6.4.

Table 6.4 - Model Validity Measures in SPSS - Model Fit Measures and Cut-off Criteria – SPSS output

	CR	AVE	MSV	MaxR(H)	EPI	EXI	TUR	RAC	PAC
EPI	0.844	0.579	0.08	0.875	**0.761**				
EXI	0.832	0.623	0.306	0.838	0.262***	**0.79**			
TUR	0.77	0.535	0.104	0.839	0.188***	0.283***	**0.732**		
RAC	0.947	0.899	0.634	0.985	0.283***	0.553***	0.322***	**0.948**	
PAC	0.82	0.696	0.634	0.852	0.270***	0.441***	0.262***	0.796***	**0.834**

Validity Concerns

No validity concerns here.

Significance of Correlations:

† p < 0.100

* p < 0.050

** p < 0.010

*** p < 0.001

Measure	Estimate	Threshold	Interpretation
CMIN	587.471	--	--
DF	216	--	--
CMIN/DF	2.72	Between 1 and 3	Excellent
CFI	0.937	>0.95	Acceptable
SRMR	0.06	<0.08	Excellent
RMSEA	0.056	<0.06	Excellent
PClose	0.042	>0.05	Acceptable

Cutoff Criteria*

Measure	Terrible	Acceptable	Excellent
CMIN/DF	> 5	> 3	> 1
CFI	<0.90	<0.95	>0.95
SRMR	>0.10	>0.08	<0.08
RMSEA	>0.08	>0.06	<0.06
PClose	<0.01	<0.05	>0.05

Overall, the initial model shows significant relationships and the validity between the stipulated reflective constructs. The illustration of the model is shown in Figure 6.3. All the factor loadings between the variables and the constructs shown values above 0.6 except for PAC_AQS2. However, the model developed in Amos does not show modification indices. In this case, the researcher considered to keep all the reflective variables.

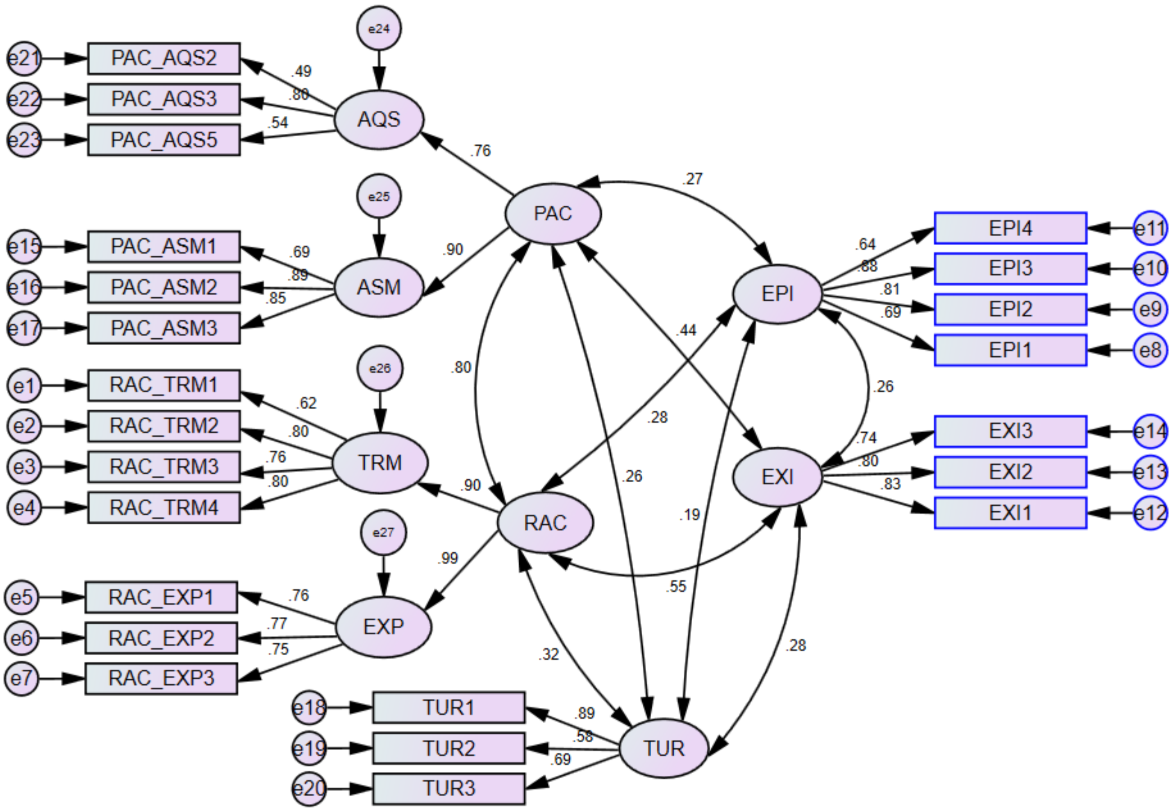


Figure 6.3 - Model running Confirmatory Factor Analysis using reflective constructs in AMOS

6.6. Partial Least Squares Analysis

A Partial Least Squares (PLS algorithm) using the statistical software SmartPLS 2.0 was conducted to test the model, including the formative constructs of network and knowledge spillovers (Sisodiya, Johnson and Grégoire, 2013; Cui et al., 2015; Chen and Chang, 2016; Limaj and Bernroider, 2017; Hair, 2018).

The model was run using a path weighting scheme with a maximum of 300 interactions and a stop criterion of seven (Hair, 2018). The analysis was chosen over the Consistent PLS Algorithm due to the combination of formative and reflective constructs. The PLS_SEM model is illustrated in figure 6.4 summarises the multi-item scales test from composite reliability (CR) and the AVE values shown in table 6.5. Overall, the results support reliability and convergent validity for the reflective constructs using the Fornell and Lacker criteria (1981).

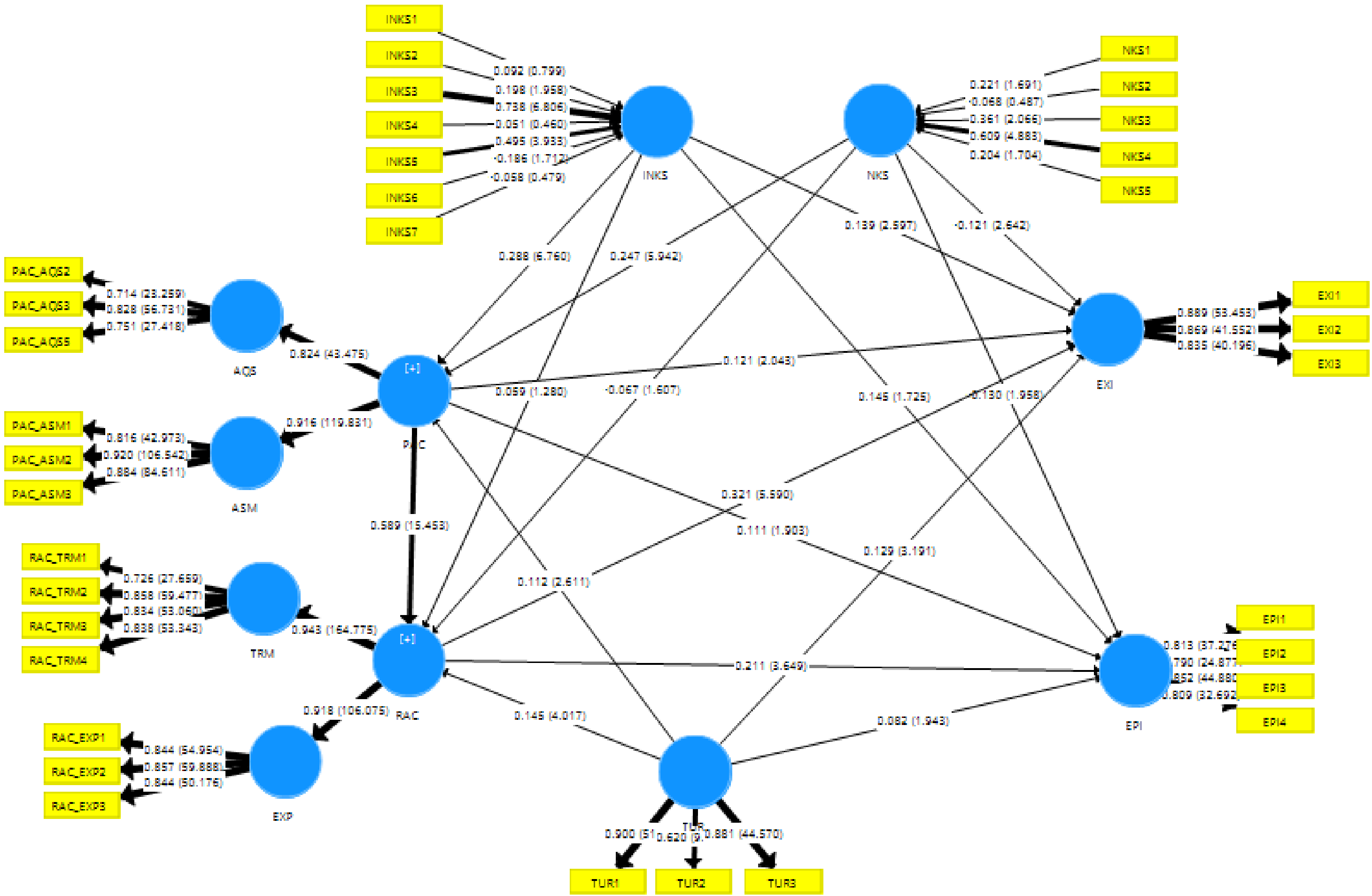


Figure 6.4 - Model running Partial Least Squares on SMART-PLS

Table 6.5 - Composite Reliability, validity and correlation table

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
AQS	0.651	0.671	0.809	0.587
ASM	0.845	0.851	0.907	0.765
EPI	0.839	0.862	0.889	0.667
EXI	0.831	0.841	0.899	0.747
EXP	0.805	0.806	0.885	0.72
INKS		1		
NKS		1		
PAC	0.807	0.83	0.863	0.519
RAC	0.887	0.891	0.912	0.598
TRM	0.831	0.839	0.888	0.665
TUR	0.759	0.851	0.848	0.657

	AQS	ASM	EPI	EXI	EXP	INKS	NKS	PAC	RAC	TRM	TUR
AQS	0.766										
ASM	0.529	0.875									
EPI	0.205	0.258	0.817								
EXI	0.301	0.326	0.247	0.864							
EXP	0.42	0.579	0.274	0.482	0.848						
INKS	0.418	0.332	0.217	0.263	0.296						
NKS	0.428	0.292	0.042	0.088	0.22	0.435					
PAC	0.824	0.916	0.269	0.36	0.586	0.419	0.397	0.72			
RAC	0.428	0.625	0.318	0.448	0.918	0.308	0.224	0.621	0.773		
TRM	0.381	0.585	0.315	0.362	0.734	0.279	0.2	0.571	0.943	0.816	
TUR	0.159	0.227	0.168	0.249	0.29	0.212	0.217	0.227	0.277	0.23	0.81

In contrast to the results obtained from SPSS AMOS, the complete model shows that all the factor loadings for the reflective constructs are above 0.7. All the Cronbach's alpha and composite reliability exceeded the value of 0.7 except for Acquisition (AQS) with a value of 0.651. The AVEs obtained are above 0.5, supporting the discriminant validity of the model. The dimension second dimension was maintained as it forms part of the first-order constructs PAC.

The researcher evaluated the Variance Inflation Factors (VIF) for the seven dimensions of Incoming Knowledge Spillovers (INKS) and five dimensions of Network Knowledge Spillovers (NKS). All the values passed the cut off criteria of 10 with a maximum value of

2.093 for dimension INKS7. The results prove that the formative constructs do not have collinearity problems (Hair et al., 2017; Hair, 2018). For Incoming Knowledge Spillovers, the variables related to suppliers (INKS2), clients (INKS3), and universities (INKS5) were significant. In the case of Network Knowledge Spillovers, variables linked to the following scientific publications (NKS3), and access to companies and associations (NKS4) are significant for start-ups. For this study, the non-significant dimensions are kept due to the non-overlapping nature of formative dimensions and can state that the variables do not significantly affect the nature of the construct; The evaluation of the formative constructs illustrated in table 6.6.

Table 6.6 - Quality Criteria of Formative Measurement

Formative Constructs	Dimensions	Weights	VIF[a]	p Values
Incoming Knowledge Spillovers (INKS)	1. Organisations or start-ups	0.095	1.416	0.420
	2. Suppliers	0.199*	1.275	0.045
	3. Clients or customers	0.735***	1.253	0.000
	4. Competitors	0.05	1.515	0.663
	5. Universities or research institutions	0.497***	1.771	0.000
	6. Consultants	-0.187	1.604	0.086
	7. Government	-0.058	2.093	0.625
Network Knowledge Spillovers (NKS)	1. Reading white papers	0.222	1.402	0.091
	2. Attending conferences or exhibitions	-0.066	1.637	0.637
	3. Scientific journals or publications	0.356*	1.628	0.039
	4. Companies or associations	0.609***	1.461	0.000
	5. Online communities	0.207	1.231	0.083

***p < .001; **p<.01; *p<.05

The same process was conducted to assess the validity of the reflective variables the PLS Algorithm using the factor weighting scheme (Hair, 2018). The reflective variables evaluated are Acquisition (PAC_AQS) Assimilation (PAC_ASM), Transformation (RAC_TRM), Exploitation (RAC_EXP), exploratory innovation (EXI), and exploitative innovation (EPI). The reflective second-order constructs are Potential Absorptive Capacity (PAC) and Realised Absorptive Capacity (RAC).

Overall, all the VIF present values were below 3, indicating no collinearity problems in the model (Table 6.7). Finally, the researcher conducted a Bias-Corrected and Accelerated (BCa) Bootstrap of the run factors using a total of 5000 subsamples using a two-tailed test with a significance level of 0.1. The results show that the outer weights and significance are valid for some of the dimensions at $p < 0.1$.

Table 6.7 - Collinearity Statistics (VIF), Discriminant validity and reliability of reflective variables and constructs

	AQS	ASM	EPI	EXI	INKS	NKS	PAC	RAC	TRM	TUR
AQS										
ASM										
EPI										
EXI										
EXP										
INKS			1.374	1.374			1.258	1.368		
NKS			1.349	1.349			1.261	1.342		
PAC	1	1	1.911	1.911				1.324		
RAC			1.692	1.692					1	
TRM										
TUR			1.121	1.121			1.069	1.085		

The researcher proceeded to conduct a series to test the model with minor modifications. The runs of the different models conducted bootstrapping help examine the results' stability (Hair, 2018). The runs were conducted with 5000 subsamples using a Bias-Corrected and Accelerated (BCa) Bootstrap using a two-tailed test with a significance level of 0.1. Model 1a took into consideration the path analysis weighting scheme to assess the direct effects of constructs. Model 1b runs the base model except for testing the moderating effects of incoming knowledge spillovers, network knowledge spillovers, and technological turbulence. A description of the models analysed is illustrated in table 6.8.

Table 6.8 - Initial models analysed and description

Name	Comments	Rationale
Model 1a	Not including control variables and TUR construct	Analysis run to develop an adequate model
Model 1b	Assessing moderation effects of knowledge spillovers between RAC and EXI, EPI and TUR	
Model 1c	Assessing moderation effects of knowledge spillovers between RAC and RAC and TUR with EXI and EPI	
Model 2	Moderating effects of Incoming Knowledge Spillovers (INKs), and TUR on RAC, EXI, and EPI	Focused on the evaluation of the types of companies and background of entrepreneurs
Models 2 a and b	Extension by evaluating the types of high-tech start-ups, KIBS, and other companies	
Models 3 a,b,c and d	Evaluation of entrepreneurs that hold a BA, MSc, PhD, and other titles	
Model 4 a and b	Evaluating diversified and un-diversified start-ups	

Model 1a, illustrated in figure 6.5, showed that the reflective constructs had appropriate levels of significance to the model based on the R^2. Realised absorptive capacity was the strongest (40.9%), followed by exploitative innovation (24,6%), potential absorptive capacity (24.4%), and exploratory innovation (13.7%). The model shows that PAC has a positive significant effect of RAC (β = 0.619,t = 15.543 p < 0.001). Hence, RAC can be considered a mediator construct for influencing innovation, supporting Hypotheses H1a and H1bx. This statement supported by the direct interactions of innovation with PAC. In these cases, PAC has a small positive effect with EXI (β = 0.122, t = 2.076 p < 0.05), and EPI (β = 0.111, p < 0.05).

On the other hand, the direct effect between RAC and innovation show a strong positive effect on EXI (β = 0.349, t = 5.975 p < 0.001) and EPI (β = 0.231, t = 4.0746p < 0.0001). Thus, hypotheses H2a and H2b are supported.

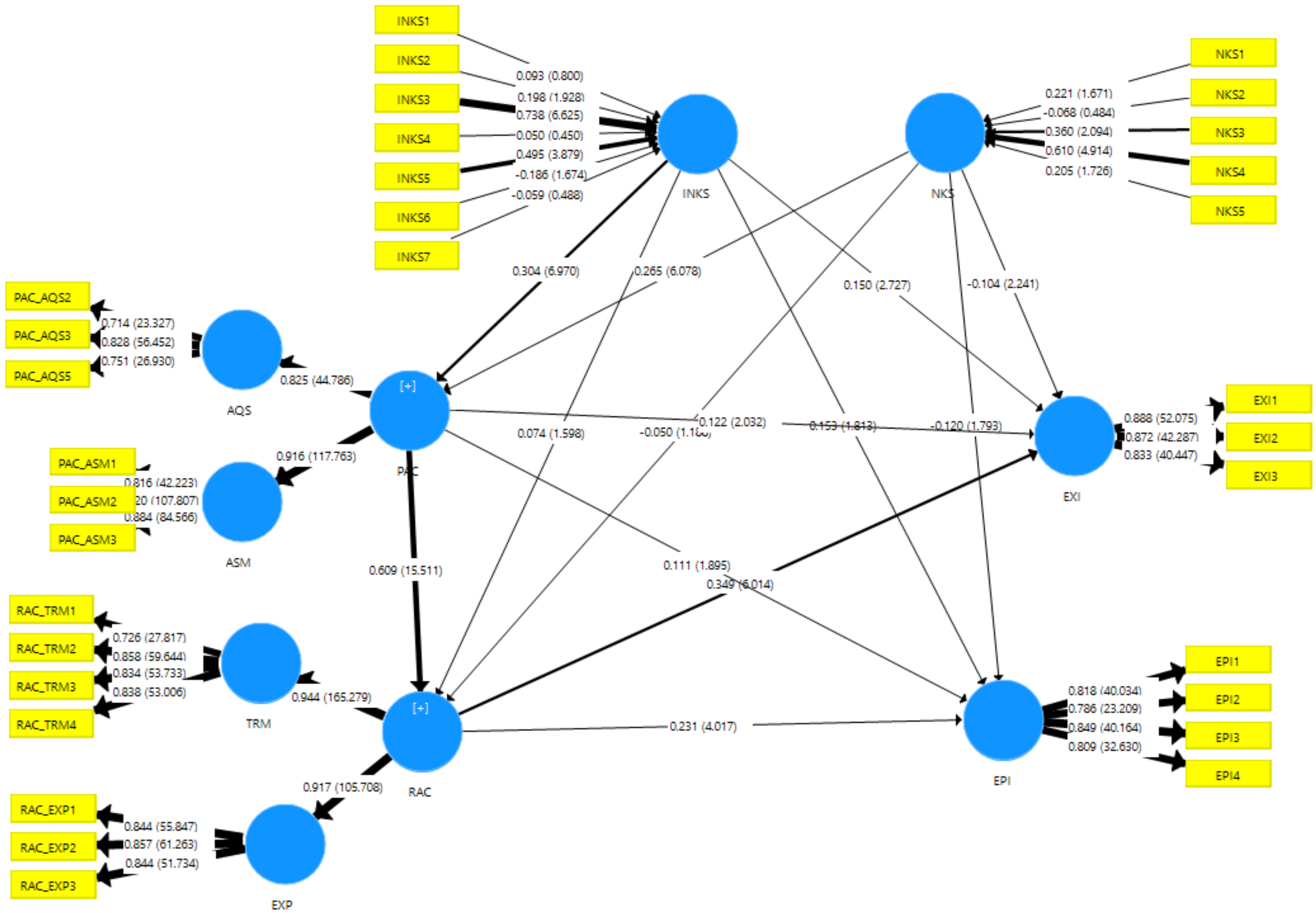


Figure 6.5 - Model 1a of direct effects illustrating path coefficients (β) and T-values in Inner model, and Outer Weights/Loadings and T-values of Outer Model

6.6.1. Evaluation of Base Model

In evaluating the effects of sources of information in the company, INKS presents a positive level of significance with PAC ($\beta = 0.304$, $t = 6.969$ $p < 0.001$). The dimensions show that the outer weights and t-values with values above 1.96 for suppliers (INKS2), customers (INKS3), and Universities (INKS5) are the most significant sources of knowledge for high-tech start-ups. On the other hand, consultants (INKS6) and the government (INKS7) negatively affect the construct, but present t-statistics below 1,96, which provides evidence that these sources of knowledge are not statistically significant. Thus, the researcher can state that hypothesis H3a is supported.

However, the INKS construct t values with RAC generated a t statistic bellow 1.96 with a p-value of 0.107. Hence, H3b is not supported. On the other hand, INKS generated a medium level of significance with EXI ($\beta = 0.15$, $t = 2.761$ $p < 0.01$), and no statistical significance with EPI ($\beta = 0.153$, $t = 1.838$, $p < 0.1$). Therefore, Hypotheses H3c is not supported, while hypotheses H3d is statistically supported. The analysis outcomes suggest that there can be a moderator effect of incoming knowledge spillovers between potential and realised absorptive capacity with exploitative innovation.

The formative construct of Network Knowledge Spillovers (NKS) followed a similar behaviour to Incoming knowledge spillovers. The dimensions that the outer weights and t-values for accessing scientific journals or publications (NKS3), and access to companies or associations (NKS4) are statistically important for high-tech start-ups. Likewise, NKS has a strong positive and significant effect with PAC ($\beta = 0.265$, $t = 6.149$ $p < 0.001$), supporting hypotheses H4a. On the other hand, NKS presents a negative effect on RAC that is not statistically significant ($\beta = -0.05$, $t = 1.188$, $p < 0.1$), rejecting hypotheses H5b. In addition, NKS at innovation has no effect on EPI ($\beta = -0.12$, $t = 1.801$, $p < 0.1$), rejecting hypothesis H5c. Surprisingly, NKS has a medium statistic significant negative effect on EXI ($\beta = -0.104$, $t = 2.214$, $p < 0.05$), contradicting Hypothesis 4Hd. These controversial results suggest that overall, knowledge spillovers positively affect high-tech start-ups during the acquisition and assimilation process. However, in product development and innovation stages, explicit knowledge spillovers can be detrimental to the innovation process.

On the other hand, tacit knowledge spillovers from INKS can positively affect the enhancement of existing products. However, if Network knowledge spillovers are used during the development of new products, the company exposure to information can be detrimental to creating new prototypes. The summary of the path coefficients of the model is illustrated in table 6.9. Mediator effects are assessed in the variations of model 1.

Table 6.9 - Path Coefficients of Model 1a

Paths	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Hypotheses	Output
INKS -> EPI	0.153	0.146	0.084	1.813	0.07	H3c	accepted
INKS -> EXI	0.15	0.149	0.055	2.727	0.006	H3d	accepted
INKS -> PAC	0.304	0.313	0.044	6.97	0	H3a	accepted
INKS -> RAC	0.074	0.076	0.047	1.598	0.11	H3b	rejected
NKS -> EPI	-0.12	-0.111	0.067	1.793	0.073	H4c	rejected
NKS -> EXI	-0.104	-0.099	0.046	2.241	0.025	H4d	accepted
NKS -> PAC	0.265	0.267	0.044	6.078	0	H4a	accepted
NKS -> RAC	-0.05	-0.042	0.042	1.188	0.235	H4b	rejected
PAC -> AQS	0.825	0.825	0.018	44.786	0		
PAC -> ASM	0.916	0.916	0.008	117.763	0		
PAC -> EPI	0.111	0.11	0.059	1.895	0.058	H2c	rejected
PAC -> EXI	0.122	0.119	0.06	2.032	0.042	H2a	accepted
PAC -> RAC	0.609	0.605	0.039	15.511	0	H1c	accepted
RAC -> EPI	0.231	0.23	0.057	4.017	0	H2d	accepted
RAC -> EXI	0.349	0.346	0.058	6.014	0	H2b	accepted
RAC -> EXP	0.917	0.917	0.009	105.708	0		
RAC -> TRM	0.944	0.943	0.006	165.279	0		

Statistically significant

***p < 0.001; **p<.01; *p<.05

Next, the researcher evaluated the direct moderated effect of technological turbulence and the knowledge spillover constructs on innovation (Model 1b). There is no statistical significance of the moderation effect of knowledge spillovers on absorptive capacity and innovation in this case. In all the cases, the p statistics are above 0.1 and have t values below 1.96. However, Incoming Knowledge Spillovers (INKS) continues to have low statistical significance with exploratory innovation (EPI). Concerning technological turbulence, there is statistical evidence of a negative moderating effect between the Realised Absorptive Capacity (RAC) and Exploratory innovation (EXI) (β = -0.78, t = 1.638, p < 0.01).

The path coefficients of the model b are illustrated in table 6.10. Hence, the perception of constant technological changes affects the high-tech start-up's capability to generate new products in the market; The illustration of the model presented in figure 6.6.

Table 6. 10 - Path Coefficients of Model 1b

Direct Paths	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
INKS -> EPI	0.217	0.193	0.119	1.83	0.067
INKS -> EXI	0.065	0.067	0.059	1.101	0.271
INKS * PAC -> EXI	-0.09	-0.107	0.079	1.136	0.256
INKS * RAC -> EXI	-0.129	-0.111	0.085	1.527	0.127
INKS * PAC -> EPI	-0.001	-0.026	0.088	0.017	0.987
INKS * RAC -> EPI	0.05	0.038	0.09	0.56	0.575
NKS -> EPI	0.129	0.069	0.122	1.053	0.292
NKS -> EXI	-0.056	-0.029	0.056	0.99	0.322
NKS * PAC_ -> EXI	0.029	0.015	0.073	0.401	0.688
NKS * RAC -> EXI	0.09	0.071	0.074	1.219	0.223
NKS * PAC -> EPI	0.028	0.035	0.1	0.276	0.782
NKS * RAC -> EPI	-0.033	-0.03	0.082	0.4	0.689
PAC -> AQS	0.818	0.818	0.02	41.657	0
PAC -> ASM	0.92	0.921	0.007	131.504	0
PAC -> EPI	0.046	0.058	0.056	0.827	0.408
PAC -> EXI	0.078	0.069	0.053	1.475	0.14
PAC -> RAC	0.622	0.622	0.035	17.645	0
RAC -> EPI	0.174	0.155	0.056	3.084	0.002
RAC -> EXI	0.238	0.234	0.051	4.661	0
RAC -> EXP	0.917	0.917	0.009	104.476	0
RAC -> TRM	0.944	0.944	0.006	163.474	0
TUR -> EPI	0.042	0.048	0.039	1.079	0.281
TUR -> EXI	0.095	0.092	0.041	2.327	0.02
TUR * RAC -> EXI	-0.178	-0.159	0.068	2.638	0.008
TUR * PAC -> EXI	0.045	0.032	0.066	0.68	0.497
TUR * PAC -> EPI	-0.048	-0.044	0.06	0.798	0.425
TUR * RAC -> EPI	-0.093	-0.069	0.058	1.604	0.1

Statistically significant

***p < 0.001; **p<.01; *p<.05

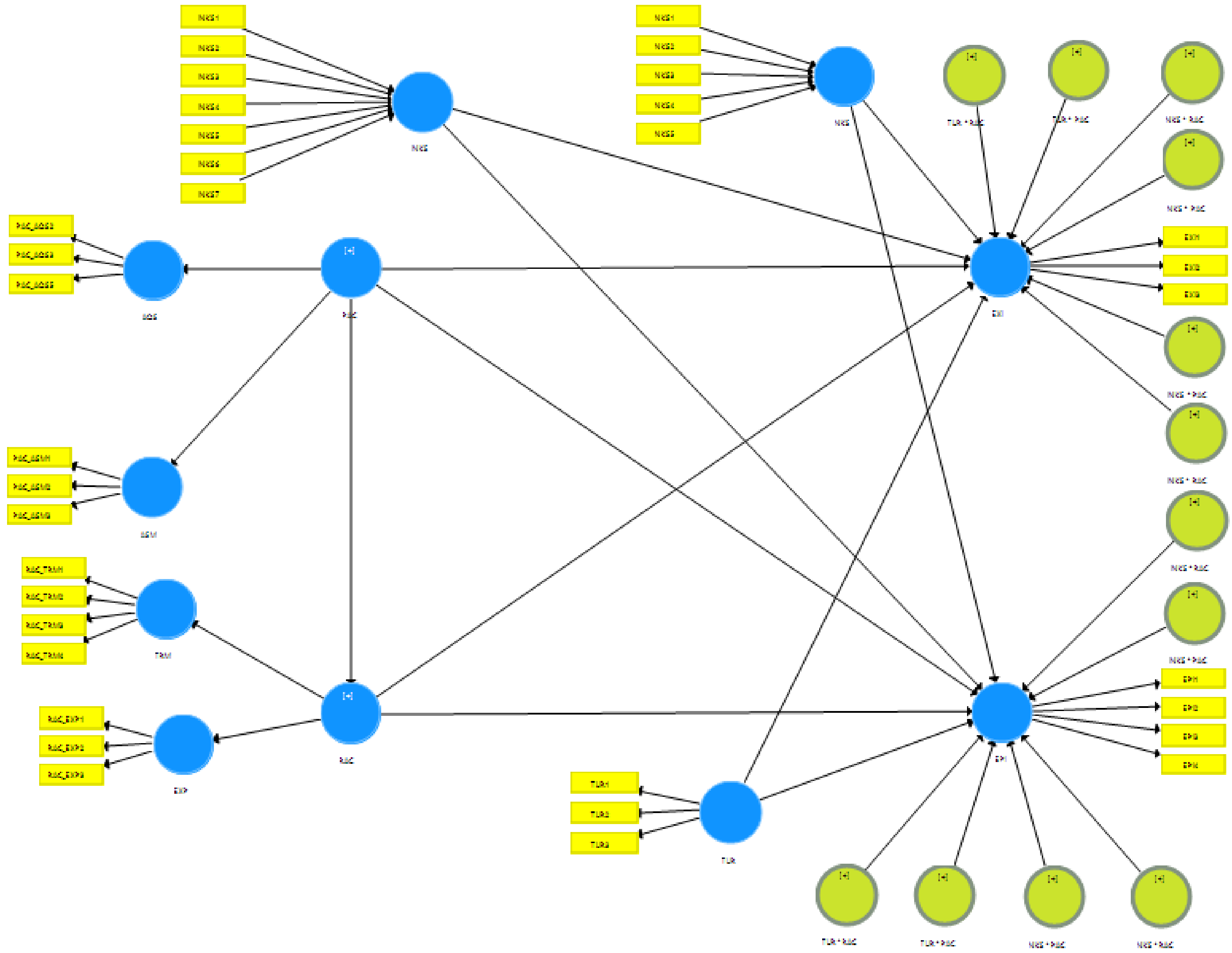


Figure 6.6 - Model 1b of moderating effects of knowledge spillovers and technological turbulence.

The analysis further evaluates knowledge spillovers moderating effects of knowledge spillovers between PAC and RAC (Model 1c). Interests, Incoming Knowledge Spillovers (INKS) has a negative moderating effect (β = -0.155, t= 3.265, p < 0.001). On the other hand, there is no statistical evidence of Network Knowledge Spillovers (NKSs) with the second dimension constructs of absorptive capacity. Hence, the evidence suggests that the influence of other companies and institutions can be detrimental during generating prototypes. Also, the moderating effect of technological turbulence remains to show a minor negative effect on the realised absorptive capacity (RAC) and exploratory innovation (EXI) of the company (β = -0.225, t = 3.469, p < 0.001). The slope analysis of the moderating effect of TUR between RAC and EXI is illustrated in figure 6.7**.**

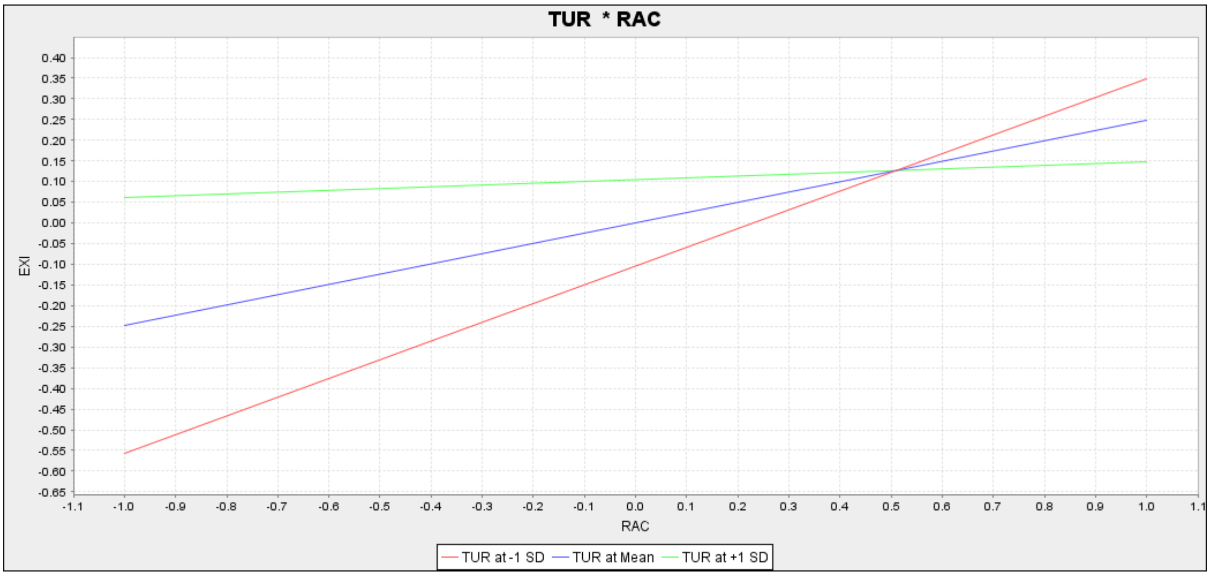


Figure 6.7 - Moderating effect of Technological Turbulence (TUR) on Exploratory Innovation (EXI).

The model showed that technological change does not affect a company's capability to enhance existing products or services offered by the company (β = 0.052, p > 0.1). The illustration and path coefficients and visual representation of model 1c are illustrated in table 6.11. and figure 6.8.

Table 6. 11 - Path Coefficients of Model 1c

Direct Paths	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
INKS -> EPI	0.173	0.171	0.094	1.842	0.066
INKS -> EXI	0.093	0.094	0.055	1.7	0.089
INKS -> RAC	0.052	0.059	0.04	1.321	0.187
INKS * PAC -> RAC	-0.155	-0.164	0.047	3.265	0.001
INKS * RAC -> RAC	0.036	0.021	0.048	0.759	0.448
NKS -> RAC	-0.016	0.006	0.04	0.395	0.693
PAC -> AQS	0.818	0.818	0.02	41.789	0
PAC -> ASM	0.92	0.921	0.007	132.99	0
PAC -> EPI	0.042	0.047	0.054	0.781	0.435
PAC -> EXI	0.077	0.074	0.054	1.431	0.152
PAC -> RAC	0.555	0.535	0.042	13.142	0
RAC -> EPI	0.165	0.16	0.057	2.904	0.004
RAC -> EXI	0.255	0.252	0.049	5.217	0
RAC -> EXP	0.917	0.917	0.009	105.144	0
RAC -> TRM	0.944	0.943	0.006	162.364	0
TUR -> EPI	0.052	0.055	0.042	1.238	0.216
TUR -> EXI	0.094	0.096	0.042	2.248	0.025
TUR * RAC -> EXI	-0.225	-0.212	0.065	3.469	0.001
TUR * PAC -> EXI	0.036	0.016	0.074	0.493	0.622
TUR * PAC -> EPI	-0.065	-0.075	0.056	1.152	0.249
TUR * RAC -> EPI	-0.078	-0.073	0.055	1.415	0.157

Statistically significant

***p < 0.001; **p<.01; *p<.05

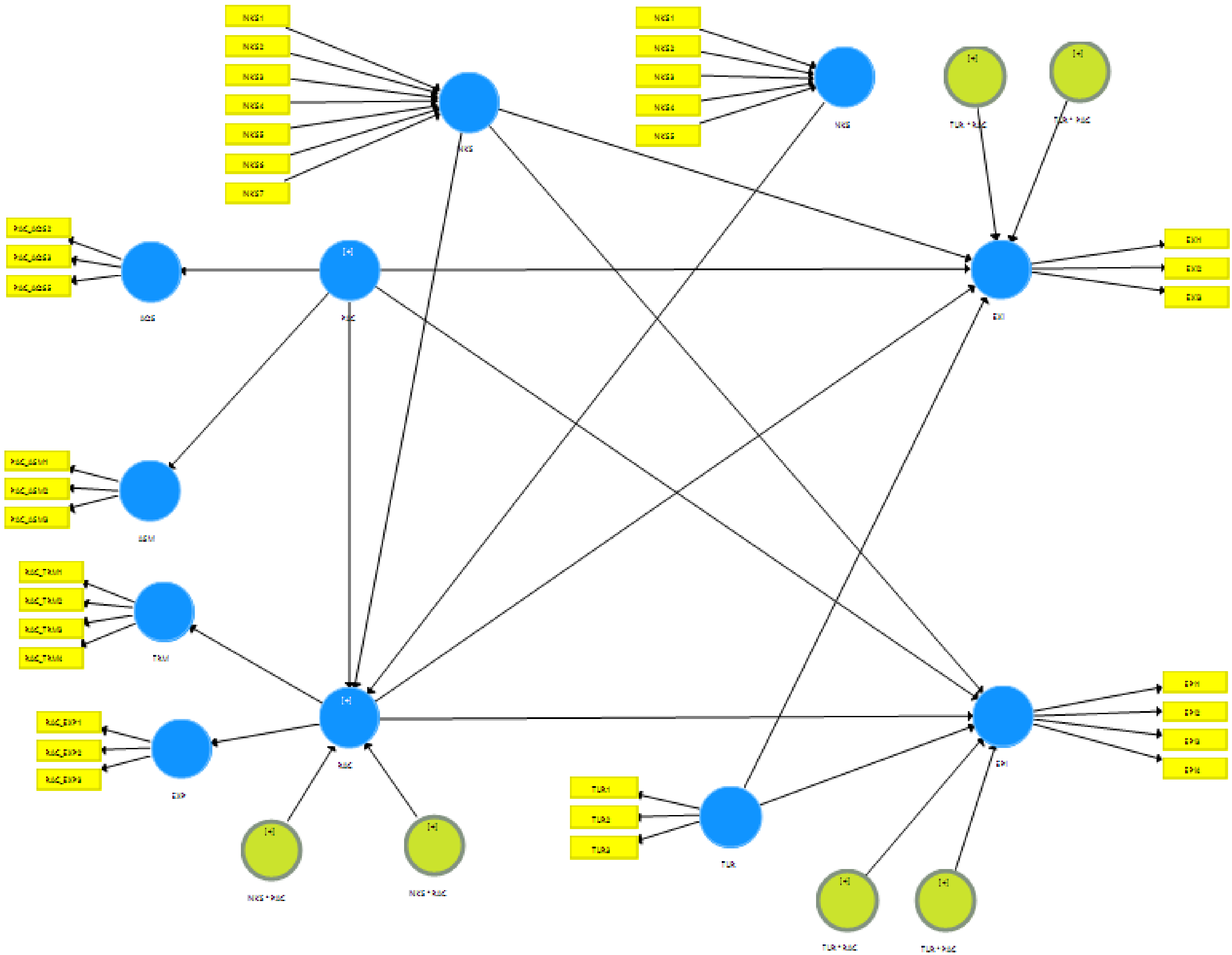


Figure 6.8 - Model 1c of moderating effects of knowledge spillovers and technological turbulence.

In summary, it can be stated that the two first-order dimensions of knowledge spillovers only have a direct positive effect on the Potential Absorptive Capacity (PAC). On the other hand, Incoming Knowledge Spillovers (INKs) have an overall positive impact on the product innovation dimensions. However, INKs can cause a negative moderating effect between PAC and RAC, confirming that the positive results of knowledge obtained during the Acquisition and Assimilation stages of information in the company.

On the other hand, Network Knowledge Spillovers has a negative direct effect only on the exploratory innovation. Moreover, technological turbulence shows an immediate positive effect on absorptive capacity and exploratory innovation. However, if the change of technology moderates how the company operates to generate new products, companies reduce their capability to engage in exploratory innovation. Hence, the researcher proposes that Model 1a, with the added statistical significant moderating effects, is the most adequate for further explaining knowledge spillovers' impact on high-tech start-ups.

6.6.2. Multiple Group Analysis

Next, the researcher proceeded to evaluate if the Model applied to different types of samples. The analysis was conducted using a Multiple-Group Analysis (MGA) between two groups. The control variables evaluated in this section are attendance to incubator/accelerator programmes, gender, and product diversification. The summary of all the proven parametric statistical differences and path coefficients is illustrated in table 6.12. The control variables of ownership, experience, and industrial experience did not present statistical significance or presented lower samples that restricted the comparison between groups (Hair, 2018).

Table 6. 12 - Parametric tests and bootstrapping results of statistically different samples.

Direct paths	**Path Coefficients-diff (| No attendance IN/AC - Attendance IN/AC |)**	**t-Value (No attendance IN/AC vs Attendance IN/AC)**	**p-Value (No attendance IN/AC vs Attendance IN/AC)**
INKS -> PAC	0.203	2.295	0.022
NKS -> PAC	0.168	1.873	0.062
Direct paths	**Path Coefficients-diff (| Diversified - Not diversified |)**	**t-Value (Diversified vs Not diversified)**	**p-Value (Diversified vs Not diversified)**
INKS -> RAC	0.266	2.786	0.006
PAC -> EXI	0.289	2.335	0.02
PAC -> RAC	0.162	1.963	0.05
Direct paths	**Path Coefficients-diff (| Female - Male |)**	**t-Value (Female vs Male)**	**p-Value (Female vs Male)**
RAC -> EPI	0.291	1.675	0.098
RAC -> TRM	0.028	2.39	0.019

First, the researcher evaluated companies that attended an incubator/accelerator programme in contrast to the companies that did not participate. The parametric test showed that companies that participated in these programmes increased the absorption of incoming knowledge spillovers (INKS) on the acquisition and assimilation processes (Path Coefficient Difference = 0.203, t value = 2.295, $p < 0.05$). On the other hand, network knowledge spillovers did not present statistical changes between the samples. Therefore, attending incubator and accelerator programmes increases Incoming Knowledge Spillover absorption. However, there is no reliable statistical evidence that differentiates both samples. The complete parametric and bootstrapping analysis for incubation attendance is illustrated in appendix D.5.

Second, the researcher compared companies with multiple businesses or products with similar combinations of characteristics measured by the variable diversification (DI). The parametric analysis showed a statistical difference between Incoming Knowledge Spillovers (INK) and Realised Absorptive Capacity (Path Coefficient difference = 0.266, t value(No Diversified vs Diversified) = 2.786, $p < 0.01$). In addition, diversification boosted slightly the direct effect that Potential Absorptive Capacity (PAC) can have on Realised Absorptive Capacity (RAC) (Path Coefficient difference = 0.162, t value (No Diversified vs Diversified) = 1.963, $p < 0.05$), and had a significant effect on Exploitative Innovation (EXI) (Path Coefficient difference = 0.289, t value (No Diversified vs Diversified) = 2.335, $p < 0.05$). The parametric test is shown in Appendix D.6.

When conducting the runs of the samples using bootstrapping (See appendix D.7), only diversified companies can engage in Exploitative Innovation (EXI) during PAC ($\beta = 0.303$, t= 3.365, $p < 0.01$). In addition, companies that diversify make use of Incoming Knowledge Spillovers (INK) during the transformation and implementation of information (RAC) ($\beta = 0.249$, t= 3.326, $p = 0.001$).

In contrast, undiversified companies are not using incoming knowledge spillovers during the RAC process ($\beta = -0.017$, t= 0.319, $p > 0.5$). In addition, entrepreneurs in this category are not engaging in active exploratory product innovation (EXI) during the PAC phase ($\beta = 0.014$ t= 0.195, $p > 0.5$).

Finally, both samples present an ongoing relationship between PAC and RAC. However, diversified companies have a higher level of interaction between the first-order dimensions of absorptive capacity ($\beta = 0.63$, t=15.493, $p < 0.001$). Hence, it can be stated that diversified companies use of incoming knowledge spillovers and engage in ongoing exploitative innovation. This engagement with the market can be done during PAC or RAC stages of product innovation.

On the other hand, companies that focus on developing a single type of product can absorb incoming knowledge spillovers only during the PAC phase. Also, entrepreneurs can only engage with exploitative innovation after the Transformation (RTM) and Exploitation (EXP) of knowledge.

Finally, the data showed no statistical difference between male and female entrepreneurs with t statistics of Female vs Male bellow 1.96. However, there was a single exception that suggests that females are more inclined to engage in Exploratory Innovation in comparison to men (Path Coefficient difference = 0.291, t value (Males vs Females) = 1.675, $p < 0.1$). In contrast, the data suggest that males can transform knowledge more efficiently during the RAC phase (Path Coefficient difference = 0.028, t value (Males vs Females) = 2.39, $p < 0.05$). The parametric analysis and bootstrapping for gender are illustrated in appendix D.8.

The summary of the significant statistical differences between all the populations is illustrated in table 6.13.

Table 6.13 - Bootstrapping results of statistically different samples.

Direct Paths	Path Coefficients Original (Attendance IN/AC)	Path Coefficients Original (No attendance IN/AC)	Path Coefficients Mean (Attendance IN/AC)	Path Coefficients Mean (No attendance IN/AC)	STDEV (Attendance IN/AC)	STDEV (No attendance IN/AC)	t-Values (Attendance IN/AC)	t-Values (No attendance IN/AC)	p-Values (Attendance IN/AC)	p-Values (No attendance IN/AC)
NKS -> PAC	0.204	0.371	0.206	0.37	0.052	0.072	3.891	5.123	0	0
INKS -> PAC	0.348	0.144	0.359	0.189	0.052	0.071	6.674	2.023	0	0.043

Direct Paths	Path Coefficients Original (Diversified)	Path Coefficients Original (Not diversified)	Path Coefficients Mean (Diversified)	Path Coefficients Mean (Not diversified)	STDEV (Diversified)	STDEV (Not diversified)	t-Values (Diversified)	t-Values (Not diversified)	p-Values (Diversified)	p-Values (Not diversified)
INKS -> RAC	0.249	-0.017	0.24	-0.006	0.075	0.054	3.326	0.319	0.001	0.749
PAC -> EXI	0.303	0.014	0.29	0.015	0.09	0.071	3.365	0.195	0.001	0.845
PAC -> RAC	0.468	0.63	0.445	0.622	0.083	0.041	5.612	15.493	0	0

Direct Paths	Path Coefficients Original (Female)	Path Coefficients Original (Male)	Path Coefficients Mean (Female)	Path Coefficients Mean (Male)	STDEV (Female)	STDEV (Male)	t-Values (Female)	t-Values (Male)	p-Values (Female)	p-Values (Male)
INKS -> RAC	0.249	-0.017	0.24	-0.006	0.075	0.054	3.326	0.319	0.001	0.749
PAC -> EXI	0.303	0.014	0.29	0.015	0.09	0.071	3.365	0.195	0.001	0.845
PAC -> RAC	0.468	0.63	0.445	0.622	0.083	0.041	5.612	15.493	0	0

The analysis extends by evaluating the effects of the control variables on entrepreneurial innovation. First, the researcher evaluated the direct and moderating effects of the binary variables has on Exploratory Innovation (EPI), Exploitative innovation (EXI), and Realised Absorptive Capacity (RAC). The moderating variables evaluated included gender, Incubator/accelerator programme (IN/AC), Ownership (OW) that evaluates location, diversification (DI), start-up experience (STEX), industry experience (INEX). The moderating effect of the variables was conducted using an unstandardized product indicator. The model was run by conducting a PLS algorithm and a complete bootstrapping with 5000 subsamples with a two-tailed test with a significance level of 0.1.

In this case, the control gender has a direct effect on the RAC of high-tech start-ups (β = 0.423, t = 1.030, p = 0.042). In addition, gender seemed to have a slightly moderate negative effect between PAC and RAC (β = 0.423, t= 1.803, p = 0.071). However, since the t value is less than 1.96, there is no statistical evidence that suggests gender influences the transformation and implementation of knowledge. The model with gender as a control variable illustrated in appendix D.9.

Surprisingly, the attendance to incubator or accelerator programmes (IN), and ownership did not present a significant effect on the model. Hence, it can be suggested that incubators and accelerator programmes can affect the company's operational processes, but not on the Absorptive Capacity or innovation processes (Appendix D.10). Moreover, the location where the company was initially founded does not affect high-tech start-ups. This evidence suggests that access to knowledge spillovers is not affected by the company's initial location or entrepreneurs.

Interestingly, the company's diversification in different businesses or products has a moderating effect between the PAC and EXI of new ventures (β = 0.214, t= 1.993, $p < 0.05$). Hence, it can be suggested that companies that focus on enhancing current products can extend to various markets that share a similar characteristic. Moreover, start-ups that are already diversified can explore new products from the acquisition and assimilation stages of knowledge acquisition. The model and bootstrapping results of the moderation are illustrated (Appendix D.11).

In regards to experience, holding industrial experience before starting a company has a negative effect on the exploitative innovation of new products (β = -0.878, t= 2.082, $p < 0.05$) (appendix D.12). This finding suggests that entrepreneurs holding previous knowledge spillovers that provides an understanding of a base product may not engage in the development of new features or product characteristics. Shockingly, previous entrepreneurial experience does not have a moderating or direct effect on product innovation (Appendix D.13). The findings suggest that entrepreneurial experience may impact only the creation and normal operations of the start-up. However, entrepreneurial experience does not affect directly on the absorption and implementation of knowledge towards product innovation.

Based on the findings, the researcher proceeded to develop Model 2. This extension includes evaluating the moderating effects of Incoming Knowledge Spillovers (INKs), and Technological turbulence on RAC, EXI, and EPI. The model includes evaluating the age of entrepreneurs, the start-up's age and size (See figure 6.8). The model was tested using a multiple group analysis to evaluate the categorical variables of type of market, type of industry, and education level. The initial analysis suggests that the moderating technological turbulence holds a negative significant effect on exploratory Innovation (β = -0.204, t= 4.946, $p < 0.001$). In addition, the age of the founder has a negative effect on how the company engages on exploitative innovation (EPI) (β = -0.113, t= 3.017, $p < 0.01$). The summary of the base model is illustrated in table 6.14. The illustration of the model is shown in figure 6.9.

Table 6.14 - Bootstrapping results of Model 2

Direct Paths	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Age company -> EPI	0.028	0.031	0.04	0.705	0.481
Age company -> EXI	-0.033	-0.032	0.039	0.851	0.395
Age entrepreneur -> EPI	-0.113	-0.115	0.037	3.017	0.003
Age entrepreneur -> EXI	-0.002	-0.001	0.04	0.06	0.952
Firm size -> EPI	0.08	0.081	0.042	1.938	0.053
Firm size -> EXI	0.051	0.053	0.034	1.508	0.132
INKS -> EPI	0.144	0.132	0.081	1.764	0.078
INKS -> EXI	0.13	0.128	0.053	2.442	0.015
INKS -> PAC	0.304	0.313	0.042	7.167	0
INKS -> RAC	0.131	0.133	0.062	2.102	0.036
INKS * PAC -> RAC	-0.012	-0.012	0.007	1.857	0.063
NKS -> EPI	-0.128	-0.116	0.063	2.024	0.043
NKS -> EXI	-0.126	-0.119	0.047	2.692	0.007
NKS -> PAC	0.265	0.268	0.043	6.083	0
NKS -> RAC	-0.022	-0.016	0.043	0.499	0.618
PAC -> AQS	0.825	0.825	0.018	44.782	0
PAC -> ASM	0.916	0.916	0.008	118.295	0
PAC -> EPI	0.085	0.087	0.058	1.481	0.139
PAC -> EXI	0.096	0.093	0.059	1.624	0.104
PAC -> RAC	0.69	0.685	0.057	12.046	0
RAC -> EPI	0.395	0.358	0.147	2.688	0.007
RAC -> EXI	0.25	0.247	0.048	5.166	0
RAC -> EXP	0.917	0.917	0.009	104.374	0
RAC -> TRM	0.944	0.944	0.006	163.395	0
TUR -> EPI	0.349	0.298	0.191	1.833	0.067
TUR -> EXI	0.1	0.1	0.041	2.434	0.015
TUR * RAC -> EXI	-0.204	-0.206	0.041	4.946	0
TUR * RAC -> EPI	-0.033	-0.027	0.022	1.504	0.133

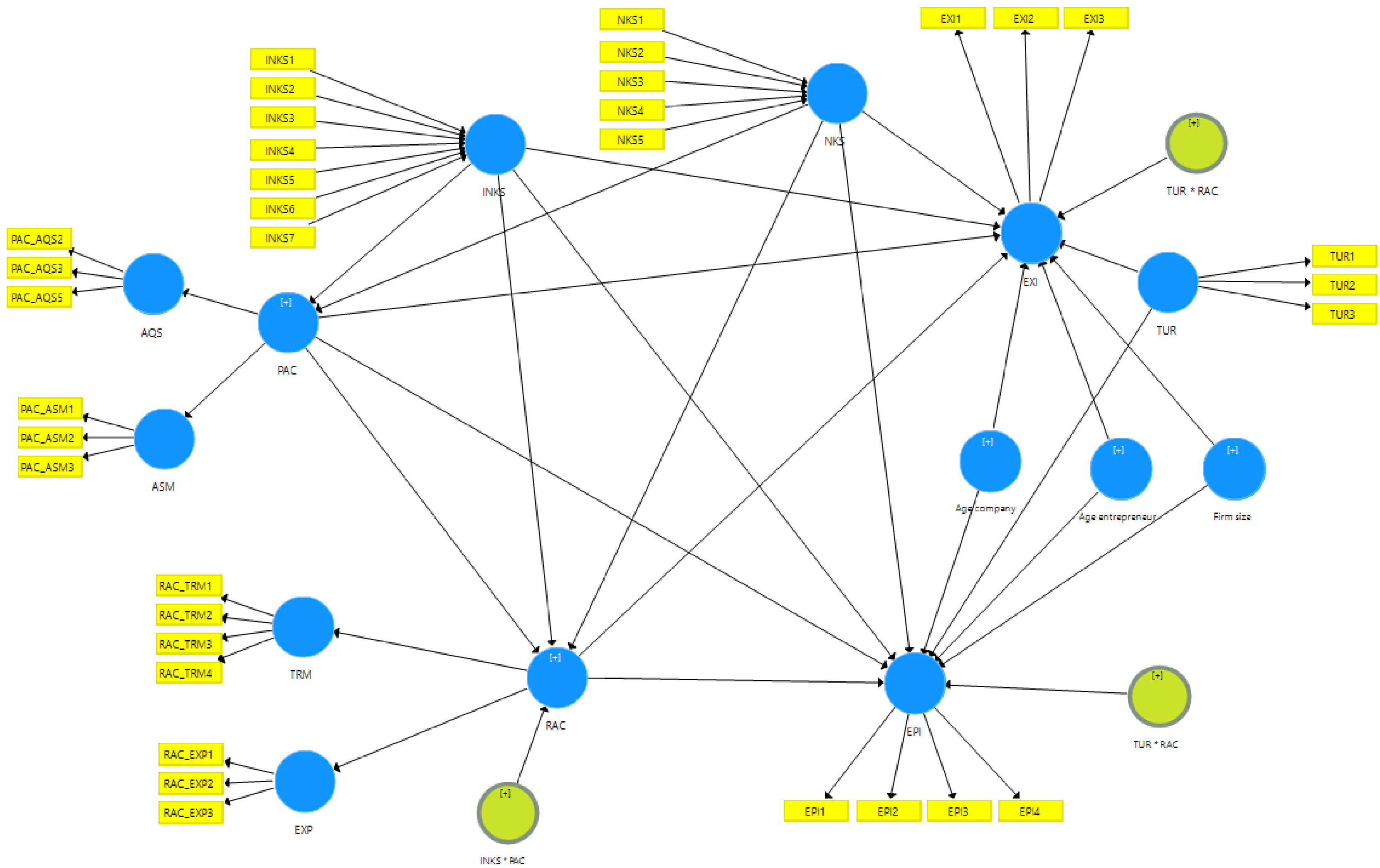


Figure 6.9 - Model 2 of the moderating effects of knowledge spillovers, technological turbulence, and continuous moderating **effects.**

The researcher extended the analysis of Model 2 on three industrial samples. The categories related to high-tech were grouped (Model 2a). Companies under the Research and Development and other types were used as a second and third group representing the Knowledge-Intensive High-Technology Services (KIBS) and Knowledge-Intensive Market Services (KMS) (Model 2b) (European Commision, 2008; Timmermans, 2009). Also, the researcher asked if the level of academic qualifications illustrated differences among entrepreneurs. For that purpose, the level of education is assessed as Bachelor’s degree (Model 3a), Masters in Science or Arts (Model 3b), other types of qualifications or none (Model 3c), and Doctor in Philosophy (Model 3d).

The results of model 2 in table 6.15 showed that the founders' individual experience represented with the age of the entrepreneur is only negatively significant for high-tech companies (β = -0.121, t=2.644, $p < 0.01$). Interestingly, the company's number is only relevant for companies that provide services in the market (β = 0.176, t=3.785, $p < 0.001$). Hence, the findings suggest that the number of employees and years of the company are not important to high-tech companies. However, as the founder gets older, the company may resist engaging in exploratory innovation.

Regarding TUR, the change of technological turbulence affects EPI directly on service ventures (β = 0.826, t=2.573, $p < 0.001$). On the other hand, high-tech companies can be affected positively from rapid technological environments on exploitative innovation of existing products (EXI) (β = 0.131, t=2.371, $p < 0.05$). Moreover, TUR presents a small negative moderating effect on High-Tech start-ups and other companies between RAC and EXI (β = -0.077, t=1.987, $p < 0.05$).

Regarding knowledge spillovers, both secondary dimensions of INKS and NKS continue to be statistically significant for PAC except KIBS. However, Knowledge-Intensive Market Service companies were the only type of industry that can absorb Incoming Knowledge Spillovers (INKs) during the RAC stage (β = 0.243, t=2.046, $p < 0.05$). Also, companies in this category can even use Network Knowledge Spillovers (NKS) during exploratory innovation (EXI). Respecting Absorptive Capacity. High-tech companies present the highest stronger significance between PAC and RAC (β = 0.74, t=10.219, $p < 0.001$). However, high-tech start-ups in this study do not present a statistically significant relationship between realised absorptive capacity and exploitative innovation (β = 0.224, t=1.662, $p < 0.1$.). Finally, on the evaluation of product innovation, high-tech companies can be negatively affected by Network Knowledge Spillovers during Innovative exploration (EPI) (β = -0.22, t=2.497, $p < 0.05$). The complete table of results of model 2a and 2b is illustrated in Appendix D.14.

Table 6. 15 - Summary of Bootstrapping results of model 2

	Model 2a High-tech companies			Model 2b KIBS and other companies		
Path Coefficients	**Path Coefficients**	**t values**	**p values**	**Path Coefficients**	**t values**	**p values**
Age company -> EPI	0.067	1.442	0.149	0.011	0.151	0.88
Age company -> EXI	-0.046	0.83	0.407	0.016	0.302	0.763
Age entrepreneur -> EPI	-0.121	2.644	0.008	-0.066	0.859	0.391
Age entrepreneur -> EXI	-0.022	0.455	0.649	0.008	0.109	0.913
Firm size -> EPI	0.011	0.2	0.842	0.176	3.785	0
Firm size -> EXI	0.047	1.025	0.305	0.058	1.09	0.276
INKS -> EPI	0.255	1.794	0.073	0.032	0.289	0.772
INKS -> EXI	0.088	1.114	0.265	0.1	0.962	0.336
INKS -> PAC	0.267	4.028	0	0.384	5.528	0
INKS -> RAC	0.096	1.293	0.196	0.243	2.046	0.041
INKS * PAC -> RAC	-0.017	2.023	0.043	-0.009	0.774	0.439
NKS -> EPI	-0.22	2.497	0.013	0.005	0.048	0.961
NKS -> EXI	-0.093	1.514	0.13	-0.133	1.659	0.097
NKS -> PAC	0.282	4.867	0	0.264	3.847	0
NKS -> RAC	0.013	0.242	0.809	-0.034	0.415	0.679
PAC -> AQS	0.833	41.949	0	0.803	18.746	0
PAC -> ASM	0.916	100.291	0	0.916	67.895	0
PAC -> EPI	0.076	1.133	0.257	0.077	0.676	0.499
PAC -> EXI	0.101	1.343	0.179	0.114	1.118	0.264
PAC -> RAC	0.74	10.219	0	0.587	5.836	0
RAC -> EPI	0.224	1.662	0.097	0.687	2.456	0.014
RAC -> EXI	0.221	3.638	0	0.296	3.549	0
RAC -> EXP	0.903	78.4	0	0.94	77.781	0
RAC -> TRM	0.931	112.815	0	0.961	138.485	0
TUR -> EPI	0.072	0.412	0.68	0.826	2.573	0.01
TUR -> EXI	0.131	2.371	0.018	0.04	0.643	0.52
TUR * RAC -> EXI	-0.158	2.17	0.03	-0.3	4.743	0
TUR * RAC -> EPI	-0.005	0.253	0.8	-0.077	1.987	0.047

Statistically significant Evidence of a reduced statistical effect

For academic qualifications, there are some relevant findings. First, the number of employees in a company have a positive statistical significance for entrepreneurs that hold a bachelor's degree ($\beta = 0.143$, t=5.517, $p < 0.05$), and master's degree (β =0.143, t=2.492, $p < 0.05$). Hence, it is possible to state that individual with higher or other qualifications believe that they have the required tacit knowledge spillovers to develop the company without hiring skilled human capital. These statements are supported by the effect of Incoming Knowledge Spillovers (INKs) on Exploratory Innovation (EXI). In this case, there is no statistical evidence that supports entrepreneurs with higher or no qualifications use external knowledge sources during the development of new products or prototypes (PhD: $p > 01$). Moreover, in comparison to other entrepreneurs, PhD holders are not engaged in the enhancing of existing products (EPI) (β = 0.107, t=0.363, $p > 0.5$). Therefore, we can state that academics or entrepreneurs with a PhD are more driven to direct their endeavours to create a new market. Entrepreneurs in this category prefer to develop new forms of products and expand on knowledge. The statement is proven by the strong statistical significance between RAC with EXI in comparison to other entrepreneurs ($\beta = 0.334$, t=3.105, $p < 0.001$). On the other hand, there is no statistical evidence that entrepreneurs without qualifications engage in exploratory innovation.

Regarding technological turbulence, only individuals holding a bachelor's or master's degree perceive that technological turbulence can support existing products' development. In contrast, entrepreneurs with other or no qualifications have a positive direct effect between TUR and EXI ($\beta = 0.334$, t=2.527, $p < 0.5$). Therefore, academic qualifications raise awareness that rapid technological change influences the development of new products.

Finally, evidence suggests by comparing all the groups by the qualification that only entrepreneurs with a PhD sense that technological turbulence can have a negative moderating effect on exploratory innovation ($\beta = -0.404$, t=6.13, $p < 0.05$). Hence, new ventures with a founder with a doctorate see advances in scientific knowledge as barriers that prevent keeping up with constant change. The effect can be discussed due to the possible lack of hiring skilled human capital to cover the company's technological knowledge gap. The summary of the statistics regarding model 3a and b are illustrated in table 6.16. The complete analysis of academic qualifications is located in Appendix D.15.

Table 6. 16 - Summary of Bootstrapping results of model 3

	Model 3a (Bachelor's degree)			Model 3b (MA/MSc)			Model 3c (Other qualifications or none)			Model 3d (PhD)		
Direct Paths	**Path Coefficients**	**t values**	**p values**	**Path Coefficients**	**t values**	**p values**	**Path Coefficients**	**t values**	**p values**	**Path Coefficients**	**t values**	**p values**
Age company -> EPI	0.051	0.803	0.422	0.051	0.8	0.424	-0.04	0.43	0.667	0.233	2.488	0.013
Age company -> EXI	-0.059	0.768	0.442	-0.059	0.762	0.446	-0.111	1.128	0.26	0.087	1.299	0.194
Age entrepreneur -> EPI	-0.032	0.495	0.621	-0.032	0.5	0.617	-0.049	0.381	0.703	-0.217	2.651	0.008
Age entrepreneur -> EXI	0.063	0.894	0.371	0.063	0.903	0.366	-0.081	0.967	0.334	-0.043	0.639	0.523
Firm size -> EPI	0.04	0.541	0.589	0.04	0.541	0.588	0.163	1.343	0.179	0.067	0.721	0.471
Firm size -> EXI	0.143	2.517	0.012	0.143	2.492	0.013	0.014	0.189	0.85	-0.103	0.987	0.324
INKS -> EPI	0.169	1.406	0.16	0.169	1.421	0.155	-0.24	0.914	0.361	0.173	1.042	0.298
INKS -> EXI	0.316	2.9	0.004	0.316	2.864	0.004	0.114	0.61	0.542	0.036	0.367	0.714
INKS -> PAC	0.228	2.59	0.01	0.228	2.594	0.01	0.28	2.346	0.019	0.478	5.439	0
INKS -> RAC	0.019	0.181	0.856	0.019	0.181	0.857	-0.091	0.495	0.621	0.209	1.601	0.11
INKS * PAC -> RAC	0.008	0.742	0.458	0.008	0.736	0.462	0.017	0.849	0.396	-0.026	1.858	0.063
NKS -> EPI	-0.056	0.493	0.622	-0.056	0.498	0.619	0.093	0.386	0.699	0.156	1.129	0.259
NKS -> EXI	-0.188	1.682	0.093	-0.188	1.702	0.089	-0.131	1.012	0.312	0.019	0.212	0.832
NKS -> PAC	0.312	3.548	0	0.312	3.701	0	0.304	2.87	0.004	0.271	3.079	0.002
NKS -> RAC	-0.065	0.796	0.426	-0.065	0.81	0.418	-0.129	0.764	0.445	0.087	0.924	0.355
PAC -> AQS	0.822	21.925	0	0.822	22.396	0	0.763	9.832	0	0.896	38.295	0
PAC -> ASM	0.926	75.327	0	0.926	75.597	0	0.91	46.478	0	0.938	61.47	0
PAC -> EPI	0.163	1.744	0.081	0.163	1.71	0.087	0.068	0.468	0.64	-0.084	0.512	0.608
PAC -> EXI	0.011	0.107	0.915	0.011	0.104	0.917	0.159	1.069	0.285	0.009	0.085	0.932
PAC -> RAC	0.583	5.944	0	0.583	`	0	0.402	2.115	0.034	0.854	8.356	0
RAC -> EPI	0.555	2.287	0.022	0.555	2.305	0.021	0.561	2.065	0.039	0.107	0.363	0.717
RAC -> EXI	0.243	2.856	0.004	0.243	2.87	0.004	0.141	1.327	0.184	0.334	3.105	0.002
RAC -> EXP	0.918	59.135	0	0.918	59.038	0	0.898	40.871	0	0.937	54.959	0
RAC -> TRM	0.954	124.791	0	0.954	123.399	0	0.924	50.521	0	0.953	75.213	0
TUR -> EPI	0.553	2.007	0.045	0.553	2.009	0.045	0.772	1.69	0.091	0.155	0.456	0.648
TUR -> EXI	0.1	1.209	0.227	0.1	1.245	0.213	0.285	2.527	0.012	-0.01	0.16	0.873
TUR * RAC -> EXI	-0.16	1.309	0.191	-0.16	1.314	0.189	-0.286	0.953	0.341	-0.41	6.13	0
TUR * RAC -> EPI	-0.052	1.509	0.131	-0.052	1.521	0.128	-0.093	1.612	0.107	0.002	0.041	0.968

Statistically significant (yellow) — Statistical difference between groups (orange)

The quantitative analysis ends with a comparison between diversified and undiversified start-ups. An initial screening shows that diversified companies portray a similar statistical behaviour of KIBS and other companies (Model 2b). In contrast, undiversified companies follow the trends of high-tech companies (Model 2a). However, the comparison in this analysis did not show statistical discrepancies in the control variables.

Diversified companies portray a statistical significance between incoming knowledge spillovers and realised absorptive capacity (β = 0.338, t=3.734, $p < 0.001$). In addition, only diversified companies are able to engage on exploratory innovation during the activities undertaken in the potential absorptive capacity (PAC) (β = 0.253, t=2.574, $p < 0.01$). Diversified companies also engage in exploratory innovation during the implementation of knowledge undertaken in activities undertaken in realised absorptive capacity (β = 0.186, t=2.108, $p < 0.05$). Companies in this category only perceive minor moderating effects from technological turbulence (β = -0.235, t=2.415, $p < 0.05$). This evidence suggests that diversified companies can engage in the process of a product development cycle. In this situation, the company can obtain knowledge spillovers in alliances during the implementation of knowledge and develop new products.

In constracts, undiversified companies seem to only engage on exploratory innovation durind the activities undertanken in realised absorptive capacity (RAC) (β = 0.293, t=4.764, $p < 0.001$). The evidence of a more linear process is evidence in the strong statistical relation between potential and realiced absorptive capacity (β = 0.739, t=11.349, $p < 0.001$). Only undiversified companies presented direct positive effects from technological turbulence diring the implementation of knowledge in RAC (β = 0.104, t=2.102, $p < 0.05$). However, start-ups in this category also were affected by the moderating effect of technological turbulence while engaging on exploratory innovation (β = -0.19, t=3.937, $p < 0.001$).

The statistical evidence suggests that undiversified companies collect knowledge spillovers during the activities of potential absorptive capacity. Afterwards, entrepreneurs commit all the resource to engage in exploratory innovation. Due to the focus on a single product, start-ups perceive technological change as a competitive technological advantage. The summary of the statistics regarding model 3a and b are illustrated in table 6.17.

Table 6. 17 - Bootstrapping results of model 4

Direct Paths	Nor diversified Start-ups: Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Diversified Start-Ups: Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Age company -> EPI	0.034	0.037	0.051	0.674	0.501	-0.026	-0.013	0.063	0.409	0.682
Age company -> EXI	-0.028	-0.025	0.048	0.585	0.559	-0.028	-0.029	0.067	0.412	0.681
Age entrepreneur -> EPI	-0.113	-0.111	0.043	2.611	0.009	-0.069	-0.061	0.071	0.974	0.331
Age entrepreneur -> EXI	0.021	0.02	0.05	0.411	0.681	-0.047	-0.044	0.061	0.771	0.441
Firm size -> EPI	0.105	0.104	0.05	2.086	0.038	-0.006	-0.01	0.082	0.076	0.939
Firm size -> EXI	0.066	0.066	0.04	1.667	0.096	0.039	0.046	0.058	0.666	0.506
INKS -> EPI	0.099	0.077	0.123	0.803	0.423	0.236	0.224	0.115	2.05	0.041
INKS -> EXI	0.181	0.169	0.064	2.801	0.005	0.048	0.053	0.116	0.415	0.679
INKS -> PAC	0.295	0.308	0.056	5.279	0	0.338	0.354	0.075	4.48	0
INKS -> RAC	0.057	0.07	0.073	0.775	0.439	0.338	0.323	0.09	3.734	0
INKS * PAC -> RAC	-0.013	-0.014	0.008	1.707	0.088	-0.016	-0.015	0.012	1.346	0.179
NKS -> EPI	-0.166	-0.14	0.078	2.126	0.034	0.059	0.063	0.179	0.331	0.741
NKS -> EXI	-0.129	-0.119	0.061	2.126	0.034	-0.098	-0.079	0.077	1.281	0.201
NKS -> PAC	0.269	0.272	0.054	5.017	0	0.234	0.233	0.11	2.129	0.034
NKS -> RAC	0.013	0.02	0.051	0.249	0.804	-0.06	-0.03	0.096	0.624	0.533
PAC -> AQS	0.826	0.825	0.023	36.091	0	0.827	0.822	0.036	22.966	0
PAC -> ASM	0.915	0.916	0.009	104.721	0	0.921	0.92	0.016	56.915	0
PAC -> EPI	0.138	0.145	0.073	1.896	0.059	-0.029	-0.026	0.111	0.258	0.796
PAC -> EXI	0.002	0.007	0.071	0.022	0.982	0.253	0.223	0.098	2.574	0.01
PAC -> RAC	0.739	0.733	0.065	11.349	0	0.583	0.563	0.115	5.071	0
RAC -> EPI	0.375	0.293	0.215	1.743	0.082	0.335	0.31	0.225	1.486	0.138
RAC -> EXI	0.293	0.284	0.062	4.764	0	0.186	0.187	0.088	2.108	0.036
RAC -> EXP	0.915	0.916	0.01	90.047	0	0.919	0.918	0.016	57.736	0
RAC -> TRM	0.94	0.94	0.006	147.902	0	0.95	0.949	0.011	86.986	0
TUR -> EPI	0.328	0.205	0.284	1.157	0.248	0.296	0.261	0.273	1.085	0.279
TUR -> EXI	0.104	0.107	0.049	2.102	0.036	0.094	0.087	0.081	1.166	0.244
TUR * RAC -> EXI	-0.19	-0.197	0.048	3.937	0	-0.235	-0.245	0.097	2.415	0.016
TUR * RAC -> EPI	-0.035	-0.019	0.034	1.014	0.311	-0.021	-0.016	0.03	0.699	0.485

Statistically significant | Evidence of reduced statistical significance

***p < 0.001; **p<.01; *p<.05

6.7. Conclusions

This chapter offers three main themes to consider about (1) The high-tech start-ups required characteristics and incubation/acceleration process; (2) the company's absorptive capacity and effects of knowledge spillovers; and (3) the adequate engagement on product innovation and moderating effect of technological turbulence. The chapter provided in-depth analysis to develop an initial quantitative model KST-QNCM that included constructs identified from the literature and guided from the model KST-QLEM2 developed in Chapter V.

The analysis conducted a confirmatory and exploratory factor analysis that established a solid statistical model 1 that passed validity and reliability tests. The analysis was extended to develop models that analyse and discuss the statistical differences of start-ups based on the background of the entrepreneurs, type of company, and diversification (models 2, 3 and 4). The quantitative analysis serves as a foundation to provide strong statistical evidence to generalise the qualitative analysis findings. The following provides a summary of the managerial implications obtained from the quantitative analysis.

6.7.1. Characteristics of High-Tech Start-ups and Incubator/accelerator programmes

The initial set of foundations of knowledge spillovers relies on entrepreneurs' background and previous knowledge to set the initial operations (Fallah, Howe and Ibrahim, 2004; Schmidt, 2015). The number of employees and years of operation since the foundation has been considered initial indicators to evaluate new ventures (Zobel, 2017; Jin, Shu and Zhou, 2019). However, the results strongly indicate that high-tech companies' capability to innovate can be restricted to the age of the entrepreneur. Also, a company's decision to develop multiple products with similar characteristics can promote the company to engage in exploratory innovation. Moreover, entrepreneurs that have previous experience with the industry can influence the exploitative innovation of new products. Therefore, it can be suggested founders need to be open to develop multiple products and are aware that previous experiences can initially affect their predisposition to innovate.

Moreover, start-ups that decide to participate in an accelerator or incubator programme can absorb knowledge spillovers successfully. On the other hand, the data suggests that the number of employees or yeas of the new venture's operation is not a restricted factor to develop new products. Besides, female entrepreneurs seem to test prototypes in new markets, even during knowledge absorption. The Companies Absorptive Capacity and effects of Knowledge Spillovers

The initial critical contribution to knowledge from the research was applying knowledge spillover dimensions as formative constructs (Laursen; Belderbos, Sisodiya). The capture process was evaluated on a two-stage process of the Potential and Realised Absorptive Capacity constructs (Tzokas et al., 2015; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Limaj and Bernroider, 2017). The document provides a crucial insight that new ventures can only absorb knowledge spillovers during the potential absorptive capacity stages of product development. The findings suggest that both incoming and knowledge spillovers can only be attained during and acquisition and assimilation processes. From one side, Incoming Knowledge Spillovers are obtained from engaging with suppliers, customers, and universities. On the other hand, access to scientific journals and access to associations with other companies are the most relevant forms of Network Knowledge Spillovers.

However, KIBS founders perceive that knowledge coming from direct contact with other entities or individuals does not provide value to the company. Also, only companies involved with Knowledge-Intensive Market Services can genuinely use knowledge spillovers during the RAC stage properly. High tech companies exposed to exploratory innovation can be negatively affected by Network Knowledge Spillovers. The findings suggest that entrepreneurs need to consolidate resources to capture knowledge spillovers during the PAC phase. Any other attempt can reduce the capability of companies to innovate. This phenomenon is evidenced by the negative but non-significant effect of Incoming knowledge spillovers between PAC and RAC.

6.7.2. The Engagement with Exploratory and Exploitative Innovation

Product innovation is a critical component necessary for start-ups to remain competitive in the market (Da Rin and Penas, 2017). The analysis has proven to be dependent on the company's resources and cooperation with other institutions (De Faria, Lima and Santos, 2010). The findings strongly suggest that RAC is a mandatory mediator construct necessary for developing new products. This requirement can be reduced if new ventures decide to diversify to develop multiple products with similar characteristics. Also, female entrepreneurs seem to be able to develop new products during the absorption of knowledge.

Regarding technological turbulence, the findings suggest that high-tech companies can perceive the constant technological change that enables companies to explore new opportunities. However, if the development of new technologies is perceived as a requirement for innovation, entrepreneurs may restrain to engage in exploratory innovation. The effects of technological change only affected companies in the high-tech and Knowledge-Intensive Market Service companies. However, KIBS seems not to be able to engage directly in the development of new products. Finally, the findings suggest that entrepreneurs with higher academic qualifications tend not to increase the company's number of employees. Also, the nature of academic training can influence the decision to use research to develop new products that can be used to attain academic publications (O’Gorman, Byrne and Pandya, 2008). This awareness comes to the price that technological turbulence can become a form of knowledge filter that can prevent start-up development.

On the other hand, entrepreneurs with bachelor's and master’s degrees are open to increasing the company's number of employees. The decision enables to obtain value from knowledge spillovers during the development of new products or prototypes. Surprisingly, entrepreneurs that do not hold a degree and have other or no qualifications may choose only to enhance existing products. Finally, technological turbulence negative moderating effect between realised absorptive capacity and exploratory innovation only affects a doctorate's entrepreneurs.

7. CHAPTER VII DISCUSSION CHAPTER

7.1. Introduction

The following discussion chapter develops a final integration of the qualitative and quantitative findings to create an integrated framework that explains the effects of knowledge spillovers on high and medium-tech start-ups. All the sections of the discussion chapter are focused on answering the research questions of the doctoral thesis. The chapter combines the analysis and discussion from Chapter V and VI to stipulate a definitive model on the effects of knowledge spillovers, incubators, and accelerator programmes on high-tech start-ups' product innovation.

Chapter VII discusses the main findings from the qualitative and quantitative analysis summarised in figures 7.7. The section links the study from the overarching dimensions, constructs, and literature to uncover knowledge spillovers' main effects on high-tech start-ups gathered from Chapter lll. The author proposes that the data provides insights on how entrepreneurs operate during the first ten years of operation. The chapter explains three main phases illustrated in 7.1, 7.2, and 7.3: 1) Identification of the Business Idea and Creation of the company, 2) Establishment and development of the company, and 3) Scaling up and the future of the company. The phases defined in this phase can overlap processes during the absorption and implementation of knowledge and the processes related to product innovation. The process is not linear as phases 2 and 3 involve a product development cycle and new ventures.

The first phase addresses the company's creation, explains the identification and validation of the business idea, and the foundation of the start-up's resources fostered by incubators and accelerator programmes. This section considers the company's main characteristics, the background of the entrepreneur, and the effect of incubators and accelerator programmes on start-ups.

The second phase of the establishment and development of the company highlights development alliances and partnerships. This section also describes the management of the new venture’s human capital to implement virtual platforms and search engines towards R&D. The section describes the mechanisms used by entrepreneurs to acquire knowledge spillovers. Furthermore, the phase explains how skilled human capital implements technological approaches and processes to support products' development.

The third phase of scaling up and the company's future defines start-up implementation of technological adaptation and knowledge absorption towards exploratory and exploitative innovation.

The final development of the effects of knowledge spillovers on high-tech start-ups conceptual framework is supported by the qualitative analysis of case studies discussed in the model on Chapter V, and the quantitative analysis of the survey through factor analysis of the MGA based on the type of industry, academic qualifications, and business diversification. The interaction between the phases and the constructs discussed in the chapter is shown as follows:

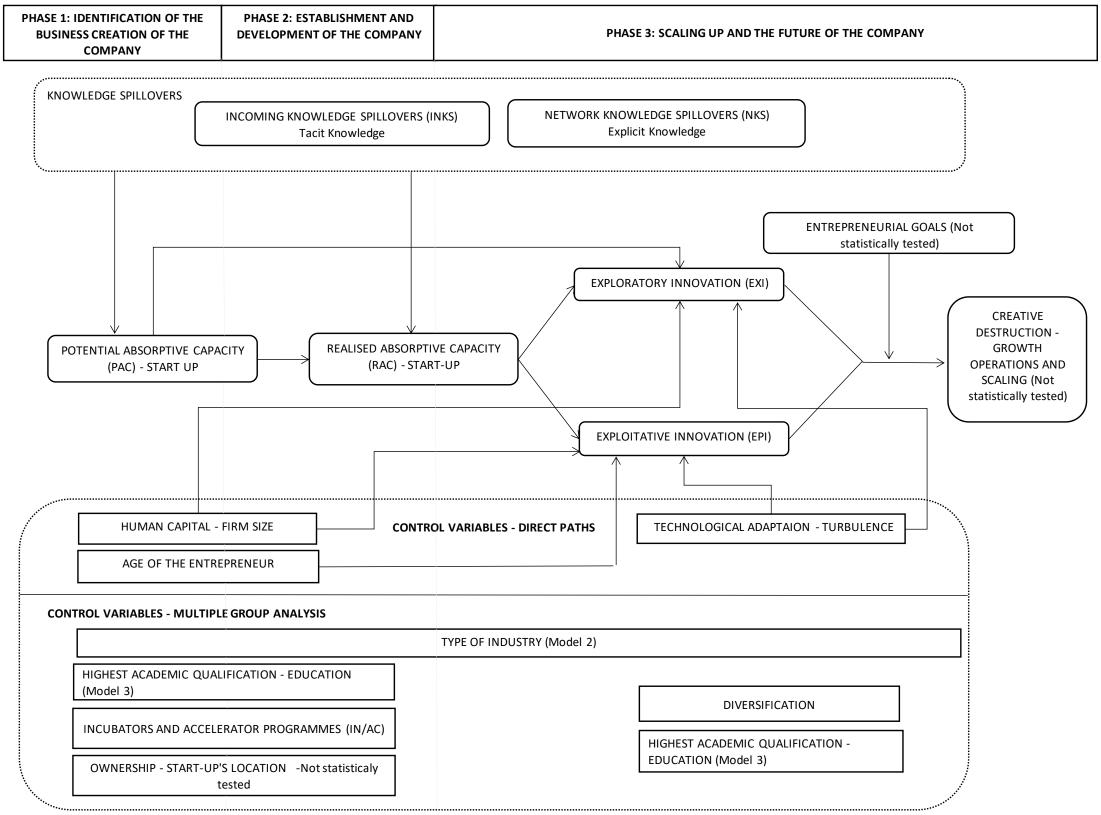


Figure 7.1 - Data Structure for the Start-up phase of The Creation and Establishment of the Company

The chapter ends by linking the discussion to the thesis's initial research statements, highlighting the main findings of the research, and includes the contributions to knowledge.

The discussion chapter includes a defined taxonomy of knowledge spillovers enunciated on the model's theoretical dimensions and development at the end of each phase and mechanisms used by high-tech start-ups during the entrepreneurial journey. The section ends by providing adapted applications of the model, based upon the start-ups type of industry and on the founder's background. The first supported overarching dimension of start-ups with established propositions and mechanisms links to a defined taxonomy, sources, and characteristics of knowledge spillovers are shown in each phase. The updated propositions of the model KST-QLEM2 on Chapter V are enunciated and further supported by the factor analysis conducted on the quantitative analysis (See Chapter VI).

7.2. Phase one – Identification of the Business Idea and Creation of the Company

The phase begins with the entrepreneur's decision to leave their current employment situation and assesses the initial steps taken by entrepreneurs to identify and evaluate the business idea from knowledge spillovers. This process is motivated by the entrepreneur's capability to detect an entrepreneurial opportunity. Two main factors can drive the catalysts to push this endeavour. First, the founder's tacit knowledge gathered from years of experience in an industrial sector or academia's knowledge. Second, the start-up's processes of enhancing their absorptive capacity to capture knowledge spillovers. This section will evaluate every proposition developed from the qualitative phase and test them with the quantitative phase analysis.

The second endeavour on the start-up's development to absorb knowledge spillovers was assessed based on two main factors. Hence, the section evaluates the effects of incubators and accelerator programmes on the formation of alliances. This phase considers the impact of incubator and accelerator programmes evaluated by discussing the given services provided to new ventures.

The quantitative analysis in the second stage was able to test the influence of the entrepreneur's profile, and company background has on start-ups performance and innovation. From the control variables regarding the respondent's age, companies age and size were assessed from the direct effects on exploratory and exploitative innovation. Furthermore, the quantitative phase enabled to test the models two and three using factor analysis by evaluating the impact of knowledge spillovers.

Moreover, the section evaluates the variable “Incubator/Accelerator attendance” (IN/AC), which enabled identifying entrepreneurs who have attended one of these programmes in the United Kingdom. The model was tested using a Multiple-Group-Analysis between both samples. This section analyses the control variables on the characteristics of the company and the entrepreneurs. The summary of the overarching dimensions, themes, and categories followed in this session are discussed as follows:

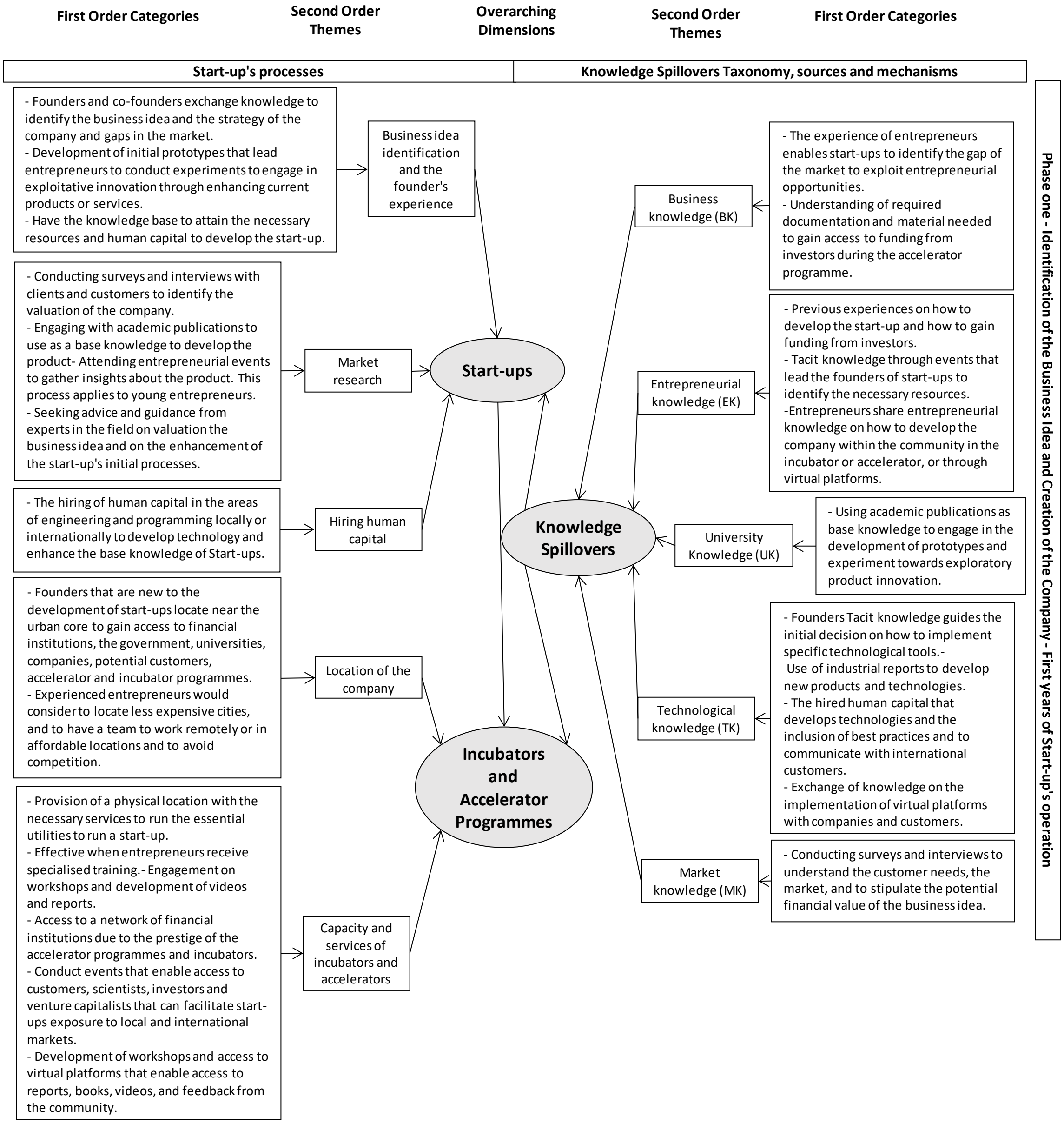


Figure 7.2 - Data Structure for Phase 1 – Identification of the Business Idea and Creation of the Company

7.2.1. Start-ups

7.2.1.1. Business Idea Identification and the founder's experience

The initial stepstone that contributes to the company's development is the identification of the business idea through knowledge spillovers. The initial sources of knowledge can be obtained from the industry, academia, or previous entrepreneurial, supported by the start-up's insights discussed from the qualitative analysis. Entrepreneurs rely on prior tacit knowledge and entrepreneurial *events* to obtain initial insights about the product and its value in the market. Moreover, entrepreneurs with extensive entrepreneurial experience bypass an evaluation of the business idea by assessing market research and can decide to start the new venture (SU7, SU10). The analysis of the entrepreneur's background led to identifying the types of knowledge spillovers that led to the business idea, and the company's creation.

- **I got together with my co-founder, we both shared experiences of how our used cars caused problems, and at that point, the idea was born that we wanted to try free trust for a used car market. That is how it came about (SU7).**

Tacit knowledge spillovers fostered on the entrepreneur's experience lead to knowing how the company would operate and the resources and network capital needed before starting the new venture (KS-TX1, KS-TX2, KS-TX4, KS-TX5). The company's creation is the necessary support between the entrepreneur, co-founders, and starting the team to attain the required funding and resources (SU-FC6-9). These circumstances highlight that scientific knowledge and cofounders with technical skills must provide an adequate knowledge base. The decision can be motivated by the expected return of investment to start a company surpasses any forms of doubts or fears (SU-FC1-5, SU1, SU2). Interestingly, it can be debatable that previous job employments' organisational culture pushes entrepreneurs to stay away from rigid bureaucracies (SU-FC4, SU-FC6).

- *“Frankly, I became increasingly frustrated by the bureaucracy of a large working pharma company, the procedures --------- way of working wasn’t able to adapt to a new area science, so everything took longer than it needed to take to get things done, so you can’t achieve very ---------------, decisions were never made, so you could not progress your project. I was offered the opportunity to work in small biotech. It’s* *high risk but potentially highly rewarded, so that's the differentiate, staying in a small start-up. Or a big pharma company. You kind of perception that you have a long time career, but that's not true. So working for a small biotech company where you have the promise of two to four years, is as good as a big pharma company right now"* (SU-FC4).

The main difference between the entrepreneurs with an academic background to the professional industry experience is the need to validate the business idea. Entrepreneurs who worked in SMEs and incumbents use previous tacit knowledge to forecast a market gap (SU3-SU6). In some instances, entrepreneurs can use their network capital to obtain a validation of the business idea from an expert in the field (SU3).

In most cases, entrepreneurs rely on previous tacit knowledge and entrepreneurial *events* to obtain initial insights about the product. However, entrepreneurs with extensive entrepreneurial experience would not require a second opinion to start the new venture (SU7, SU10). The founder's tacit technological knowledge involves understanding how to implement the most convenient intellectual tools and technologies (KS-TX-TKS-FTK2, KS-TX-TKS-FTK3). This process can prove to be the next step to gain investment to fund the required resources and human capital (SU-FC7, SU-FC8).

- *"Yeah, a lot of the work I have done in the past has been about technology, enhancements, and implementation on launching new products and processes, a lot has been about enhancing existing products, or adding new features or functionality. Yes, I have a lot of experience doing it, innovating in that way and leading teams and being the touchpoint between the business and the technical. The team is something that I have had quite a lot of experience in it"* (KS-TX-TKS-FTK3).

The age of the entrepreneur can suppress the high-technological start-up's direction to engage in exploitative innovation. the negative effects of the entrepreneur's age are only significance on high-technology start-ups (Age entrepreneur -> EPI: $\beta = -0.121$, $t=2.644$, $p < 0.01$). On the other hand, the experience of the entrepreneur of medium-high technology and knowledge-intensive high-technology services does not impact product innovation ($t < 1.96$). This statistical result confirms that experience influences entrepreneurs to enhance a current product or service that requires new technologies. Therefore, the researcher can strongly suggest that:

- **Increased age and experience of the founders of high-technological start-ups prevents entrepreneurs from engaging in exploitative innovation.**
- **Entrepreneurs in medium high-technology services can engage in exploratory and exploitative product innovation, regardless of experience or age.**

At this stage, knowledge sharing only occurs between the founders, cofounders, and potential future clients for the company. Hence, knowledge spillovers support companies on their performance.

7.2.1.2. Market Research

The second step on start-ups is to gather tacit knowledge spillovers that enable entrepreneurs to recognise if the business idea has potential in the market (KS-TX1, KS-RX11, KS-TX13). Initially, Start-ups with founders with an entrepreneurial background cofounder exchange knowledge to conduct market research that allows estimating the product's initial valuation and the company. Ideas obtained from entrepreneurial experience focus their initial endeavours on sharing their experiences on expected gaps in the market (SU8, SU9, SU11). Therefore, entrepreneurs and cofounder's initial sharing of knowledge can guarantee the development of a new company.

The qualitative analysis identified the various mechanisms and technological tools used by entrepreneurs to identify knowledge spillovers. First, entrepreneurs conduct market research or academic research to gain access to explicit technological knowledge spillovers to support the business's relevance (KS-S-EKS3, KS-S-EKS4, KS-S-EKS6). These elements can be conformed from conducting surveys and interviews with customers or by developing academic publications. Moreover, entrepreneurs would use industry reports and contracts with previous clients to create initial products and develop technological tools.

Entrepreneurs also aim to directly engage with experts in the field to obtain a valuation of the business idea and the product (KS-TX12, KS-TX-EKS-FND5, KS-TX-EKS-E&C3). Alternatively, entrepreneurs can also improve internal processes in the company and enhance current products or services (KS-TX9, KS-TX10, KS-TX14). Thus, knowledge spillovers use are not entirely centred on capturing uncommercialized knowledge and identifying entrepreneurial opportunities to test new prototypes and services in the market.

- *"How do you mean, in terms of money? We did research and interviews to validate our idea the value of the ---- if there was an actual demand for such service, the results were positive and encouraged us to go forward. And with the investors, we said: OK. Let's give it a try"* (KS-S-EKS4).

In this scenario, the commercial value of the product or service is perceived to hold substantial unknown potential that will generate revenue for the company in the future. In case that initial product evaluation is required, the evaluation process can prove to be complicated and can be obtained from asking experts in the field and conducting market research. The discussion of the qualitative analysis regarding market research can be summarised as follows:

- **Experienced entrepreneurs with experience in developing start-ups can identify the product's characteristics based on the valuation of the idea from tacit knowledge. On the other hand, founders with limiter experience will conduct market research by conducting interviews, surveys, and consulting experts in the field.**

7.2.1.3. Human Capital

The data suggest that entrepreneurs hire human capital from the industry, which holds technological knowledge spillovers that can support technology development in the company; That can fit the entrepreneurial culture (SU-HC2, SU-HC3, SU-HC4, SU-HC5) (Table 5.5). In some cases, start-ups would gain international knowledge spillovers by contracting employees located in foreign countries (SU-HC9, SU-HC10, SU-HC11, SU-HC12). The background of human capital can support the expansion of the start-up to other countries in the future.

The central initial insight is that cultural diversity at this stage is not considered the main driver for entrepreneurs, as stated in the literature (Cheng and Li, 2012; Rodríguez-Pose and Hardy, 2015). On the other hand, the founders would seek to recruit engineers and programmes. The breakthrough regarding human capital is that it is meant to be one of the primary sources of knowledge spillovers from universities. However, entrepreneurs do not consider as a priority to hire graduate students to boost the start-up's technological knowledge (SU-HC6, SU-HC7, SU-HC13).

- *"It is a mix of people but not from academia because I don't know how to find them. I guess, for example, if somebody studied a P.H.D. in tourism and I work with Chinese tourists, I would consider that. That would be for a full-time role, a big salary which we can't afford right now, instead we have hired people on a part-time basis with the view of later full time, most of our engineers used to work for Delloyds consultant as engineers, so they are working on developing new apps, so I guess they come from the industry but not the startup industry. Not from academia, they would know something in a certain area, and I would hire them"* (SU-HC13).

The firm size of the company initially indicates that the number of hired employees do only reinforce KIBS or medium technology companies on reinforcing exploitative innovation (firm size -> EPI: $\beta = 0.176$, t=3.785, $p < 0.001$) (See table 6.14). When the multiple groups analysis was run based on the founders highest academic qualification, the number of permanent staff members in a company only influence start-ups with founders that hold a bachelor and master degrees to engage on exploratory innovation (firm size -> EXI / Bachelor's degree: $\beta = 0.149$, t=2.517, $p < 0.05$; MA/MSc: $\beta = 0.143$, t=2.492, $p < 0.05$) (See table 6.15

Hence, the evidence suggests two critical findings. First, high-technology companies at this stage do not focus on hiring human capital, but on using academic research and the knowledge of the company's initial members to engage in exploratory innovation. On the other hand, medium high-technology and knowledge-intensive companies employed skilled human capital to develop technological tools to enhance a current product or service (EPI). If the founder's highest academic qualification from university is a master's degree, the start-up would need to hire the required staff to obtain the required technological and scientific knowledge. Therefore, the number of employees would not affect product innovation unless the first team holds a bachelor's or master's degree. Companies in this category can be part of aerospace, computers, office machinery, electronics-communications, pharmaceuticals, and scientific instruments (European Commision, 2008; Timmermans, 2009).

The findings suggest stating the following propositions in the model:

- **The size of start-ups reflected on the initial number of employees affects medium-high technology and knowledge-intensive start-ups to engage in exploitative innovation.**
- **The size of start-ups reflected on hired human capital with founders that hold a bachelor's and master's degrees can influence the company's engagement on purposeful exploratory innovation.**

Both scenarios apply for companies during the business development, seed, and growth stages regardless of the company's number of years. It is essential to mention that the data showed no statistical significance that entrepreneurial and industrial experience affects the final start-up's absorptive capacity.

7.2.2. Incubator and Accelerator Programmes

7.2.2.1. Location of the company

The sections seek to provide evidence on how the facilities, services, and capability of incubators and accelerator programmes can affect start-up's absorptive capacity and product innovation. The KSTE states that the company's location sets a base of the possible access to knowledge spillovers from companies and individuals located in the urban core (Nicolopoulou et al., 2016; Audretsch and Belitski, 2017).

First, start-ups will decide to start the venture on a location that enables the founder and cofounder to be close to companies and governmental institutions related to the new company's type of industry (SU-CC1, SUCC2).

The data suggested that entrepreneurs decided to locate in metropolitan cities to gain access to companies, universities, human capital, and government institutions (LO1, LO2, LO5, LO7, LO8). In most cases, academic institutions were visualised as sources of talented professionals that can provide the required technological knowledge.

- *"I moved from Paris to London because there is a lot more money in London for startups. SEEDCAMP was the accelerator for us, and the investor -------------------- was also our first customer. We had built; we have a great---- system to start, and also we had the market --- the market is much bigger in English speaking countries, like Canada, U.S. and U.K."* (LO3)

However, the United Kingdom was perceived by entrepreneurs with previous experience in the United States that is a nascent entrepreneurial ecosystem due to banks' restrictions to provide the required funding for the project (LO16, LO17). Starting the new venture in an urban location could also provide a limitation of covering the company's expenses and the competition in the city (LO18, LO19). Hence, the initial insights suggest that the experience of entrepreneurs can influence the location of the company. Entrepreneurs with limited resources and tacit base knowledge would seek to locate in the core of an entrepreneurial ecosystem to gain access to knowledge spillovers and resources. On the other hand, experienced entrepreneurs would choose to establish their company and team in cities that enable them to save financial support and reduce competition with other companies.

- *"So location wise it does not make a huge difference. London is convenient for getting people to a lot of advances, which is good. London is not in the middle of nowhere like the accelerator in-----; it is generally expensive, so that is on the downside. I don't think it is good to have a team based in London. There are much competition and too high a cost. So we don't want to be restricted to just one area."* (LO18)

The data also suggested that entrepreneurs attending these programmes can hire more skilled human capital from universities and enforce the required prestige to gain funding and gain more customers. On the other hand, information obtained from the government was not considered a primary source of knowledge spillovers towards product innovation, but for supporting the company's internal processes. The rationale behind it is that the government is perceived as an entity that provides only support for start-ups (LO2, LO7).

7.2.2.2. Capacity and Services of Incubators and Accelerator Programmes

Literature states that incubator and accelerator programmes are meant to facilitate entrepreneurs with the physical and virtual resources necessary to develop a product, gain exposure to the market, and to obtain funding (Looi et al., 2010; Pauwels et al., 2016; Audretsch and Belitski, 2017; Cantù, 2017).

Initially, the incubators were perceived as organisations that enabled to set the company in a location, which covers the staff and services required to run the new venture (IN-SE1, IN-CA1). In rare cases, entrepreneurs would gain access to equipment donated from companies that conducted collaborations with other companies (IN-CA1). Next, the theme “mentorship and access to the market” revealed that accelerators and incubator programmes are only perceived as support when they provide specialised training and mentorship (AC1, AC2, AC4, IC-CA7). In some instances, knowledge obtained from these interactions and exchange of business knowledge is perceived as informal, which is a form of knowledge spillovers (IN-CA5). The analysis discussed in the “collaboration” theme also suggested that entrepreneurs work in workshops and events that enabled start-ups to gain access to knowledge spillovers from reports and videos (IN-CA3, AC9). However, the data also suggested that there would be no formal alliances between entrepreneurs due to restrictions of time and competition (AC7, AC8, IN-SE1).

- *“And the third one, the SERIUS program, honestly we did it because it came with financial support to each member, there were 14 got a monthly value which is incredibly grand, and they are part of the government team, and they have good networks, and they gave us open space, and that was very attractive, and the one we did in the U.S. was because we now had good relationships in the U.K. but did not have anyone in the U.S. They were well connected; they had dealt with Google, we went on that program because we were not even near for the U.S”* (IC-CA7).

The second reason to establish the company in an incubator or accelerator programme in metropolitan areas is to gain access to funding and increase the start-up's prestige (IC-CA7, IC-CA9, IN-CA10). The choice to enter the accelerator programme in Greater London enabled entrepreneurs to a pool of financial institutions and investors that could not be found in other countries (LO3, LO4, LO12, LO14).

Regarding networking events, the incubators and accelerators facilitated entrepreneurs with the opportunity to engage with investors, scientists, venture capitalists, and customers (IN-SE2, IN-SE4, IN-CA2). These events would run on several days per week. The local and international market engagement theme also highlights the opportunity for entrepreneurs to be exposed to the market and understand customers' requirements (IC-CA7, IN-CA8, AC13, AC14, AC15, AC16). Moreover, the theme “facilitators” reinforced that alliances and consult from experts in the field are necessary to set a strong knowledge base in the company (IN-FA3, IN-FA6). Hence, the data suggest that incubators and accelerator programmes provide opportunities to foster alliances, collaborations, and partnerships with companies and stakeholders outside that are not part of the programme.

- *“During the program, we had to be there three days a week, and most days they would bring in people for us to meet. They’d be marketing people. --------they could be ------management people; they could be customers. Several investors, we met a lot of V.C., and we met the chief scientist that enthusiast you, so they can talk to us.”* (AC13)

The multiple group analysis provided statistical evidence that an incubator or accelerator programme's attendance influenced the exchange of knowledge in alliances with customers after formation. The multiple group model run shown that both groups of start-ups that attended and that did not attend the start-up were able to absorb customers and technological knowledge spillovers during the acquisition and assimilation steps of the Potential Absorptive Capacity (See table 6.12).

The attendance of incubator and accelerator programmes increases the statistical effect of Incoming Knowledge Spillovers (INK) has on the Potential Absorptive Capacity (PAC) of companies (No Attendance IN/AC vs attendance IN/AC) = $t=2.295$, $p<0.05$) (See Table 6.12). The evaluation of the quality criteria of the Incoming Knowledge Spillovers constructs (INKS) confirms that clients, customers, and universities are the main actors that are important to new ventures as a source of information ($p < 0.05$).

The bootstrapping results between companies that have attended and not attended incubator and accelerator programmes revealed that companies attending accelerator and incubators showed a more robust positive level of significance between INKS and PAC (β =

0.348, t = 6.674, $p < 0.001$). In contrast, companies that did not attend note of these programmes showed a lower level of positive statistical significance between INKS and PAC (β = 0.144, t = 2.023, $p < 0.05$) (See table 6.12). Therefore, there is enough evidence to state that accelerators and incubator programmes facilitate start-ups to hire human capital from universities and facilitate the initial prestige of forming alliances with customers. The discussion led to update the following effects of incubators and accelerator programmes on high-tech start-ups.

- **High-tech start-ups that attend incubators and accelerator programmes seek to gain access to mentorship, funding, training, and resources to support entrepreneurs' access to finance and exposure to the market. Start-up's participation in incubators and accelerator programmes increases incoming knowledge spillovers' absorption and the formation of alliances.**

One of the first significant insight is that entrepreneurs did not consider start-ups attending an incubator or accelerator programme as a potential partner (AL-F1). The lack of engagement was not caused to the perceived notion of negative spillovers or the potential competition in the programme (Al-F1, AL-F2, AL-F5). Instead, entrepreneurs see this endeavour to distract the resources of the company in the wrong direction. At this stage, entrepreneurs prefer to innovate and maintain a constant interaction from customers (AL-F2, AL-F4). Moreover, accelerator and incubator programmes enable entrepreneurs to access virtual platforms, which are repositories of information to share knowledge (IN-CA3, AC11, AC12). Slack was the central virtual platform that enabled entrepreneurs to access books, videos, and answer queries between entrepreneurs (IN-CA4).

- *"So it is a key part of what we do a slack channel where we share with the whole company articles that are important to read or books so that type of personal development I am doing for investment" (AC11).*

Therefore, it is plausible to state that:

- **Virtual platforms implemented on incubator and accelerator programmes enable access to knowledge spillovers between entrepreneurs and companies.**

The attendance to the incubator and accelerator programmes did not increase the start-up's capability to acquire Network Knowledge Spillovers (NKS). The quality criteria of the formative construct support the evidence that entrepreneurs are obtaining most of the knowledge spillovers from scientific journals, companies, or associations ($p < 0.05$, $p < 0.001$) (See table 6.5). However, the statistical analysis determined that there is no evidence to state that accelerator and incubator programmes increase start-ups' capability to absorb Network Knowledge Spillovers (NKS -> PAC: $p > 0.05$). However, the difference of 0.168, of the path coefficient and the higher effect of Network Knowledge Spillovers suggests that companies that did not attend these organisations were more likely to capture Network Knowledge Spillovers (NKS -> PAC: $\beta = 0.371$, $t = 5.123$, $p < 0.001$) (See Table 6.11, p.144). The difference of 0.168 and t value of 1.873 suggests that the programmes' attendance enables entrepreneurs to be exposed to knowledge spillovers. On the other hand, the qualitative data indicated that this increment is attributed to other companies' interactions. Entrepreneurs would unintentionally be gaining access to knowledge spillovers from virtual platforms such as Slack.

The discussion of the qualitative and the quantitative findings enabled to update the proposition of the empirical qualitative model (KST-QLEM2) as follows:

- **High-tech start-ups that attend incubators and accelerator programmes enables entrepreneurs to obtain knowledge spillovers to enhance start-ups performance and processes through explicit knowledge spillovers. However, incubators and accelerator programmes do not directly enforce start-ups' absorptive capacity to capture network knowledge spillovers.**

7.2.3. Main findings and model explanation during Phase 1 - The Creation of the Company

7.2.3.1. Start-ups

The first statement on the Knowledge Spillover Theory of Entrepreneurship is that the business idea is identified initially through knowledge spillovers. The theory is founded on the assumption that current uncommercialized knowledge can be used as an input for enabling entrepreneurial opportunities (Colombelli, 2016). Hence, it is expected that knowledge spillovers would allow entrepreneurs to fund the company to gain access to funding and incubators and accelerator programmes (Cantù, 2017; Ghio, Guerini and Rossi-Lamastra, 2019). These bases supported the following research statement:

- **Tacit Knowledge Spillovers gathered from industry and academia facilitate start-ups identification of an entrepreneurial opportunity that supports the business idea, performance and engagement towards innovation (Nielsen, 2015).**

The KSTE has confirmed that the primary source of knowledge would come from industry and academia. However, this research has shown that they also identify business ideas from their entrepreneurial knowledge spillovers. Also, knowledge spillovers enable entrepreneurs to determine the necessary resources to develop a product and to be competitive in the market. This certainty is covered through the exchange of knowledge with co-founders and the initial members of the company.

Second, The theory states that the initial forms of knowledge spillovers lead to selecting a specific type of industry and the company's initial location (Nieto and Quevedo, 2005; Montoro-Sánchez et al., 2011). The selection of the company's initial location leads to access to human capital, suppliers, customers, competitors, and other institutions (Montoro-Sánchez et al., 2011; Hájek and Stejskal, 2018). Hence, formal and informal exchange of knowledge influences the new ventures (Desrochers, 2001; Colombelli, 2016). The entrepreneur's background can also set the foundation for initial alliances and partnerships (Bouncken and Kraus, 2013; Shu et al., 2014). The initial assessment of the literature led to the formulation of the following research question:

- **Highly educated individuals are more prompt to recognise knowledge spillovers in comparison to entrepreneurs that do not hold an academic degree (Korosteleva & Belitski, 2017).**

The main insight from the evaluation of the entrepreneur's experience in this study is that tacit knowledge spillovers from industry or academia can lead to knowing the business idea's value. However, the findings expand the theory's understanding by proving that founders with experience also need to make use of previous networks to validate the business idea. However, the validation of knowledge spillovers in most cases must go through the assessment of reports from the industry, interviews, surveys, experiments, and talking to experts in the field. The founder of the company's experience and age can influence to locate the start-up in areas that require reduced operational costs and on the decision to engage in exploitative innovation. However, entrepreneurs with no experience can engage in exploratory and exploitative innovation but choose to locate in the urban core of an entrepreneurial ecosystem.

Third, the conditions lead entrepreneurs to access knowledge spillovers from face to face interactions between individuals or human capital on companies. In contrast, explicit knowledge spillovers are gained through access to documents and information (Lasch et al., 2013). For the company side, the start-up's type of industry conditions the number of full-time employees and intensity on Research and Development (R&D) (Chun Sung-bae; Mun, 2012; Jin, Shu and Zhou, 2019). The KSTE states that access to human capital is bounded by geographical proximity (Braunerhjelm et al., 2010; Stuetzer et al., 2017). These supporting evidence led to the following research statement:

- **The number of full-time employees in a start-up increases the performance of high-tech start-ups (Ferreras-Mendez ta al., 2016; Rothaermel & Thursby, 2005; Tufool & Gerard, 2016).**

The discussion of human capital enabled to specify how human capital empowers start-ups to increase performance. At this point, medium and knowledge-Intensive technological start-ups would choose not to hire directly from universities, but skilled human capital from the industry. Furthermore, entrepreneurs are open to employing internationally to gain access to market and international knowledge spillovers. At this stage, it can also be stated that if the initial team of a high-technological start-up has a strong knowledge base, hiring human capital does not influence exploratory innovation. However, medium technology and knowledge-intensive start-ups can enhance their capacity to engage in exploitative innovation by employing skilled human capital. In these cases, employees will be directed to implement and improve IT tools in the company. The main insights break the notion that human capital must be hired based on the start-up's geographical proximity to the sources of knowledge.

7.2.3.2. Incubators and Accelerator Programmes

The base knowledge that a company has can lead to an incubator or accelerator programme (Nicolopoulou et al., 2016). These programmes enable access to networking events that can develop alliances or partnerships (Desrochers, Kenney and Patton, 2009; Montoro-Sánchez et al., 2011; Shu et al., 2014). Also, these workplaces offer mentorship from experts in the field, and training sessions on business and technical knowledge spillovers (Bandera, Bartolacci and Passerini, 2016). The literature leads to uncover the following research statement:

- **The incubators and accelerator programme's location facilitate the identification and absorption of knowledge spillovers from universities, incumbents, and research organisations (David B Audretsch & Keilbach, 2007b; Cantu, 2017; Rothaermel & Thursby, 2005)**

The findings' discussion strongly suggested that entrepreneurs seek to locate near governmental institutions and universities to progress entrepreneurial projects. However, the advantages of gathering knowledge spillovers come with the challenge of covering expenses to keep the start-up functioning, and to face potential competition. However, new entrepreneurs would be willing to locate in the urban core to gain access to human capital and gain investors' funding. On the other hand, the findings' discussion highlights that KIBS and medium technological start-ups actively engage with incumbents and organisations. However, the results digress on the KSTE, showing an existing knowledge filter that prevents entrepreneurs from engaging with universities. On the other hand, high-technological start-ups would use the founders and human capital tacit technological knowledge to conduct research and engage with universities at this stage. In this case, incubators or accelerator programmes' attendance is not perceived as a source of knowledge, but resources.

The second assessment is related to the effects of incubators and accelerator programmes. The main drive to be part of the incubator and accelerator programmes are the potential to gain access to investors (Narula and Santangelo, 2009). Therefore, such programmes can have on new ventures depending on their capability and services (Markovitch, O'Connor and Harper, 2015; Pauwels et al., 2016). Further effects can lead to the potential diversification of products, and the entry to international markets (Cantù, 2017). The discussion of this section is linked to the following research statement:

- **The incubator and accelerator events facilitate the flow of knowledge spillovers and resources with third-party organizations and entrepreneurs (Cantu, 2017, Assenza, 2015; Bandera et al., 2016; Eveleens, van Rijnoever, & Niesten, 2017; Nair, Blomquist, 2017; Nonaka, 2000).**

The findings suggest that entrepreneurs would use networking events to obtain unidirectional knowledge spillovers from customers, companies, and investors through network events. However, in phase 1, start-ups would be mostly gaining insights into increasing funding and identifying the necessary resources to develop the company. On the other hand, start-ups would initially share broad and general business knowledge spillovers on how to set the company's activities and how to obtain financing. However, entrepreneurs would not be keen to share technical knowledge due to the perceived required time and effort. In this case, the knowledge filter that prevents knowledge flow is the diversity of business ideas and recognised null value and entrepreneurial opportunity for the start-up. These finding highly suggests that the stipulated geographical proximity stated on the KSTE between companies in a shared open space does not guarantee the absorption of knowledge spillovers between entrepreneurs.

The third assessment evaluates if tacit knowledge spillovers gathered from informal meetings between entrepreneurs and customers, suppliers, competitors, and institutions. Access to open spaces can also lead to obtaining rent knowledge spillovers form inventory, materials, and machines (Kaiser, 2002; Koo, 2005). The key characteristics that distinguish knowledge spillovers obtained information management systems that do not require financial resources to access them (Hallin and Holmstro, 2012; Connell et al., 2014). Moreover, the theory's extension is the potential expansion of an entrepreneurial ecosystem in virtual communities (Blind and Mangelsdorf, 2013; Shu et al., 2014). The initial effects of incubators and accelerators can involve access to explicit knowledge spillovers shared through platforms (Acs et al., 2017). The literature led to the research questions of the thesis:

- **Incubators and accelerator programmes improve knowledge spillovers absorption and start-up's absorptive capacity (Clarysee, Wright, Lockett, Velde, & Vohora, 2005; Markovitch el al., 2015)**

The findings suggested that all start-ups and entrepreneurs could absorb incoming and network knowledge spillovers regardless of their attendance to incubators and accelerator programmes. However, the findings strongly suggest that companies that attended incubators and accelerator programmes presented a higher chance of obtaining knowledge spillovers from suppliers, customers, and organisations. The involvement of new entrepreneurs in these programmes enabled them to gain access to customers, investors, and organisations that facilitated business and entrepreneurial knowledge spillovers. On the other hand, the absorption of network knowledge spillovers is not affected by incubators' attendance and accelerator programmes. However, the discussion also suggests that entrepreneurs with experience and skilled human capital do not need to attend the programme to gain academic publications and industrial reports. Moreover, early entrepreneurs may gain access to explicit knowledge spillovers through workshops and virtual platforms. This insight suggests that business knowledge spillovers would be used to enhance the start-up's performance, and not on assessing the market and engaging in product innovation.

Finally, KSTE has started to focus on assessing agglomeration as seen in cities and market size on the assessment of agglomerations in cities and the market size (Audretsch, Belitski and Desai, 2015). The theory started by evaluating the importance of universities' investment in R&D and creating start-ups (Audretsch and Lehmann, 2010; Ghio, Guerini and Rossi-Lamastra, 2016). From one side, the literature heavily emphasised on the agglomeration of companies in science and technology parks and the formation of industry clusters (Montoro-Sánchez et al., 2011; Connell et al., 2014). The effects of agglomeration were focused on assessing the cooperation of companies (Hervas-Oliver, Lleo and Cervello, 2017). In the case of incubators and accelerators, case studies have demonstrated that start-ups would choose to access facilities and resources (Cantù, 2017). However, the additional motive can only be dependent on the start-up's reputation and location (Cohen et al., 2017; Autio et al., 2018). This discussion leads to the following research statement:

- **The incubator and accelerators geographical location to urban cities facilitate the identification and absorption of knowledge spillovers from universities and incumbents (Cantu, 2017, David B Audretsch & Keilback, 2007b; Cantu, 2017; Rothaermel & Thursby, 2005).**

Incubators and accelerator programmes were expected to facilitate face to face interactions, causing entrepreneurs to benefit from being part of these facilities. This support has been confirmed by the access to knowledge that start-ups had through workshops, networking events, and virtual platforms. However, the decision to move to the urban core was depended on the entrepreneur's tacit knowledge and experience. Entrepreneurs that founded their first venture would decide to move to the city that facilitates access to companies and the government. Their second main purpose is to gain access to funding and to engage with the market. However, experienced entrepreneurs would consider locating their team and installations in locations with more government support and less competition. The central insight from these findings suggests that the company's headquarters could be situated in locations that enable entrepreneurs to use transport to access highly populated cities. Hence, the location of the incubator or accelerator to access knowledge spillovers would support new entrepreneurs. This analysis's assessment remains to be tested statistically for future research due to having only from the study out of eight participants that have located their company outside of the United Kingdom.

The main managerial implications of the research during phase one suggest that high-tech entrepreneurs need to consider how to identify and exploit entrepreneurial opportunities using knowledge spillovers to support the new ventures funding on R&D and product innovation. The discussion led to the development of the framework/model presented in Figure 7.3 that illustrates the effect of knowledge spillovers in creating the company.

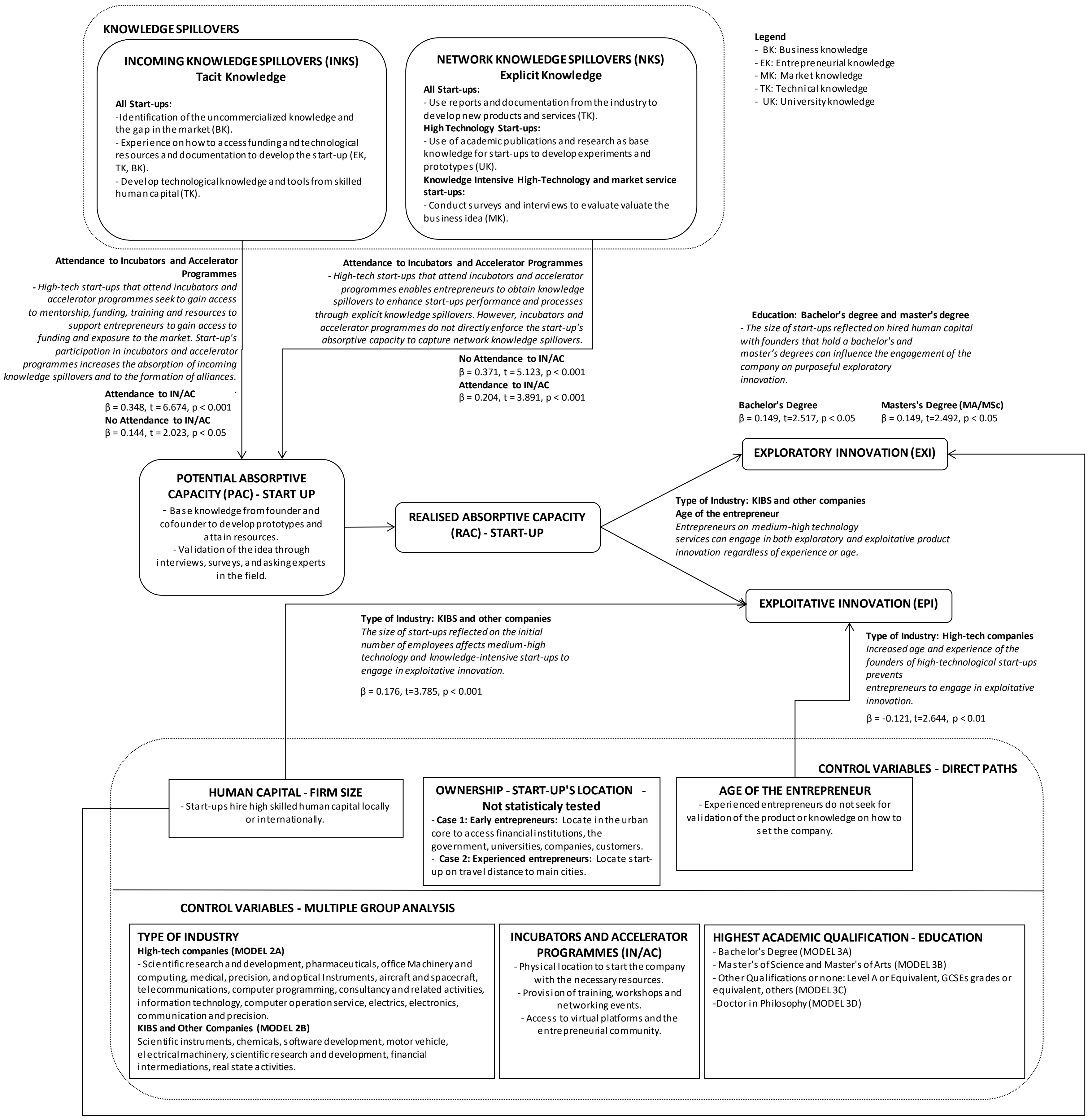


Figure 7.3 - The model explained during Phase 1 –Identification of the Business Idea and Creation of the Company

7.3. Phase 2 - Establishment and Development of the Company

The initial start-up's process in the first years of operation focuses on enhancing its absorptive capacity to acquire and assimilate knowledge spillovers. This section will discuss and update every proposition and analysis of data developed from the qualitative phase to support the quantitative phase's hypotheses. The potential absorptive capacity processes relate to the first phase with the alliances and partnerships. Furthermore, the processes related to acquisition and assimilation of knowledge spillovers are discussed based on the Start-ups capacity, human capital, and information technologies implementation. Finally, the processes of realised absorptive capacity are discussed in the product development and R&D section.

Alliances and partnerships extend the understanding of the initial contact of start-ups with other institutions and individuals to start developing products.

The technological adaptation and knowledge absorption sections focus on assessing how the background of the entrepreneurs and initial exposure of knowledge spillovers leads to the development of the start-up’s internal processes towards developing products. The discussion considers the tools and mechanisms used by entrepreneurs to generate new knowledge are and how they are used during the product life cycle (Qian and Jung, 2017).

The discussion on absorptive capacity identifies the existing mechanisms and practices undertaken by start-ups used to develop products. This section provides evidence from the second-order themes of technological, information, and explicit knowledge spillovers to identify entrepreneurs' mechanisms. This section's discussion adjusted the themes of the qualitative phase into the potential and realised absorptive capacity overarching dimensions.

The research's quantitative phase seeks to support the level of importance of relevant stakeholders to gain access to knowledge using the Incoming and network knowledge Spillovers constructs. The selection of the most relevant variables was chosen based on the types of alliances and exchange of knowledge discussed in Chapter V. The analysis proceeded to support this analysis with recent research that has identified knowledge spillovers coming from companies, individuals, and institutions (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Hájek and Stejskal, 2016; Amoroso, Audretsch and Link, 2017). The use of statistical evidence supported the possible most essential sources of knowledge spillovers that led to the formation of alliances evaluated from the quality criteria of formative measurement of the Incoming and Network Knowledge Spillovers constructs. The qualitative analysis discussion aligns on evaluating a start-up's potential to gather knowledge spillovers from customers, suppliers, and competitors.

The quantitative construct of absorptive capacity evaluated how start-ups could access knowledge spillovers (Tzokas et al., 2015; Limaj and Bernroider, 2017; Flor, Cooper and Oltra, 2018). The first-order constructs of potential and realised absorptive capacity fit for evaluating the first stage of knowledge absorption, and the second stage of knowledge implementation.

The factor analysis using the second-order construct of Potential Absorptive Capacity construct (PAC) evaluates how start-ups acquire and assimilate incoming and network knowledge spillovers. The Realised Absorptive Capacity (RAC) construct assessed how to update and transform absorbed knowledge and highlights the effects of knowledge on developing new technologies and product innovation (See Figure 6.6, Table 6.9). The factor analysis was extended to critically evaluate where knowledge spillovers have direct, or moderating effect on high-tech start-ups absorptive (Table 6.13, Figure 6.10). The discussion of model 1c also enabled to assess the moderating effects of knowledge spillovers between PAC and RAC (See Table 6.10, p. 139).

The summary of the overarching dimensions, themes, and categories illustrated in Figure 7.4. in this session are discussed as follows:

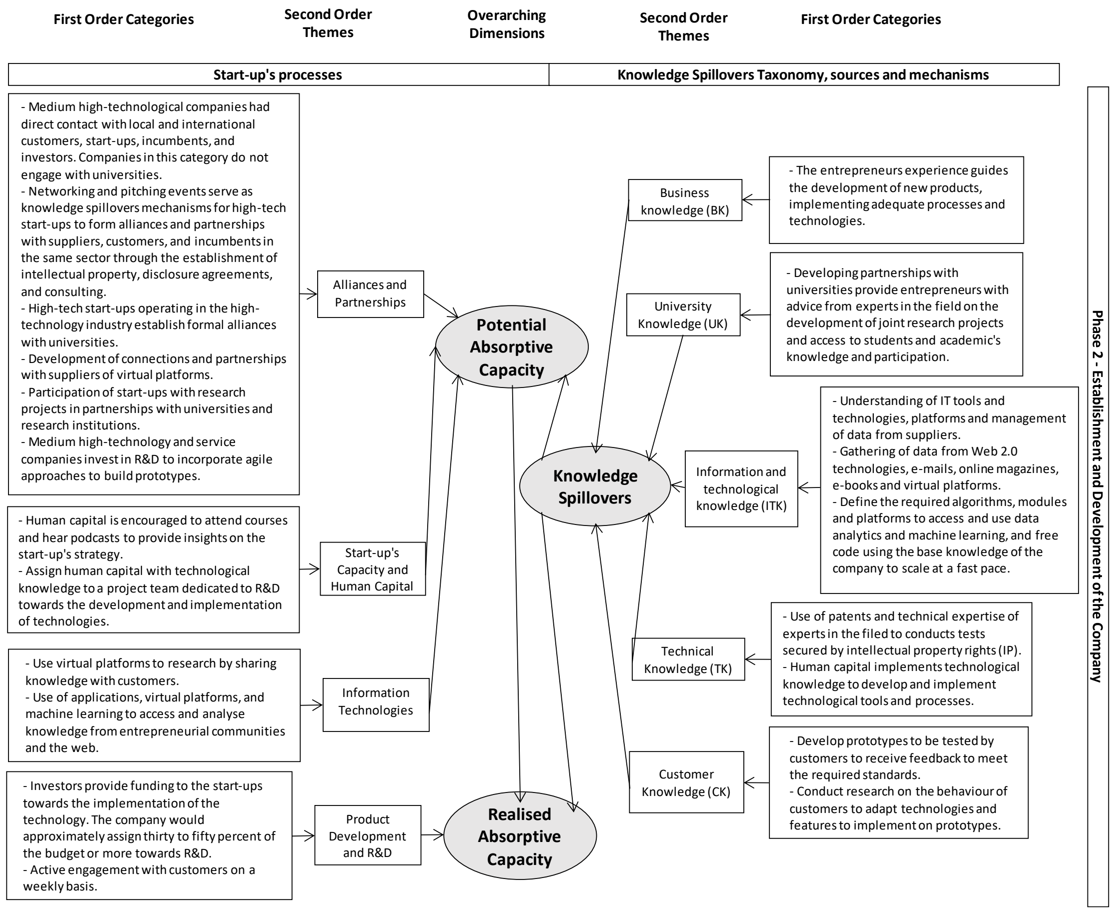


Figure 7.4 - Data Structure for the Start-up phase 2 - Establishment and Development of the Company

7.3.1. Potential Absorptive Capacity

7.3.1.1. Alliances and Partnerships

The qualitative analysis further suggests that start-ups rely on the exchange of knowledge spillovers. The discussion on networking events suggests that start-ups would possibly not develop further or engage in product innovation if alliances are not formed (IN7, IN8).

One of the main mechanisms that facilitated the development of networks from accelerator programmes was pitching events. The attendance to gatherings and pitching events enable entrepreneurs to establish to develop formal alliances between companies and potential partners that facilitate the access to knowledge spillovers (NT-EV12, NT-EV13). These gatherings enabled medium high-technological and knowledge-intensive start-ups to gain access to suppliers, incumbents, and potential customers to influence the start-up's survival (NT-EV1, NT-EV4, NT-EV5, NT-EV9, NT-EV10). In most instances, the initial exchange of business knowledge spillovers is centred on understanding the necessary regulations to learn the regulations required to operate the company in the sector and how to obtain investment (NT-EV6, NT-EV8, NT-EV9). In industries such as medium-high-technology, Knowledge-intensive High-Technology Services, and Knowledge-Intensive Market Services, start-ups perceived that academics do not conduct an adequate marketing approach to the benefits of working with academia as a partner (AL15). In these cases, companies prefer not to engage with academia due to the perceived amount of monetary resources and time necessary to gain access to universities (AL-UJV4, AL-UJV2).

- "*Networking always helps Doing pitches and most important, being in the same room with customers, is the number one thing that helps. Oh, Academia, I wouldn't say so much. We go, for example, one good presenter; I say this is good. It creates a name for the start-up. I would say it doesn't help the innovation proses much. It does create a brand name. So, investors come in and start talking to us*" (NT-EV1).

The knowledge sharing between companies is supported by setting Intellectual Property and disclosure agreements to protecting sensitive information between partners (NT-EV12). Entrepreneurs would seek to establish alliances with suppliers, costumers, and companies to align the company's processes (AL1-AL13). In some instances, start-ups involved in medium high-technology and knowledge-intensive services would establish secure connections with virtual platforms' suppliers. As such, formal would lead to understanding the required information technologies necessary to innovate (KS-TX-ITKS-MCH4, KS-TX-ITKS-MCH5, KS-TX-ITKS-MCH6).

- "*We get a lot of knowledge; if you are in a software space, you are going to get a lot from reading books and materials and things like that. There is a lot of knowledge of the websites. Working with platforms like that gives a lot of knowledge, and they help you a lot ----- they would want to keep you as their client. So, they kind of invest in you, give you that knowledge to get you started*"(KS-TX-ITKS-MCH6).

On the other hand, new ventures would seek to form partnerships with incumbents in the same sector that enable sharing knowledge, increasing credibility, and competing in the market (AL4, AL5, AL6, AL7). Furthermore, technical knowledge spillovers through consulting were limited to only attaining brief initial advice on the required base knowledge necessary to develop the company (TKS-CO1, TKS-CO2, TKS-CO3, TKS-CO4, TKS-CO5) (see Table 5.35). However, the qualitative analysis highlighted that at this stage that entrepreneurs would have limited exposure to the government to understand regulations and policies from pitching events (SU-KSIP5, NT-EV6, IC-CA7, SU-CC2).

- *"We are called WEEBATS; we operate in a few industries, the easiest way to put it is: we help tourists ---- funds on their shopping in Europe. So we are in the travel industry, in the finance industry, a little bit in the slash government authority, all of our revenue comes from the taxes in the U.K., and when we are not going to focus just on tourists, we ---- with the tax authorities. So we have a few verticals that we have touched. We have travel, finance, and tax. Yes, those are the three main ones*." (SU-CC2)

The data revealed that start-ups do not necessarily foster informal collaborations and alliances from networking events regarding high-technology companies. In these cases, companies use their network capital to set partnerships with universities (AL11, AL12, AL13). In this case, start-ups would focus their attention on gaining access to experts in the field, academics, and students in joint research projects (AL11, AL12, AL13). Most importantly, collaborations between entrepreneurs and universities can only be attained if the start-up is willing to spend the time scrutinised by academic experts (AL14).

- *"There are several universities we work with, including Crampton, -------- where I sit on the board of advisors, University of Bristol and U.C.L. so we are doing that, and we get value out of it. We are also taking interns and graduates ----------- also, we have an academic initiative ---- for academics to use in their institutions"* (AL2).

Hence, high-tech start-ups operating in the high-technology sector establish formal alliances with universities. The partnerships provide entrepreneurs with advice and development of joint research projects. The quantitative data further clarified that entrepreneurs use pitching events and gatherings to attain initial insights on what is happening in the industry. Networking events and conferences have proven mainly to be a mechanism to access knowledge spillovers from customers, suppliers, incumbents, universities, and research institutions.

The following statement summarises the findings regarding the interactions between entrepreneurs.

- **Start-ups would not actively engage in forming formal alliances with entrepreneurs due to a perceived low value that can provide to the company. The formation of partnerships between these companies would only be possible if the companies share a joint knowledge base and work in the same industry.**

The evaluation supported the statement that universities and customers are considered the most important sources of knowledge that can lead to a possible partnership or alliance (Clients or customers: *w: 0.735, p < 0.001*; Universities and institutions: *w: 0.497, p < 0.001*). On the other hand, suppliers did show a low positive statistical significance level for entrepreneurs (Suppliers: *w: 0.199, p < 0.05*).

Furthermore, the variable NKS5 representing "Companies or associations" clearly shows that high-tech start-ups consider incumbents a significant source of knowledge (*w: 0.609***, p < 0.001*); The difference in the sample size and supporting evidence from the qualitative phase to state that informal alliances and exposure to supplier knowledge spillovers almost transferred automatically to the start-up. The analysis did not analyse the individual types of industries due to having sample sizes bellow one hundred responses.

The quantitative analysis has confirmed that entrepreneurs engage in projects with universities and companies to exchange knowledge. In the case of customers, knowledge spillovers are obtained mainly from feedback. Moreover, the process sets the company's initial foundation to exchange explicit knowledge through the development and implementation of virtual platforms.The final discussion on the influence of networking and pitching events that are not necessarily involved with incubators and accelerator programmes led to update the following statement.

- Alliances and partnerships enhance start-up's absorptive capacity by exchanging knowledge spillovers with local and international organisations. Knowledge-intensive companies develop a partnership with incumbents that share the same knowledge base and with IT suppliers. Start-ups in the high-tech sector are prompt to develop research projects in collaboration with academic staff and human capital operating in universities.

7.3.1.2. Start-up's Capacity and Human Capital

There are two significant insights on high-tech start-ups operations: the processes undertaken to absorb knowledge, and the decision making the process of entrepreneurs taken to invest in research and development. Entrepreneurs highlighted that the vital component in the initial start-up journey is fostering an agile process that enables close deals with customers (AC-SUC4, AC-SUC5, AC-SUC6). This process seems to be more prominent for companies involved in the development of software. The quotes further enforce that customer knowledge spillovers are obtained at this stage by maintaining a culture of openness in the company. The data suggest that entrepreneurs, at this point, will potentially aim to take companies as their main customers (IN-PI9).

- *"Every time ------ there's always an idea, that in every situation, that somebody says something. It's not a Start-ups Capability fundamental change of strategy, but it's an improvement, an enhancement, a twitch, a minor realignment and I perceive ---- into that. I'm constantly listening to that, that's very hard for certain team members to cope with because what you find in a team is ------ a certain function, -------You told me to this, I have a plan, and I'm doing it. And when you come in and say ----- we need to twitch -------so we are doing X study on X population ------- is that population what we need to focus on. People between that age and that age, so it's a minor realignment, but it's not -----because people like to implement what they said they would, so my job is to make change ----- so we can continue to grow and progress."* (AC-SUC6)

In the case of high-technological start-ups, the founder's tacit knowledge starts to serve as a base to implement a strategy for innovating and developing the teams (KS-TX-TKS-FTK1, KS-TX-TKS-FTKS2, KS-TX-TKS-FTK3). The qualitative analysis specifies that companies in high-tech industries such as pharmaceuticals could use patents, academic research, and partnerships to develop the product (KS-TX-TKS-PI, KS-TX-TKS-P3, KS-TX-TKS-P4).

On the other hand, medium-high technology and knowledge-intensive service start-ups acquiring knowledge spillovers do not only fall on the chief executive officer capabilities. At this phase, human capital must be aware of sets of data and information to support product innovation. The data suggest that the entrepreneur's assessment of tacit and explicit knowledge spillovers can raise awareness to adapt the strategy (AB1). These further transcend into enabling employees to enhance their base knowledge through self-training further and sing up for podcasts (AB2). Hence, to make the whole process work, start-ups conform project teams of around ten people to fully engage in technology and active R&D (AC-SUC10, AC-SUC11, AB7, AB8, AB9).

- *"We have a dedicated R&D. Department, which counts with four people, and we undertake a series of investigations background scientific research on virgin technology trends. Then we look towards how we can commercialise our ideas."* (AB7)

The composite reliability of the reflective variables showed statistical significance in the model (see table 6.6). However, the Cronbach's alpha of 0.651 for acquisition (AQS) suggested that start-ups may not be sharing information internally through meeting within the company. Although the value obtained is not above 0.7, it is feasible to suggest that the Potential Absorptive Capacity (PAC) construct should explain the company's exchange of knowledge. However, this assertion can be questioned for further research, as only three variables of the acquisition second-order construct of Potential Absorptive Capacity (PAC).

The KTSE has clearly stated how human capital movement acts as mechanisms to access knowledge spillovers (Audretsch and Belitski, 2019). The data analysis strongly suggested that start-ups knowledge absorption is implemented by human capital towards product development and the usage of virtual platforms and search engines (See Section 5.4.4).

In this research, entrepreneurs enforced start-ups absorptive capacity by hiring highly skilled human capital that holds the necessary technical knowledge spillovers to develop the required technology to innovate (AC-SUC6, AC-SUC10, AC-SUC11). The data suggests that a team of engineers with years of experience in the industry in the required field of experience enables us to gain a competitive advantage (AC-SUC2, AC-SUC3, AC-SUC4). The constant absorption and evaluation of human capital must be conducted every year due to the constant change in technology (AC-SU4).

- *"We have about 12 engineers when they have a problem; they use a series of the----------- knowledge base; they might even attend workshops outside to re-skill themselves. ------------------------------ deeper and deeper into this knowledge sharing."* (AC-SUC3)

In this case, the new staff members are meant to have high-specific technological knowledge in the software, manufacturing, medicine, or biology (KS-TX-TKS-HUC1, KS-TX-TKS-HUC2, KS-TX-TKS-GUC3, KS-TX-TKS-HUC4). Once, all the resources are set, the team would initially use the internet to gain access to knowledge through e-mails, magazines, videos, books, and blogs (KS-TX-ITKS-MCH1, KS-TX-ITKS-MCH2, KS-TX-ITKS-MCH3, KS-S-EKS15). Interestingly, if the start-ups absorptive capacity is limited due to human capital, knowledge spillovers' exposure and absorption could be restricted (AB3). Hence, the discussion leads to summarise that:

- **Start-ups actively share knowledge with customers to develop an initial prototype that can further secure funding and contracts. A project team must enforce the process with highly skilled human capital that engages in R&D directed towards developing technology and acquiring knowledge spillovers.**

Inherently, the factor analysis showed that Incoming Knowledge Spillovers had a negative moderation effect on the realised absorptive capacity of high-technological start-ups (INKS*PAC -> RAC: $\beta = -0.017$, $t = 2.023$, $p<0.05$). This finding strongly suggests that during the product life cycle, the project team needs not to be influenced by knowledge spillovers during the implementation of technological tools and search engines. The statistical findings also suggested that network knowledge spillovers do not have a moderating effect between PAC and RAC on KIBS and medium technological start-ups. Moreover, the quantitative supported that at this stage, knowledge spillovers from suppliers, customers, and are acquired and assimilated during the Potential Absorptive Capacity. However, high-tech start-ups partnerships with universities are more prompt to generate their technological knowledge and stop consulting with other organisations. In these cases, any form of interaction would be detrimental to the transformation and exploitation of knowledge. The discussion led to establishing the following proposition that explains the moderating effect of incoming knowledge spillovers:

- **High-technological start-ups form alliances with universities to generate knowledge endogenously. The process is carried out by highly skilled human capital that is part of the company. All forms of external incoming knowledge spillovers would disrupt the transformation and exploitation of knowledge.**

Part of the company's diversity could also be influenced by the age or the gender of the founders of the company (Castro Soeiro et al., 2016; Stuetzer et al., 2017). Literature would suggest that female academics and entrepreneurs would have a higher motivation to be involved in research activities. The qualitative data briefly suggested that human capital's cultural diversity and gender could lead to enhance the company's performance on the exploration of new ideas (AC-R&D7). However, the quantitative analysis revealed that start-ups led by male entrepreneurs were able to record information and exploit opportunities in comparison to women (RAC -> TRM: p-value (Female vs Male = 0,019) (See table 6.12). Although the moderating effect did not carry on the final model, the data sample was sixty-five responses. It would be considerable if gender influences knowledge, spillovers absorption, and product innovation.

7.3.1.3. Information Technologies

The development of the projects on medium high-technology and knowledge-intensive start-ups is based on the constant sharing of knowledge through virtual platforms with customers to ensure a fast-paced creation process (CA-R&D10, CA-R&D11).

The team should access public knowledge spillovers using search engines and specific information technologies (CA-R&D13, CA-R&D18, CA-R&D21). At this stage, the start-up would change from motivating human capital to search for *technical knowledge spillovers*, to enter a formal training that enables the team to handle specific technological tools (CA-R&D19, CA-R&D21). The data also suggest that if training is not provided, the start-up attempts to gather information may be restricted (CA-R&D13).

- *"It depends if it is knowledge to redesign, and train people in a new process, and teach them how to use it if it is technical tools, we might go to formal training, or the developer will be sent to train in that technology. We have to be sure the product is relevant, so we put an enormous amount on project development first you build* *your development centre. Your development team, then your sales team, ------------- ---------------------- so you make sure that cycle after cycle your product gets better and so receiving more benefits, as you grow appropriately".* (CA-R&D19)

Companies on software development would be more specific and state virtual platforms such as slack to engage with customers and developers (KS-TX-ITKS-MCH4, KS-TX-ITKS-MCH5, KS-TX-ITKS-MCH6, KS-S-EKS11). Entrepreneurs in this sector would have a base culture of sharing knowledge through open-source, which is slight for technological or IT knowledge spillovers (KS-TX-ITKS-OS1, KS-TX-ITKS-OS2, KS-TX-ITKS-OS3). Hence, medium high-technology and knowledge-intensive service companies implement technological tools such as machine learning to track down data used to understand the market's needs (KS-S-EKS9, KS-S-EKS10). Companies using virtual platforms consider critical to keeping up to date to IT's use due to the fast-technological change.

- "*The value proposition is there, obviously, sometimes it's a feeling and a direction that you take, luck, or maybe focusing at the recruitment of and the value proposition, and then we work everything else out. You have to agile, understand what the pinpoints are; you also have to plan to be sticking around. This is what we are building, and if you research the market to be in the right place at the right time. Now people understand machine learning, performance."* (KS-S-EKS10)

Initially, the base model 1a confirmed that the Potential Absorptive Capacity (PAC) has a positive statistical effect on how on how start-ups can implement new acquired information (PAC -> RAC: $\beta = 0.609$, $t = 15.511$, $p < 0.001$) (See Table 6.9). The evidence showed that hiring highly skilled human capital to develop new technologies if necessary for all types of companies. If we assess the cases based on the type of industry, high-technological start-ups have a strong statistical direct effect on the application of knowledge (PAC -> RAC: $\beta = 0.74$, $t = 10.219$, $p < 0.001$) (See Table 6.14). This effect suggests that entrepreneurs would set intellectual property rights and disclosure agreements to develop a new product. Therefore, the company's approach is to gather knowledge spillovers once and start innovating once using scientific research. Once started, the company would stop to gather knowledge spillovers outside of the partnership or alliance with companies or universities.

On the other hand, medium high-technology and knowledge-intensive companies presented a lower statistical effect between the absorption and implementation of knowledge spillovers (PAC -> RAC: $\beta = 0.587$, $t = 5.836$, $p < 0.001$) (See Table 6.14). The lower effect implies that companies' approach is not unidirectional but cyclical. The qualitative data insights state entrepreneurs would establish a partnership with IT suppliers to understand the implementation of technological tools. Afterwards, the start-up would use machine learning and search engines to absorb network knowledge spillovers from the web. Moreover, virtual platforms are a mechanism used to contact costumers, companies, and suppliers and gather tacit knowledge spillovers. The discussion of the statistical evidence led to the establishment of the following research propositions.

- **High-technological start-ups hire highly skilled human capital to implement and generate technological knowledge endogenously. Entrepreneurs would share knowledge in alliances with universities and companies to conduct academic research and develop patents. Start-ups prevent the absorption of external knowledge spillovers.**
- **Medium high-technological start-ups hire skilled human capital to implement technological tools. Entrepreneurs would motive employees to attain information and technology knowledge spillovers from virtual platform providers. Start-ups assign research and development project teams to analyse knowledge through technological tools such as software applications or machine learning.**

7.3.2. Realised Absorptive Capacity

7.3.2.1. Product Development and R&D

The research and development initiatives led by entrepreneurs uncovered that start-ups actively use the hiring of human capital as a mechanism of capturing knowledge spillovers (CA-R&D1). Hence, most of the company's allocated budget is directed towards the development of products and technology (CA-R&D3, CA-R&D5, CA-R&D6). This approach's development can potentially involve scientific research or the assistance of specialised consultants to develop specialised products (CA-R&D5, CA-R&D8). The financial resources are funded from gained contracts and funding from investors (CA-R&D3, CA-R&D4). All these endeavours seek to strengthen common projects between the start-up and client companies further.

- *Ok. So, it's technology. In NARROWS therapeutic we have ------, so that's the technology, so we've raised money from investors were going to take up money and invest it to see if we can turn it into medicine ---and the study that we are doing ------- It's the spread of money invested in seeing whether or not -------because the study is big enough and if it's well-conducted if the survey is positive it's likely higher, it's a 50/50 that we have something that could be a medicine. It's the technology ------ in uncovering the value to the medication.* (CA-R&D3)

Research and development projects involved in the process are to research base technology that can enhance the design of the product using the feedback of customers (CA-R&D9). The development of the projects is based on the constant sharing of knowledge through virtual platforms with customers to ensure a fast-paced creation process that aligns with the company's business strategy (CA-R&D10, CA-R&D11). Most of the resources in this process are directed to enhance the product's features through testing prototypes on weekly estimated intervals (CA-R&D9, CA-R&D11, CA-R&D12).

The insights on the absorptive capacity output on product innovation suggest that start-ups may use existing technology to enhance a product or create an entirely new product suitable for entering the market (AB10, AB11, AB10). During this development process, start-ups focus on implementing existing technology and adapting it and presenting it to customers (IN3). This process ensures that the products and services meet the standards. In some instances, entrepreneurs would consider spending time and resources researching the customer's behaviour (AB12). Finally, the data reveal that during the product life cycle and engagement with customers, there may be a minor intervention from phase 1 on how incubators and accelerator programmes affect the start-up's capability to innovate (AB2).

- "*So the approach you take is: you develop that technology, you develop it to a standard that meets the nature of the requirements basically, so you take something that is purely research-based that may have fundamental issues and the original design and some technology used, and you fix that so it's suitable to a commercial environment.*" (AB10)

The initial evaluation of incoming and network knowledge spillovers effects on start-ups is only statistically significant during the processes of acquisition and assimilation of knowledge (INKS -> PAC: $\beta = 0.304$, $t = 6.97$, $p < 0.001$; NKS -> PAC: $\beta = 0.265$, $t = 6.078$, $p < 0.001$) (See Table 6.9). The strong significant positive effect of knowledge spillovers maintained for all start-ups. The main initial insights at phase 2 on product development are that start-ups need to identify the most adequate technological and IT knowledge spillovers to develop a product. This approach would enable entrepreneurs to attract investors to finance the company of developing new prototypes.

The quantitative statistical evidence confirmed that high-tech start-ups focused on the development of highly technological products. Hence, entrepreneurs only absorb knowledge spillovers during the potential absorptive capacity process. Afterwards, companies would focus only on developing technology within the company and establishing formal knowledge management systems and contracts to engage with potential customers. The main sources of incoming knowledge spillovers are the alliances with universities, companies, and using R&D to hire human capital and conduct experiments (INKS -> PAC: $\beta = 0.267$, $t = 4.028$, $p < 0.001$). Entrepreneurs would then analyse network knowledge spillovers form academic research, publications, and industrial reports and patents (NKS -> PAC: $\beta = 0.282$, $t = 4.867$, $p < 0.001$). These processes would be developed internally and secured using intellectual property rights and disclosure agreements. The data enabled to develop the following propositions:

- **High technology start-ups absorb network knowledge spillovers obtained for this purpose are academic research, patents, and technical reports through human capital's technical expertise to conduct R&D and experiments. Entrepreneurs would potentially be exposed to unintentional knowledge spillovers from online sources and e-mails.**
- **High-technology start-ups gather incoming knowledge spillovers from alliances and partnerships with universities and organisations aligned with a research project through the access to academic staff, students, and leading experts in the field.**

On the other hand, medium high-technology and service start-ups encourage human capital to gather network knowledge spillovers from web 2.0 technologies, courses. Moreover, entrepreneurs in these companies would establish alliances with IT suppliers to learn and implement technological tools. Thus, the company starts an agile product development cycle, were incoming knowledge spillovers are obtained from customers and companies to develop prototypes. These interactions are held at least every week through face-to-face meetings or the use of virtual platforms (INKS -> PAC: $\beta = 0.384$, $t = 5.528$, $p < 0.001$). Furthermore, entrepreneurs would use technological tools such as search engines, applications, or machine learning to access the customer's behaviour. Start-ups also access information technology spillovers that facilitates a fast adaptation to technological change and the market (NKS -> PAC: $\beta = 0.264$, $t = 3.847$, $p < 0.001$). Hence, the following propositions are stated.

- **Medium high technology start-ups motivate human capital to gather network knowledge spillovers from web 2.0 technologies and online sources. The entrepreneurs further capture IT knowledge spillovers through applications such as data analytics and machine learning to understand customers behaviour or support technological implementations on prototypes.**
- **Medium high technology start-ups absorb incoming knowledge spillovers through face to face meetings and virtual platforms with customers and IT suppliers. Agile project management teams conduct this process to conduct R&D on the development and implementation of technology and the enhancement of prototypes.**

7.3.3. Main findings and model explanation during Phase 2 – Establishment and Development of the Company

7.3.3.1. Potential Absorptive Capacity

Knowledge absorption was further assessed through the second-order constructs of Potential Absorptive Capacity (PAC) and Realised Absorptive Capacity (RAC) (Flatten et al., 2011; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016). The constructs enable to critically evaluate the new venture's capability to acquire, assimilate, transform, and absorb knowledge (Acs and Gifford, 2008; Lau and Lo, 2015). Hence, learning processes and though process on is highlighted on how to obtain revenue by reducing operational costs

- **Investment in research and development enable the capture and implementation of knowledge spillovers (Markovitch, O'Connor, & Harper, 2015).**

and maintaining the normal operations of start-ups (Jiménez-Barrionuevo, García-Morales and Molina, 2011; Limaj and Bernroider, 2017). Absorptive capacity is further assessed based on the constant access to knowledge between the entrepreneur and customers, suppliers, competitors, and other institutions (Montoro-Sánchez et al., 2011; Blind and Mangelsdorf, 2013; Hájek and Stejskal, 2018).

The data suggested that start-ups would attend pitching events to form alliances with companies and other institutions. For this point, the behaviour of new ventures depends on the type of industry. High-tech-start-ups aims to build partnerships with universities and research institutions. These alliances lead to the development of university joint ventures to engage in research projects. In this scenario, R&D from the entrepreneurial side is fundamental to hiring skilled human capital. However, the primary input of knowledge spillovers caused by the investment of R&D come from universities and research institutions.

The findings support statement on the KSTE that investment from universities causes alliances to generate knowledge endogenously. However, the research powerfully highlights that after this point, high-technological companies would only create knowledge endogenously, which would solely be presented in the future on explicit form through technical reports from companies, and academic publications.

The expected behaviour of start-ups in the KSTE has been generalised to all types of new ventures in the literature and emphasises companies and universities (Qiu and Yang, 2018; Triguero and Fernández, 2018). However, this research has pointed out in the medium-high technological and service start-ups that entrepreneurs would have specific applications of R&D aside from hiring human capital. Entrepreneurs in a company will be encouraged to access IT knowledge spillovers external sources. These tools are continuously shared with technological suppliers to implement IT applications towards product prototyping. Therefore, the finding contributes actively to the KSTE by clarifying that knowledge spillovers are gathered with third parties located outside of geographical proximity, but by virtual platforms that common knowledge related to the start-up.

Moreover, the always stated form of supplier and rent knowledge spillovers in this scenario ceases to be an exchange of goods and information from materials' transportation. Instead, the new information and technological knowledge spillovers are the missing link and gap between the KSTE and software development disciplines. This approach seeks not to expand on the development of technology and software development, but on its entire and precise application towards product innovation.

The evidence suggested that around thirty to fifty percent of the start-ups budget is directed towards research and development (CA-R&D6, CA-R&D8). Therefore, future research can be considered to assess how financial resources on a start-up should be allocated during the first ten years of operation.

Second, the KSTE has considered patents have been recognised as a source of uncommercialized knowledge spillovers that entrepreneurs can exploit (Audretsch and Lehmann, 2017). On the other hand, patents have been considered as an indicator of entrepreneurial activity in regions caused by R&D (Krammer, 2014). Thus, trademarks' applications to evaluate economic activity in the region (Audretsch and Lehmann, 2017). These are stated to be used as a mechanism for new ventures to protect knowledge and attain competitive advantage (Lhuillery, 2011; Huang et al., 2014). Since these approaches have led to evaluate the development of entrepreneurship in regions, the research seeks to state if the first approach of start-ups is to generate patents and trademarks. This first analysis of the use of knowledge spillovers towards this purpose is assessed in answering the following research statement:

- **Start-ups seek to develop and use patents at the end of the first ten years of operation, and during the development of the company (Qian & Jung, 2017).**

At this stage, patents have mainly been used as a source of technical knowledge spillovers mostly implemented by high-technological start-ups. At this stage, these sources of knowledge have been used to conduct tests and experiments to develop new products. However, at this stage, the securement of knowledge is only addressed by establishing intellectual property rights to secure the sharing of knowledge. The discussion further clarifies that entrepreneurs in this early stage are only recipients of knowledge spillovers.

However, the development of projects and prototypes do not mention an initial strong intent from entrepreneurs to develop patents.

Moreover, medium-high technological and knowledge-intensive companies do not assign resources for this purpose. Instead, entrepreneurs aim to establish agile project management teams to gather as much knowledge spillovers as possible from customers and IT suppliers. The central insight in response to the research statements is that patents should not be considered an indicator for entrepreneurs during the first ten years of operation.

7.3.3.2. Realised Absorptive Capacity

The initial capability of a company to identify knowledge spillovers as an entrepreneurial opportunity depends on the start-up's human capital, and the entrepreneurs' background (Audretsch and Belitski, 2017; Cantù, 2017). The foundation of the initial business idea depends on the entrepreneur's background. Identifying the business and technological resources in the seed stage depends that leads to the development of a prototype (Nieto and Quevedo, 2005). The qualitative data gathered insights on the perception that knowledge spillovers can have on entrepreneurs and start-up's survival, influence on routine operations, and product innovation. The test of propositions and hypotheses leads to evaluating the effects of hiring human capital for start-ups (Enkel et al., 2017). The analysis infers on the impact of recruiting skilled professionals to fill business and technological knowledge of the new venture (Forés and Camisón, 2016; Shafique and Kalyar, 2018).

- **The cultural diversity and background of human capital working on high-tech start-ups facilitate product innovation (D. Audretsch et al., 2010; D Audretsch & Keilbach, 2008; Hardy & Rodriguez-Ponse, 2014; Zobel, 2017).**

The findings' discussion suggested that the founders of start-ups do not directly target the diversity of knowledge and background. However, the effects fall into another for that has to assess, which is the organisational culture. The companies' founders would be interested in gathering human capital that enables entrepreneurs to understand the regulations established by governments that need to be followed. High-technological start-ups would focus on setting an environment where search and development implementations on experiments, research, and key. However, the medium high-technology start-ups approach aims to reward and implement an entrepreneurial culture where human capital can absorb knowledge spillovers. This process is further expanded to apply project management teams that can maintain flexible and agile methods. The approach is also extended to enable a constant sharing of knowledge with suppliers and customers.

The main insights in this process are that the founders of medium high-technological start-ups do not purposefully explore human capital's cultural diversity. Instead, companies appreciate that human capital enables the company to gather interactional and technological knowledge spillovers that facilitate prototypes' development. Hence, the evaluation of openness during the potential and absorptive capacity should be evaluated on the KTSE.

This section's central insight points out that the absorption of knowledge on medium high-technology start-ups is a cyclical process and highlights the key components and mechanisms that enable new ventures to remain competitive in the market. The estimated product development cycle is developed weekly by a highly technical team. On the other hand, high-technological start-ups would follow a formal process, where knowledge is absorbed, implemented, and used towards exploratory innovation, following a linear process. The discussion led to the following explanation and effects of knowledge spillovers of the model during the development and absorption of knowledge in start-ups illustrated in Figure 7.5.

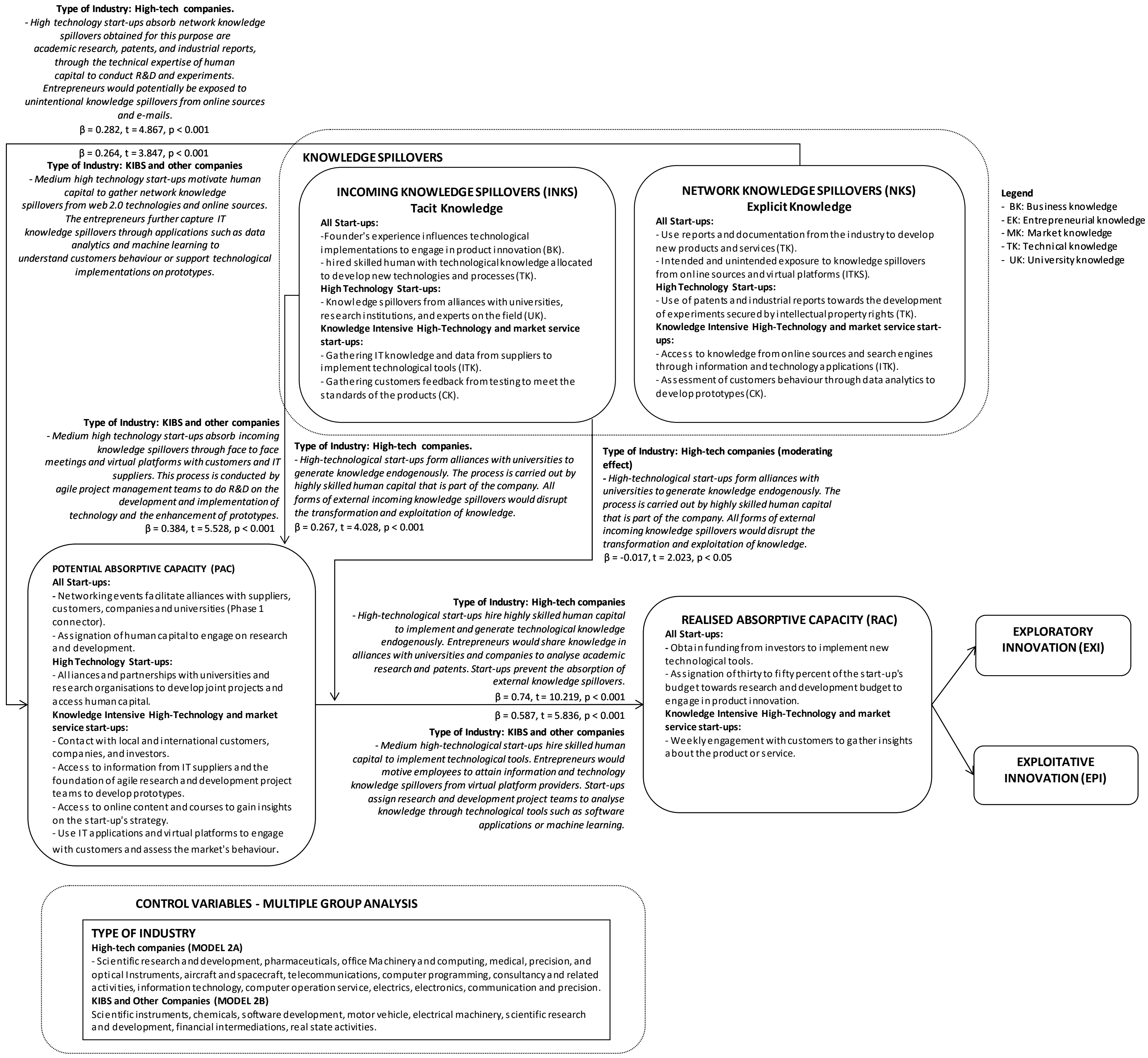


Figure 7.5 - The model explained during Phase 2 – Establishment and Development of the Company

7.4. Phase 3 - Scaling up and the Future of the Company

The discussion chapter's final section seeks to address the effects of knowledge spillovers on start-ups during their scaling up. The analysis also extends to predict from the product innovation approach of the new venture to engage in creative destruction or creative construction. This final section ends on explaining how entrepreneurs locate their companies internationally. The aim is to uncover the start-up's transition into a small and medium enterprise.

The qualitative analysis chapter analysis provided support to discuss the facilitation and engagement taken by companies to engage in product innovation. The quantitative model's evaluation addresses the key components that guide the main objective of the start-up and the company's survival. The key insights and propositions are thoroughly reinforced and updated by the quantitative phase's factor analysis. In this case, the exploratory and exploitative constructs, among the control variables, enabled to statistically prove how knowledge spillovers affect the start-up's innovation process and business approach at the end of the seed stage.

The qualitative phase's final discussion seeks to identify the types of knowledge spillovers, the most relevant mechanisms that enable the absorption and implementation of knowledge towards innovation, and the spatial contexts that will allow its flow between institutions, companies, and individuals. The discussion on the knowledge spillovers sources aimed to clearly state the most relevant stakeholders and locations used to access knowledge spillovers.

The quantitative analysis insights led to assess further how entrepreneurs are affected by incoming and network knowledge spillovers (See figure 6.8). Model 2 and model 3 evaluated the direct effects of knowledge spillovers on realised absorptive capacity product innovation (See Table 6.14 and Table 6.15).

Technological turbulence (TUR) evaluated if the rapid technological change in the industry causes start-ups to require new features or products not developed before. The quantitative analysis would enable to test the survival of start-ups. The assessment would focus on evaluating the effects of technological turbulence (TUR), and its implications during a process of creative destruction. The discussion seeks to test if entrepreneurs view rapid technological development and change in the market to enable product innovation (Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Zobel, 2017).

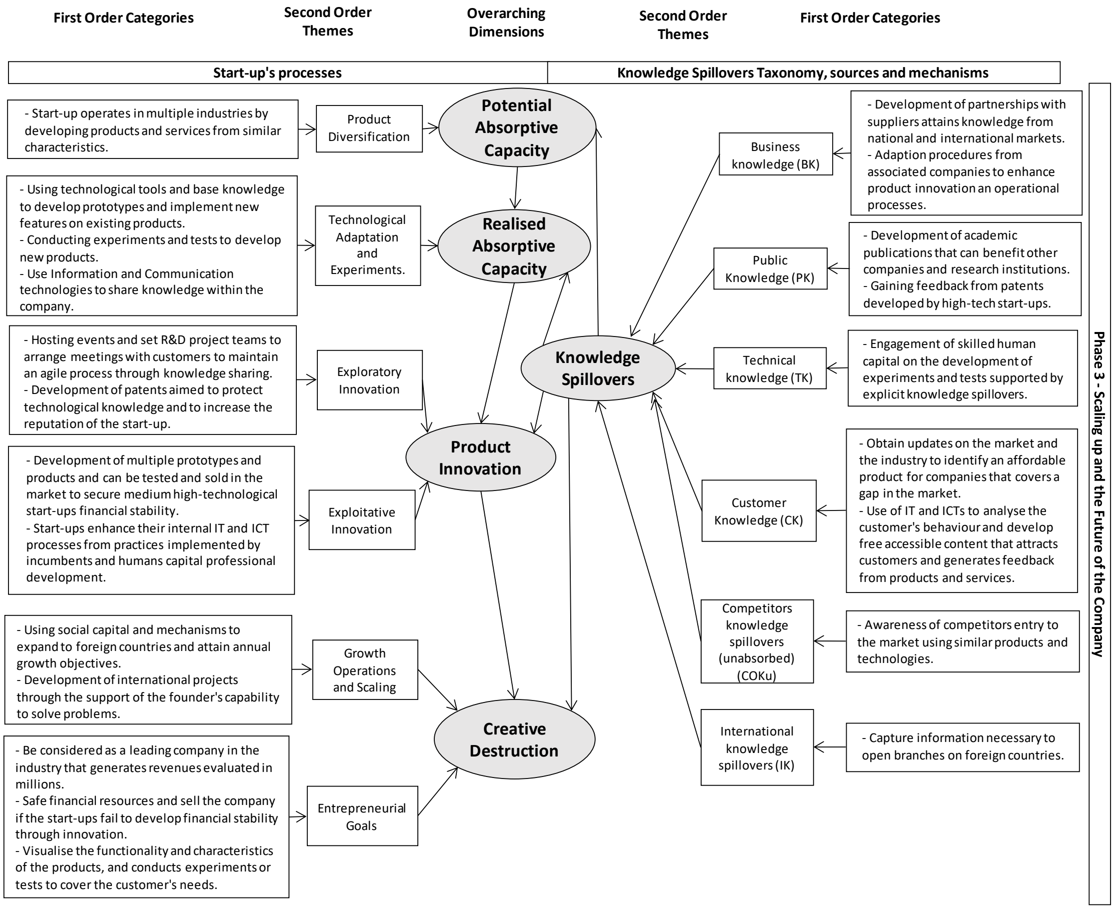


Figure 7.6 - Data Structure for the Start-up phase 3 - Scaling up and the Future of the Company

7.4.1. Potential Absorptive Capacity

7.4.1.1. Product Diversification

The end of phase 2 on the second-order theme of product development and R&D provided insights on early engagement with customers using IT applications. This discussion provided some insights into how companies can potentially engage in product innovation in the early stages. Moreover, the openness approach with customer companies and IT suppliers could lead to considering if start-ups are involved in the development of multiple products (NT-EV2, NT-EV4, NT-EV6).

- *"They were very retail-specific connected to ----, and we found ourselves having success with European retailers -------, and it was a way to expand our market. At the end of 2017, we did one more in Munich --------------------- which is the largest electronic consumer in Europe -------------------------- if we select you, then we want to do business with you. --------------------------------------- we had 100's of retailers interested in what we were doing."* (NT-EV4)

The discussion of the analysis of model 1c was analysed using a multiple group analysis to evaluate diversification. This analysis raises to evaluate the diversity of tacit knowledge from human capital with similar or different, which would lead to engaging in various markets. The parametric test with two different samples showed that only diversified companies can engage on exploratory innovation (PAC -> EXI: $\beta = 0.253$, $t = 2.574$, $p < 0.01$). These direct effects of potential absorptive capacity with product innovation could not be statistically distinguished between the high-tech companies and the medium high technology companies (See Table 6.14). Thus, any start-up's direct effect of diversification can be implemented regardless of the founder's academic qualifications (Table 6.15). The findings can initially suggest that either type of companies would benefit from diversifying on multiple markets to engage in exploratory innovation. It can also be suggested that these effects were carried from phase 1, were hired human capital locally and internationally, and provided insights from various markets.

In the scenario of diversification, the discussion if the data provided supporting evidence to state the following proposition:

- **Start-ups that decide to engage in multiple markets or develop multiple businesses are prompt to engage in developing new products in contrast to other new ventures. The process is supported by business knowledge from human capital hired locally and internationally.**

This finding suggests a middle ground, were either start-ups could exploit this capability to engage in exploratory innovation. However, the qualitative data provided insights that high-technological companies may not choose to diversify due to a perceived detrimental effect of judgment from sharing knowledge with companies or associations (AL14). The multiple group analysis on diversity a very close statistical difference of direct effects between potential and realised absorptive capacity (PAC -> RAC: t-value (Diversified vs Not

Diversified = 1.96). The output of the analysis revealed that medium high-technological and knowledge-intensive companies followed almost the same statistical effects of diversified companies (PAC -> RAC: $\beta = 0.583$, $t = 5.071$, $p < 0.001$). The same behaviour was evidenced for high-tech start-ups in comparison to undiversified companies (PAC -> RAC: $\beta = 0.739$, t = 11,349 $p < 0.001$).

The discussion strongly suggests that medium-high technology and knowledge-intensive service companies engage in exploratory innovation from the very beginning of the start-up's foundation. This approach is supported if entrepreneurs use tacit business knowledge from human capital to understand the market's needs and diversify with multiple businesses. On the other hand, high-tech start-ups prefer to engage in product innovation by developing a single product.

This section's discussion led to highlight that the overlapping action between phase 1 and phase 2 are the processes from transforming to implementing knowledge and the approaches of start-ups to innovate. The discussed evidence led to support the relation between potential and realised absorptive capacity with the following statements:

- **High-technological start-ups centred all its research and resourced to develop a single product to enter a single market.**
- **Medium high-technological start-ups engage in diversification by establishing multiple businesses and developing products for similar markets.**

7.4.1.2. Technological Adaptation

The first steppingstone was to evaluate if new ventures are fully involved in product innovation, process innovation, or both. The initial qualitative discussion of facilitators highlighted that incubators do not directly affect product innovation (IN-FA1, IN-FA7). Furthermore, high-tech start-ups were enforced to develop or create a new product or to decide to adapt previous product features to cover the market needs. The qualitative analysis showed that at this stage, it is necessary to have a robust technological base to be able to compete in the market (IN-PI1, IN-PI3, IN-PI4, IN-PI6).

- *"A lot of the work I have done in the past has been about technology, enhancements, and implementation on launching new products and processes; a lot has been about enhancing existing products or adding new features or functionality. Yes, I have a lot of experience doing it, innovating in that way and leading teams and being the touchpoint between the business and the technical. The team is something that I have had quite a lot of experience in it."* (IN-PI4)

Respondents from medium high-technological emphasized how entrepreneurs would engage in exploitative innovation by adapting their base technology to develop a prototype from an existing product and adding the necessary features (IN3). On the other hand, the high-technological start-up's approach focuses on engaging in exploratory innovation by conducting experiments (IN7, IN8). This process would be done with experts in the field and would follow rigorous tests. This approach would lead high-tech entrepreneurs to tests new ideas and products (IN7, IN8).

In the initial stages of product innovation, the data has confirmed that entrepreneurs would not gain significant insights from supplier knowledge spillovers (KS-S-EKS21). In this case, suppliers would only be considered as sources of knowledge (S-CV-SKS1, S-CV-SKS3, S-CV-SKS4). At this point, suppliers are not considered as a source to engage in product innovation. On the other hand, suppliers would be a source of knowledge that enables them to enter national and international markets (S-CV-SKS1, S-CV-SKS3, S-CV-SKS4). In other cases, entrepreneurs would only contact these companies for attaining resources to develop products (S-CV-SKS9).

- "*during the Lafayette program there were things we found out that we did not know and were not sure they were important at the time, like a certain type of suppliers, ----- like ---- he is now a chief officer in our company she invested and then she joined us, from my perspective the matrix sessions there I was looking at it from the point of view; I want retailers, I want retailers. I was meeting someone who, in the end, turned out to be very useful to us."* (S-CV-SKS4)

Medium high-technological start-ups focused on software development would not entirely consider not having suppliers in their chain of value or would use suppliers to attain the necessary hardware (S-CV-SKS6, S-CV-SKS8). On the other hand, suppliers of virtual platforms and equipment would be considered formal allies from the company or providers of resources (S-CV-SKS6, S-CV-SK8). The discussion reinforced that supplier or rent knowledge spillovers are more predominant in companies operating in the manufacturing sector, which is not applicable from most high-technological start-ups (S-CV-SK2, S-CV-SKS3 S-CV-SK5, S-CV-SK8, S-CV-SK9). Hence, the summary of the discussion is stated as follows:

- **Start-ups do not acquire supplier knowledge spillovers from the acquisition of resources. However, entrepreneurs form alliances with ICTs and IT suppliers to gain insights from national and international markets.**

In the innovation stage, there is still evidence suggesting that medium high-technological start-ups would share knowledge from incumbents to learn the processes necessary to innovate (IN5, IN6). The technology adaptation theme code also confirmed that high-tech start-ups could decide to enhance current products' characteristics (IN3). In phase 3, the qualitative analysis suggests that start-ups are more likely to continue transforming knowledge spillovers. The data indicate that entrepreneurs use information and communication technologies (ICTs), such as Slack, which enable the team to capture and share explicit IT and technological knowledge in the within the project teams of the company (KS-TX-PKS3, KS-TX-PKS4, KS-TX-ITKS-OS2, KS-TX-ITKS-OS3). The discussion of the R&D teams leads to continue understanding the behaviour of the market through technological tools (KS-S-CV-CKS9, KS-S-CV-CKS10, KS-S-CV-CKS11). In other instanced, high technological start-ups not focused on software development capture and store knowledge on academic articles, e-mails, or online sources (KS-TX-PKS1, KS-TX-PKS7).

- *“Yes, it is about free knowledge, it’s free code more than free knowledge, but there is some free knowledge in that. We don’t use as much open source as perhaps we should, that is large because there are security implications, and also open-source programs are not too much controlled so you can get a relief that can mess up all your core. Someone’s update could affect your --- rollout. So, you have to be very pragmatic about the management source, and you have to have excellent management to see the place because it could cause an overhead.”* (KS-TX-ITKS-OS3)

These initial findings suggest that the sharing of explicit knowledge is predominant on medium-high technology and knowledge-intensive business services. The following statement summarises the discussion:

- **Medium high technology companies use ICT and IT to share knowledge in the R&D project teams and capture customer knowledge spillovers from feedback and data analysis. Companies in the high-tech sector can choose to develop public knowledge spillovers through academic publications.**

The discussion of the qualitative analysis leads to assess if start-ups have effects of knowledge spillovers. The evidence would suggest that companies would begin to transition into knowledge management procedures to innovate. The factor analysis confirmed that high-technological start-ups would continue to conduct experiments and tests during the realised absorptive capacity process. On the other hand, medium high-technological start-ups would continue to exploit incoming knowledge spillovers from customers and alliances (INKS -> RAC: $\beta = 0.243$, $t = 5.071$, $p < 0.05$). The quantitative analysis continued to solidify the statement that start-ups in this category are also involved in product diversification by showing a similar statistical effect (Diversified: INKS -> RAC: $\beta = 0.338$, $t = 3.734$, $p < 0.001$). The evidence suggests that companies that develop multiple businesses and products are required to gather incoming knowledge spillovers. The discussion of the qualitative and quantitative data led to the development of the following proposition:

- ***Medium high-technological start-ups use IT and ICT to absorb and implement incoming knowledge spillovers from customers and allied companies towards developing prototypes, implementing processes, and technologies on virtual spaces. These processes would be carried out by a dedicated research and development project team that shares knowledge within the company.***

The main insight regarding the transformation and exploitation of knowledge spillovers is that its effects depend on industry type. High-technological start-ups would not be obtaining positive effects or making attempts to gather knowledge. Instead, knowledge spillovers would be unintendedly obtained through online sources. The evidence suggests that high-technological start-ups would become a potential source of public knowledge spillovers through academic publications.

On the other hand, the discussion further suggests that medium high-technological start-ups are purposefully using ICTs and IT to gather free knowledge from companies in alliances and customers. Moreover, the mechanisms used during this phase suggests that geographical proximity to sources of knowledge is reduced. However, the conditions would tent to replicate on cognitive spaces such as virtual environments. Hence, tacit knowledge spillovers are gathered from interactions between individuals.

7.4.2. Product Innovation

7.4.2.1. Exploratory Product Innovation

The qualitative evidence has suggested that medium high-technological start-ups would create a new product that enhances a supply chain's operations. Hence, carried obtained customer knowledge spillovers in-phase one from conferences and enabled entrepreneurs to identify a gap in the market (KS-S-CV-CKS2, SK-S-CV-CKS3, SK-S-CKS4, KS-S-CV-CKS5, KS-SKS-LKS4). This knowledge can also be obtained from other online sources, or from gathering updates from the industry (KS-SKS-LKS5, KS-SKS-LKS6). In this approach, the entrepreneurs consider developing a product or service that the customers can afford to pay for (KS-SKS-6). Hence, the start-up would establish constant communication with customers and establish the agile R&D team to enhance the product.

- *"there was an event three months ago from ELEVATE, which is a sports health industry. It was over open data and how it is affecting the industry --- the core drivers, that was interesting --- other people interested in the subject and came to speak to me."* (KS-SKS-LKS4)

On the other hand, high-technology start-ups, entrepreneurs would set the foundations to use patents and solidify the collaborations with research organisations. The target is to set the technological processes and resources to support the development of the product (KS-TX-PKS8, KS-TX-PKS10). Furthermore, new ventures in this sector aim to develop patents to protect their knowledge and gain feedback (KS-TX-PKS10, KS-TX-PKS11, KS-TX-PKS12). However, entrepreneurs recognise that a patent's development can be challenging for start-ups due to the financial resources and difficulty to do it (KS-TX-PKS8, KS-TX-PKS17, KS-TX-PKS18). Moreover, the data suggest that entrepreneurs would choose to use patents as a source of knowledge spillovers, and enabler to establish a strong reputation (KS-TX-PKS8,

KS-TX-PKS9, KS-TX-PKS10).

- *"We take feedback on the pattern itself, so if they particularly like a feature and see how it works, then we can relate it to develop it, and then we can tweak it. ---- People are trying to steal our algorithms."* (KS-TX-PKS10)

In this stage, the quantitative phase would enable us to provide insights if all new ventures can develop a new product. First, medium high-technological start-ups capability of recognition of opportunities from customers enables them to engage on exploratory innovation (RAC -> EXI: $\beta = 0.296$, $t = 3.549$, $p < 0.001$) (See Table 6.14). Also, the evidence suggests that the set of companies that may decide to diversify on different products or services reduces their capability to develop a engage in the development of a new product (RAC -> EXI: $\beta = 0.186$, $t = 2.108$, $p < 0.05$). The findings highlight that companies in this category may start by only seeking to cover a gap in the market. Thus, companies may decide to keep on the path of diversification or continue enhancing their technological tools to develop new products. The evidence led to the development of the following proposition:

- **Medium high-technological start-ups host events and meetings and use ICTs with companies to develop new products that are affordable to customers and supply a gap in the market. This approach seeks to develop a solution that enhances the supply chain. The diversification of products in this category would reduce the start-up's capability to engage in exploratory innovation.**

Second, high-technological start-ups can continue supporting the development of experiments and tests through research projects that lead to the creation of new products (RAC -> EXI: $\beta = 0.221$, $t = 3.368$, $p < 0.001$). One hidden indicator in the quantitative analysis is that entrepreneurs who do not hold a degree from the university may not engage in exploratory innovation (RAC -> EXI: $\beta = 0.141$, $t = 1.387$, $p > 0.01$). Moreover, undiversified companies that decide to focus on developing a single product have a higher statistical significance when engaging in exploratory innovation (RAC -> EXI: $\beta = 0.293$, $t = 4.764$, $p > 0.001$). Hence, the evidence suggests that high-tech start-ups tend to solidify their alliance with research institutions to focus on developing technological processes. Thus, exploitative innovation can be supported in some instances, from feedback obtained from developed patents. The discussion of the data led to the development of the following proposition:

- **High-technological start-ups conduct tests and experiments to engage in exploratory innovation. Companies in the category would aim to use patents in the long term to protect and attain technological knowledge. Companies in this category may decide to focus their R&D project team and resources on concentrating on developing a single product.**

The final discussion to explore is to evaluate the constant change of technology that affects the start-up's capability to develop new products. The factor analysis suggested that high technological start-ups are indirectly affected by technological turbulence (TUR * RAC -> EXI: $\beta = -0.158$, $t = 2.371$, $p > 0.05$) (Table 6.14). However, the moderating effect has shown that the responses from founders with a doctoral degree seem to receive a negative moderating effect from turbulence (TUR * RAC -> EXI: $\beta = -0.41$, $t = 6.13$, $p > 0.05$) (Table 6.14, page 151). This effect was also evidenced for companies that have not diversified into the development of multiple products (TUR * RAC -> EXI: $\beta = -0.19$, $t = 3.937$, $p > 0.001$).

This evidence suggested that the company would face initial difficulties in keeping with technology change while conducting experiments and applying for patents. This effect would only affect companies involved in the types of innovations not developed before. Thus, companies, where the founder has a doctorate, are engaging heavily with universities and institutions on research projects. The proposition is stated as follows:

- **High-technological start-ups experience a rapid technological change in the industry struggle to conduct experiments and fund patents. This effect is evidenced by entrepreneurs holders of a doctoral degree involved in developing new products from for projects undertaken in alliance with universities and research institutions.**

Once the company has managed to reach the final stages of developing new products, high-tech start-ups might perceive that technological change as a positive support for the company (TUR -> EXI: $\beta = 0.131$, $t = 2.371$, $p > 0.05$). The effects also replicated for the sample of undiversified companies (TUR -> EXI: $\beta = 0.104$, $t = 2.102$, $p > 0.05$). However, the perceived positive support from turbulence is only attained on companies were the founders that didn't hold a degree from the university (TUR -> EXI: $\beta = 0.285$, $t = 2.527$, $p > 0.05$). The evidence suggests that high-tech companies perceive technological changes and breakthrough as a positive input when the company does not seek to generate new knowledge, publish, or develop patents. This strategic decision can be influenced if the company's founder does not hold a degree from the university. Supportive evidence leads to the development of the following proposition.

- **Rapid technological change in the market or the industry can only support high-tech start-ups not involved in developing products that include technological breakthroughs. The start-up's strategical decision to enter this process is followed by founders that do not hold a degree from universities.**

These results suggest that high-tech entrepreneurs must initially strive to implement technological and scientific knowledge to develop a new product while keeping up with technological change. Once a final product has been designed, technological turbulence enables entrepreneurs to have a competitive advantage due to the development of patents or technological knowledge protection.

In regard to medium high-technological start-ups, technological turbulence seemed to have a higher negative moderating impact from technological turbulence (TUR * RAC -> EXI: $\beta = -0.30$, $t = 4.743$, $p > 0.001$). A reduced effect was evidenced from companies that have diversified into the development of multiple products, or the engagement with multiple industries (TUR * RAC -> EXI: $\beta = -0.235$, $t = 2.415$, $p > 0.05$). The data also revealed that companies under this category that may decide to diversify might also me initially affected by the moderating effect of technological turbulence (TUR * RAC -> EXI: $\beta = -0.19$, $t = 3.937$, $p > 0.001$). However, it is important to note that under this category, it cannot be rejected that this effect is evidenced by respondents that hold a doctoral degree. This evidence supports entrepreneurs' emphasis on R&D project teams using technological tools to keep up with the changes in the market. The proposition for start-ups under this category is staged as follows.

- **Medium high-technological start-ups perceive technological change as a restricting factor to engage in exploratory innovation. Companies in this category have founders who hold a doctoral degree and give higher emphasis on the establishment of R&D project teams and IT to support the development of prototypes.**

In this scenario, start-ups would only past this experience once the initial prototype is completed. After this point, technological turbulence ceases to have a direct effect on exploratory innovation (TUR -> EXI: $\beta = 0.04$, $t = 0.643$, $p > 0.1$). Furthermore, there is evidence that supports that diversified start-ups that diversify are not affected by technological change. The data support the evidence that companies in this category use the current technology to develop new products to cover a necessity. Start-ups then would not be generating new knowledge that can be published or needs to be protected. These insights also highlight that new ventures in these cases cannot be complexity assed based on attempts to develop new patents. The explanation of this phenomenon is stated as follows:

- **The first interaction on a product's development cycle is negatively affected by technological turbulence. Once the initial sets of experiments and prototypes, technological turbulence passed from a form of knowledge filter to a facilitator that supports exploratory innovation through continuous engagement with customers and companies using ICTs.**

7.4.2.2. Exploitative Product Innovation

Start-ups would be more prompt to engage in exploitative innovation when they want to enhance the characteristics of existing products and services in the market. During this process of product innovation engagement, start-ups exceed on product innovation by directing most of the resources to develop a product that can be sold in the market through interactions (IN-PI11, IN-PI2, IN-PI3, IN-PI4). This process involves reliable communications with the sales team to secure contracts' formation and consider developing multiple products. This start-ups approach to product innovation is enforced by absorbing customer knowledge spillovers coming from the market unintentionally. This process can lead the start-up to enter the stage of growth, were the product development cycle leads to a continuous process of testing and selling products in interactions (IN-PI13, IN-PI14).

- *"Once you have sold the product, you have a 50% chance of selling it again if you sell the product, you have a 60% chance to keep on that and a 70% chance on your third product. You build 5, 10 or 20-pound products. That is why I built the PROPERTY PAGE. You have a customer --- long lead time, it's a much more complex sale, but if you remove some of the complexity barriers, you don't have a ready customer, so productisation was key. I did not learn this at an academy"* (IN-PI13)

The data strongly suggests that medium high-technological start-ups quotes from process innovation have enunciated that entrepreneurs do not focus on adapting ICT and IT tools through the constant human capital training (IN-PD-DA2, IN-PD-DA3, PD-TR2,). The adaptation of processes can also come from the practices that have been implemented by incumbents (IN-PD-DA1, PD-TR3). The start-up approach is to be willing to rush the process to monetise the developed product and enable it to enter the market (IN-PI1, IN-P4). On this approach, start-ups' main mechanisms to test new products are screening the product in the market (IN-PI7, IN7, IN8).

- *"A lot of the work I have done in the past has been about technology, enhancements, and implementation on launching new products and processes; a lot has been about enhancing existing products or adding new features or functionality. Yes, I have a lot of experience doing it, innovating in that way and leading teams and being the touchpoint between the business and the technical. The team is something that I have had quite a lot of experience in it."* (IN-PI4)

Finally, the qualitative data strongly suggests that entrepreneurs cannot acquire a competitor's knowledge spillovers (S-CV-COKS1). The reason is due to the established knowledge management systems from incumbents and SMEs to protect information. The reasons involve entrepreneurs considering setting alliances with companies or perceiving that there are imminent competitors that use similar technological tools to exploit the market (S-CV-COKS3, S-CV-COKS4). Overall, entrepreneurs do not consider the presence of competitors can affect the company's survival due to the market size.

- *"The competition is not very big. ------ so, there is a gap there. Security experts are hard to find. So to sum it up in the particular segment that we are there are not many because it is relatively new, ------------------ we are not in direct competition. on the other hand, the market is growing fast, and the skill gap makes for less competition in our space."* (S-CV-COKS3)

The qualitative evidence and sample suggested the practices and strategies from medium high-technological start-ups. The quantitative analysis supported that companies under this category focus their attention to continue improving existing products and services through the implementation of small characteristics and features (RAC -> EPI: $\beta = 0.687$, $t=2.456$, $p <0.05$) (See Table 6.14). Furthermore, the statistical evidence suggests that all entrepreneurs who hold a doctoral degree are prompt to engage in exploitative innovation (PhD: $p > 0.1$). Moreover, the diversification of products and services does not play a statistical factor that supports the enhancement of existing products. Finally, the most crucial quantitative evidence from the quantitative analysis confirms that high-technological start-ups do not follow this strategy (RAC -> EPI: $p > 0.1$).

The discussion of the data has shred light that medium high-technological companies aim entirely to focus on developing one or multiple products through the use of IT. Regardless of this approach, the survival of start-ups in this category depends on using existing technologies to enhance current prototypes. Once complete, entrepreneurs would strive to sell their products to attain financial stability, regardless of the competition. The discussion of the data led to the development of the following proposition:

- **Medium high-technological start-ups engage in developing prototypes using existing technology to test and sell products and services in the market to attain financial stability. Companies under this category do not generate new technological knowledge and implement IT practices from incumbents.**

Medium high-tech start-ups also proclaimed that they have to keep up to technological change used by competitors to engage in the market. This set of circumstances can initially affect entrepreneurs to engage on exploitative innovation (TUR * RAC -> EPI: $\beta = -0.077$, $t=1.987$, $p <0.05$). This effect is applied to all entrepreneurs, regardless of their academic qualifications. Moreover, there are no statistically moderate effects from turbulence effects when diversification is taken into consideration. These circumstances are caused due to the constant reprocessing and integration of knowledge between teams. The quantitative analysis also hinders that companies under this category are on a state of constant survival. Hence, the entrepreneur’s strategy during prototypes is to sell a product affordable for customers. The discussion of the data led to the state the following proposition:

- **Constant rapid technological change in the industry can limit medium high-technological start-up's capability to use the current technology to develop initial prototypes. Start-ups, in this scenario, implement technological tools and practices from incumbents to develop a single product that can be sold in the market that secures financial stability and growth.**

The quantitative analysis also revealed how medium-high tech start-ups would perceive to impact technological turbulence during the process of exploitative innovation directly (TUR -> EPI: $\beta = 0.826$, $t=2.573$, $p < 0.05$). These effects are prevalent for founders with a bachelor's and master’s degrees from universities with a very statistical significance between samples (TUR -> EPI: $\beta = 0.553$, $t=2.009$, $p < 0.05$). This statistical effect was not visible between companies conducting product diversification. The evidence suggests that once the entrepreneurs start selling products and obtaining contracts, they enter an accelerated process of rapid growth. At this point, entrepreneurs’ race to use technological tools as an advantage to remain on top of the competition. This strategy is focused on enhancing technological tools and engaging in an aggressive expansion in the marker. The discussion of the qualitative and quantitative evidence led to the formulation of the following proposition:

- **Technological Turbulence enables medium high-tech start-ups to maintain competitive advantage through aggressive expansion in the market. The founders of the company hold a master’s degree as a higher qualification aim for the company to enter a rapid growth process regardless of engaging in diversification.**

7.4.3. Creative Destruction

7.4.3.1. Growth Operations and Scaling

Start-ups entering this phase seek to find routes or mechanisms to continue growing. The company's initial social capital would enforce the capability to locate extensions of the company in foreign countries (KS-SKS-CKS2, KS-SKS-IKS2, KS-SKS-IKS3). This tread clearly states that companies aim to engage in international markets (CD-GR1, GD-GR2, CD-OC-PD4, CD-GR5). These processes are to solidify the business operations and strategies that aim to expand to different regions setting annual goals and objectives. The qualitative data can strongly suggest that start-ups transition to becoming SMEs.

To reach the end of the entrepreneurial journey, a start-up needs to have a strong team and obtain the necessary investment to survive during the first ten years of operation (SU-FU1, SU-FU2 SU-F3, IN9). It can be questioned that entrepreneurs need to have high levels of resilience to solve problems (SU-RE1). If product innovation is not supporting the start-up's development, the company prepares to set a plan to save as many resources as possible before the company faces financial turmoil.

The qualitative evidence shed light on how companies would start to operate and behave as SMEs. Although the transition is outside of the thesis's scope, the research has been able to provide evidence that knowledge spillovers have to be directed initially to engage in product innovation through the establishment of an R&D team and tailored processes. The focus changes into setting the necessary business processes to repeat the same process and international branches or engagement with the market. Hence, the use of the model extended to SMEs new business locations can be used initially from phase 2 of the development and absorption of knowledge. Thus, the proposition that links start-ups transformation to an SME is established as follows:

- **Start-ups use social capital and resources to expand to international markets and open branches in foreign countries. The development of projects supports the start-ups grow through the acquisition of knowledge, and the entrepreneur's capability to solve problems.**

7.4.3.2. Entrepreneurial goals

The company's objectives are that the company's mission and vision depend on the entrepreneur's goals in the long term. The evidence strongly suggests that entrepreneurs aim to be part but to be recognised as a leading corporation in the market (CD-OC-PL2, CD-OC-PL3). The entrepreneur's approach at this stage is not to just be financially stable but to be considered as a company that worth millions, and that generates extensive revenue (CD-VL1, CD-VL2, CD-VL3). Hence, start-ups planning would involve expanding partnerships with businesses to establish a strong foundation with customers (CD-OC-PL1, CD-OC-PL2, CD-OC-PL3).

During this process, start-ups will continue to maintain the operations of the company. Regular activities in the start-up are achieved by gaining constant revenue and seeking investment from venture capitalists (CD-OC-PL2, CD-OC-PL4). All these endeavours must be directed to the development of R&D towards product innovation. If this process follows from the very beginning, start-up development can fail due to the lack of financial services to continue innovating (IN9, IN10). This evidence would further enforce that a process of creative destruction or construction for new ventures happens during the scaling transition.

- *"We want to be a ------------- TITAN; we want 100.000 pounds per month, ----------------- 12 million a year would be very nice --- a million pound per year per employee. That is a very nice and clean objective. -- I can see making 30 or 40 million a year with the same number of employees. It is a very ambitious target. I would LOVE to achieve that! I would say that is our long term objective."* (CD-VL1)

Entrepreneurs quotes also suggest that start-ups founder may also be interested in the characteristics of the product. Entrepreneurs would have a clear vision of the functionalities and appearance of products developed by the company (CD-OC-PD1, CD-OC-PD2, CD-OC-PD3, CD-OC-PD5). This process would suggest that high-tech start-ups would consider setting adequate tests to evaluate products through experiments. On the other hand, medium high-technological start-ups focus their attention on enhancing the product's characteristics and functionalities to satisfy the customer's needs.

The end target in the long term is to operate the company without the need for financial support from investors (CD-OC-PL4). Hence, the evidence suggests that start-ups are reaching the ten-year journey since its foundation engages in the process of creative destruction. In these cases, entrepreneurs would consider continuing to develop the company and overtake incumbents. If the process goes wrong, the founders will consider saving as many financial resources as possible and sell the company (CD-OC-PL3).

- *"Plan A is keeping it the same largely because the property market is real --- and I have been doing it for a long time. I don't have access to ---- don't have a good business plan for the future because there are several unknowns for what I can scale---. Plan A is to sell, Plan B is to reactivate and plan C ----- to grow in business, but I don't have any more plans."* (CD-OC-PL3)

The evidence suggests that the founder's future goals and objectives can direct the company's strategy. These processes seem to be initially dependant on investments, which could be restricted to start-ups in other industries. Furthermore, the entrepreneurs never mentioned seeking to sell the company to form part of an incumbent. Hence, entrepreneurs in these circumstances would not aim to enter a process of creative construction. The final discussion of the qualitative data provided insights to stipulate the following moderating proposition:

- ***The company's vision is to reach a valuation of millions by becoming a leading organisation in the market. These endeavours are nurtured by a vision of the product's functionality, appearance, and expected user experience.***

7.4.4. Main findings and model explanation during Phase 3 – Scaling up and the Future of the Company

7.4.4.1. Potential and Realised Absorptive Capacity

The resources involve the location and tacit knowledge of the entrepreneur to market the product. The section covers start-ups' aim to support financial funding towards the development of prototypes and new services by using knowledge spillovers (Nieto and Quevedo, 2005). The quantitative analysis covered the start-up's approach to developing new products or services through the exploratory innovation construct (Enkel et al., 2017;

Limaj and Bernroider, 2017). On the other hand, entrepreneurs can use tacit knowledge to enhance and existing product and market (Enkel et al., 2017; Limaj and Bernroider, 2017). This analysis's discussion centralises to emphasise the potential technological adaptations and enhancement of internal processes to adapt to the market needs (Blind and Mangelsdorf, 2013; Cantù, 2017). Therefore, the start-up's capability to perceive and adapt to technological change is evaluated through the turbulence control variable (Ferreras-Méndez et al., 2015; Zobel, 2017).

- **Start-up's location in urban cities enables access to diverse types of knowledge spillovers (David B Audretsch, Belitski et al., 2015; Hardy & Rodriguez-Pose, 2014; Kirchhoff et al., 2007)**

The KSTE has always demonstrated how companies have located near the sources of knowledge. However, this research has expanded this view. First, as time goes on, start-ups will slowly stop gathering knowledge spillovers from external sources. Instead, the new ventures would solidify their ties with research organisations, universities, or customers. All these interactions lead to the fully intended capture of knowledge spillovers shared on an alliance or partnerships. Also, medium high-technological start-ups would continue to use ICTs and IT to access data, information, and knowledge through virtual platforms. In this case, the transition ascends changes from geographical proximity, to cognitive proximity. In this approach, companies would seek to gain insights from similar knowledge sources that support the implementation of technological processes in the start-up.

The model has not only confirmed that entrepreneurs were able to capture diverse forms of knowledge spillovers but also defined a clear taxonomy that indicates where and how it has been used. Moreover, the research has shown that some classifications support developing new products, while others provide insights that helped entrepreneurs develop the company. The discussion has also demonstrated that only some medium high-technological start-ups tend to create multiple businesses or products out of the combination of knowledge. On the other hand, high tech start-ups discussion has demonstrated that entrepreneurs focus their resources and research to produce a single product.

7.4.4.2. Product Innovation

The final stages of a start-up are the transition from the early stages of development. This seed-stage results from the company's capability to implement knowledge spillovers towards creating a new product or service. The company's founders can use their increased base knowledge to set the foundations of the start-up's processes and performance (Cantù, 2017). The discussion of these stage emphasises the company's capability and the entrepreneur to evaluate the product in the market (Cantù, 2017; Hervas-Oliver, Lleo and Cervello, 2017). The product development cycle is expected to be supported by the exposure to knowledge spillovers, and the start-ups absorptive capacity.

- **Competition disrupts the flow of knowledge spillovers between start-ups, incumbents, and research institutions (David B. Audretsch et al., 2002; Ghio, Guerini, Lehmann, & Rossi-Lamastra, 2015b; Tothaermel & Thursby, 2005; Shu et al., 2014; Tsvetkova, Thill, & Strumsky, 2014).**

The discussion profoundly demonstrated that the entrepreneur's focus in the first ten years of operation is to gain funding and engage in product innovation. In this case, high-tech start-ups would prevent other companies from being a threat to the goal of developing patents or trademarks. While this happens, entrepreneurs would only share knowledge with companies, universities, and research institutions in the alliance. On the other hand, medium high-tech start-ups would embrace this by developing prototypes and obtaining constant feedback from the market. Entrepreneurs in these cases aim to create a product that enables them to earn revenue. Once achieved, companies strive to compete by expanding aggressively in the market and supporting the company's growth.

The data revealed that competition would only enforce stronger alliances and partnerships, booting access to knowledge spillovers. However, entrepreneurs are not able to obtain knowledge spillovers from competitors. Moreover, competition has not been enunciated as a potential factor that can disrupt the start-up's survival during the first ten years of operation. The discussion highlighted that this sector's market size is vast, allowing entrepreneurs to participate without feeling a direct opposition from start-ups or other companies. Finally, the data suggested that technological change can be considered an initial disruptor for implementing knowledge spillovers into product innovation. Once the prototype is completed and sold, technology's evolution becomes a competitive advantage for the company.

7.4.4.3. Creative Destruction

The innovation discussion expands on the transition that start-ups go through to enter the growth stage (Audretsch, Kuratko and Link, 2015; Hervas-Oliver, Lleo and Cervello, 2017; Ries, 2017). In this phase, the new venture can either enter on a process of creative construction or destruction (Agarwal et al., 2010). This process involves using information to disrupt the current market and survive, or to decide to engage on a merging process with an incumbent (Agarwal et al., 2010; Shu et al., 2014).

- **The location of start-ups in urban cities enhances the survival and growth companies (Renski, 2017; Tsvetkova et al., 2014)**

The end of the scope of the thesis is the analysis of creative destruction. At this stage, the discussion on the entrepreneurial journey in the first years did announce the intention of start-ups to obtain financial stability. This process would end with the engagement to produce innovation. However, the data suggested that the entrepreneurial mindset is not set only on survival but on aggressive growth. Hence, the start-up has aimed to become a leading company in the industry by raising its revenue and valuation to millions. Thus, entrepreneurs consider now not to remain in a single city but expand to foreign countries.

This entrepreneurial motivation is also motivated by the visualisation on how the features and functionality of the product. The model ends by potentially explaining how the model of knowledge spillovers on start-ups can explain SMEs' operation based on the beginnings of the company. Hence, the doctoral thesis has led a door open to predict the sources of knowledge spillovers for surviving medium and high-tech start-ups that became SMEs after ten years of operation.

The discussion of phase 3 on product development and scaling presented in Figure 7.7 led to the development of the model of the overall research.

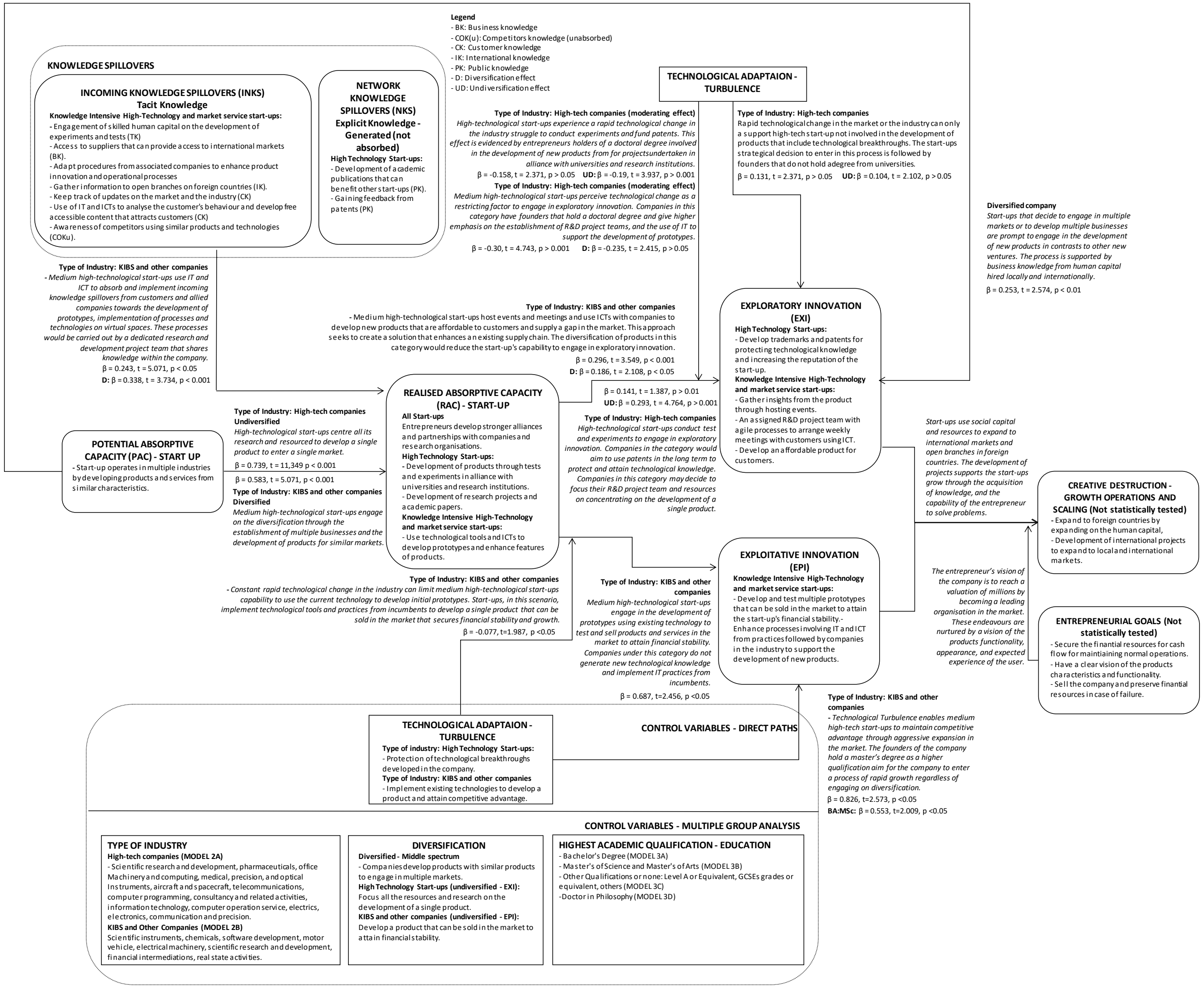


Figure 7.7 - Knowledge Spillovers model of High-Tech Start-Ups (KSM-HTS)

5.1. Discussion of Knowledge Spillovers model on High-Tech Start-ups

The discussion chapter identifies knowledge spillovers, and mechanisms by high-tech start-ups engaged in product innovation. Moreover, the qualitative phase's critical discussion highlighted why entrepreneurs operate and implement specific strategies depending on the type of company, the background of the entrepreneur, and exposure to knowledge spillovers. The support of the qualitative and quantitative phases' statistical significance led to generalising the findings to a larger population. Moreover, the application of the factor proved which constructs and variables affect entrepreneurs during the defined phases.

The discussion chapter finalises by not only justifying a conceptual model two constructs of knowledge spillovers. The research has proven that entrepreneurs' decisions are dependent on the type of industry, which can lead to engaging in a cyclical product development cycle or on a unidirectional approach towards exploratory innovation. The research was also able to precisely identify how the knowledge conversion process has moved to include geographical proximity changes to interactions on virtual platforms.

This section summarises the operability of the models connecting the entrepreneurial journey phases based on the type of high-tech start-up.

During phase one of identifying the business idea and creation of the company, all entrepreneurs identified their business idea from knowledge spillovers obtained from their experience of academia and the industry. Also, an entrepreneurial disruptor's approach was to identify entrepreneurial opportunities by visualising how a process can be improved using current technology. Depending on the background, the entrepreneur would decide to validate their business idea through knowledge spillovers by asking the field experts, conducting interviews, and surveys. The entrepreneur may not conduct market research if their tacit knowledge and sharing of information with cofounders have provided enough information on how to operate the company, develop the product, and enter the market. Also, entrepreneurs previously involved in academia may have obtained validation by using academic research.

The assessment of the incubators and accelerators provide a source of tacit knowledge spillovers from experts and mentors. The data also suggested that experienced entrepreneurs can develop collaborations with companies, universities, and research institutions regardless of geographical proximity. The attendance to incubators and accelerators in start-ups has an increased effect of facilitating access to incoming knowledge spillovers at the very beginning of the PAC phase. The qualitative data confirmed that knowledge spillovers from the government are not perceived to affect start-ups directly or substantially, highlighting that it is necessary to implement more adequate policies to support entrepreneurs at this stage.

Once phase 2 of scaling up and the company's future begins, the alliances and partnerships lead to the development of R&D project teams. Medium high-technology start-ups would emphasise on the formation of partnerships to been found to be suppliers of IT. On the other hand, high-technology companies solidify their alliances with universities and research institutions. Tacit and explicit knowledge has to be statistically significant from suppliers, customers, universities, or research institutions. The most prominent forms of explicit knowledge from network knowledge spillovers come mainly from companies or associations, scientific journals, or academic publications expressed by the literature.

Overall, knowledge spillovers have a positive effect on the start-up’s potential absorptive capacity. The data confirmed that the start-up’s capability is boosted from acquiring technological knowledge spillovers obtained by hiring highly skilled human capital. Technological knowledge would also be obtained from emails, magazines, and books that intentionally or unintentionally reach the company's staff. The process includes the implementation of technological tools and resources. The study shows entrepreneurs must assign thirty to fifty per cent of the R&D budget towards product prototyping and development of services to survive. From this point, the entrepreneurial journey of start-ups and application of the model, starting from the potential absorptive capacity stage is tailored to the type of new venture. From this point, onwards start-ups processes change depending on the type of industry. In the high-technology sector, start-ups would be most characterised by having a founder with an academic degree, who gains access to academic publications through the use of search engines. High-technology companies would seek to use and develop patents to obtain financial gain and reputation. Entrepreneurs would then focus on developing research projects with universities and research institutions.

High-technological start-ups during phase 3 highlighted that high-tech start-ups prefer to develop an entirely new product that has not been developed before, causing them to engage in only exploratory innovation fully. During the implementation of knowledge in the realised absorptive capacity phase, entrepreneurs would stop to gather knowledge spillovers altogether and focus entirely on conducting experiments and developing the product. The transition between the implementation of knowledge and the product's competition is initially affected by technological change. Once the company is in the final stages of product innovation, technological turbulence becomes a positive factor that helps develop the final product, and the exploration of new markets. The adapted model focused on high-technological start-ups is illustrated in figure 7.8.

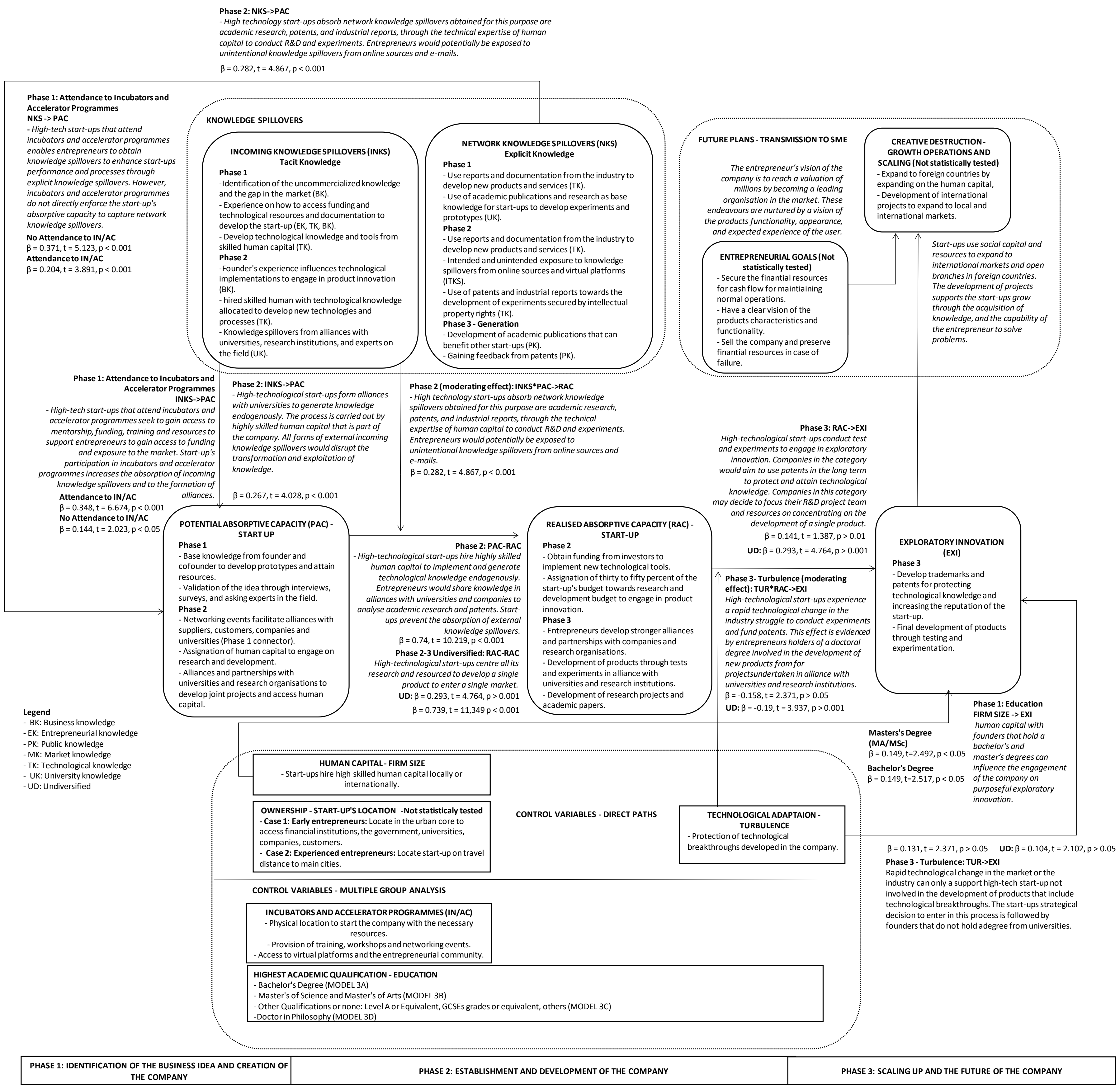


Figure 7.8 - Knowledge spillovers model of absorptive capacity and product innovation for high-technology start-ups.

The discussion also highlighted that providers of IT and ICTs would be considered potential partners of medium high-tech start-ups, which are handled using knowledge management systems.

Medium high-technology and knowledge-intensive business services at the beginning of phase 2 can gather network and incoming knowledge spillovers during the potential absorptive capacity phase. For that purpose, entrepreneurs emphasise the importance of hiring experienced highly skilled human capital such as engineers. The findings suggest that an increased number of employees helps the company implement existing technology to enhance existing products. Hence, increasing the company's knowledge base from various backgrounds and disciplines enables the new venture to diversify their products and markets.

Start-ups embrace a culture of openness that facilitates the sharing of information. This approach enables entrepreneurs to engage in both exploratory and exploitative innovation. The entrepreneurs' first step is to foster alliances with business, suppliers, and customers that support the development of an initial prototype. The processes related to potential absorptive capacity characterise by the self-training of human capital, and the acquisition of explicit knowledge spillovers from emails, books, blogs and videos. Entrepreneurs at this step will seek to engage in networking events to gather tacit knowledge spillovers from customers to provide insights on how to enhance new and ongoing prototypes.

Medium high-tech start-ups engage on the overall the processes of phase 2 with the product development and scaling processes of phase 3. This approach further enhances the assimilation, transformation and exploitation of knowledge by allocating thirty to fifty per cent of R&D budget towards product innovation. Entrepreneurs would conduct formal training on how to implement ICTs and IT. The key priority in this stage is to develop a virtual platform that enables them to maintain a constant channel of communication with partner companies and customers. This exchange of knowledge allows a product development cycle, were entrepreneurs gather incoming knowledge spillovers from customers on a weekly sprint. Afterwards, network knowledge spillovers are also gathered by entrepreneurs through the hosting of meetings and events. The start-up's approach is to engage in local and international markets by testing prototypes continuously. Once the start-up begins to sell the company in the market, entrepreneurs aim to increase the company's valuation. Thus, companies would have to face technological turbulence as a moderator that can prevent exploitative innovation. Once the prototype is developed, the constant technology change would be an enabler that start-ups can use to maintain a competitive advantage. The model for medium high-technology start-ups is illustrated in figure 7.9:

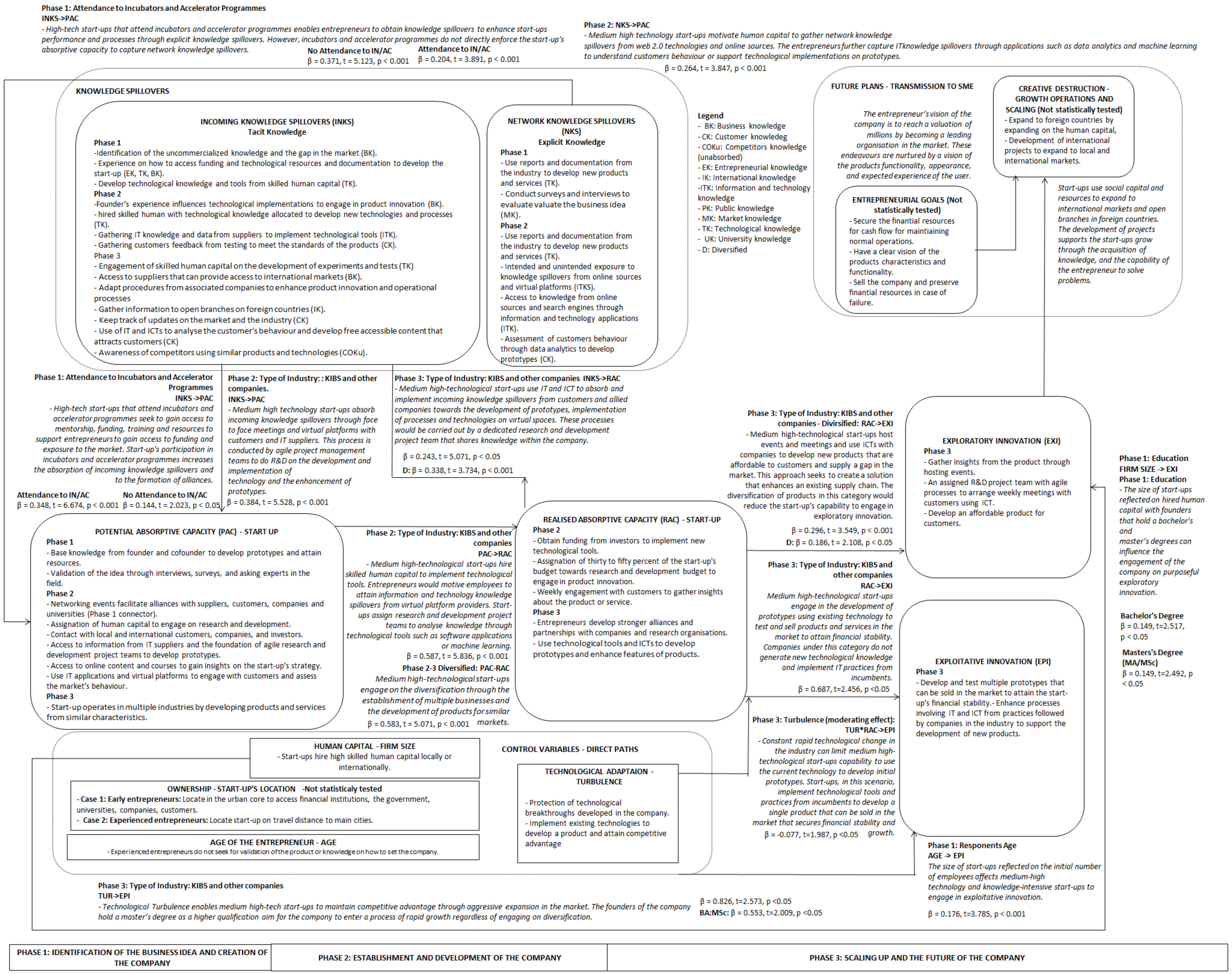


Figure 7.9 - Knowledge spillovers model of absorptive capacity and product innovation for medium-high technology and knowledge-intensive business service start-ups.

The research's main insights can inform future researchers in the area of knowledge spillovers as to which considerations have to be in consideration when assessing early entrepreneurs. Patents have been continuously used to measure start-ups' activity and growth as a definite determinant of economic development in regions and research and development activity (Audretsch and Vivarelli, 1996; Woodward, Figueiredo and Guimarães, 2006; Markovitch, O'Connor and Harper, 2015). However, this research suggests that patents' use and creation are more critical for high-technological start-ups, but not for the other new ventures in the medium high-technology sector. The data also suggest that the development of an initial prototype or finished product is the key determinant to provide a competitive edge and survival in the first ten years of operation.

The discussion of the qualitative and quantitative analysis gives the main findings for this research. Namely: 1) identified a taxonomy and nature of knowledge spillovers at the individual level of entrepreneurs in every phase, 2) Informed the effects of incubators and accelerator programmes on start-ups through the identification of opportunities for funding, provision of facilities, and exposure to the market, 3) Developed a conceptual model that has been validated by providing the reasoning of entrepreneurs through qualitative data, and to generalise the findings and operationality with statistical rigour, and 4) To directly link product innovation as a direct indicator of performance for high-tech start-ups.

8. CHAPTER VIII CONCLUSION CHAPTER

8.1. Introduction

Chapter VIII provides an overview of the research with an overview of the most critical insights and summary developed in the chapters. Next, the contributions to knowledge section discuss how the research addressed the research aims of the thesis. The section emphasises the process taken to develop the model and to empirically establish definite themes, definitions and compiled taxonomy of knowledge spillovers. Next, the research implications section provides key insights into how the research can inform start-ups of implementing adequate strategies to survive in the first ten years of operation with limited resources. The researcher provides insights on how the research offers a ground base for future research on knowledge spillovers. Lastly, the chapter concludes by stating the limitations of the research and provides insights into addressing them on future research.

8.2. Overview of the Research

Chapter I provided an introduction to the research. The bases established how entrepreneurs can exploit knowledge spillovers to generate new ventures. Hence, entrepreneurs can attain opportunities due to their geographical proximity to sources of knowledge. The KSTE emphasises that the company's location in urban cities facilitates access to human capital and resources. Research in this area has tested the phenomenon using regional indicators from companies. Hence, the exploration of knowledge spillovers has been centred in the field of economics. New approaches started to evaluate how companies used informal knowledge to collaborate on the development of projects. Thus, researchers have evaluated knowledge spillovers on science and technology parks, developing case studies of companies on incubators, and assessing the sources of knowledge spillovers. All these endeavours started to highlight the importance of evaluating the effects of knowledge spillovers on companies.

The doctoral thesis's main purpose was to analyse the effect knowledge spillovers at the individual level of high-tech entrepreneurs and clearly state the mechanisms and technologies used by start-ups to capture knowledge spillovers. The research conducts primary data collection and analyses empirical evidence to analyse knowledge spillovers develop a definitive taxonomy. Next, the doctoral thesis first objective is to develop a model with qualitative research that explains the start-up processes and activities involved with the absorption and exploitation of knowledge spillovers towards product innovation. The second objective was to generalise the model using quantitative analysis to incorporate adequate constructs that unravel knowledge spillovers' effects.

Chapter II developed an adapted, systematic literature review. The section followed an initial protocol that established the parameters to identify the selection of bibliographic databases and academic publications. The initial search of academic papers used initial keywords that linked knowledge spillovers with start-ups and business value. The initial screening of the data showed that the leading research on the KSTE conducted in economics, led by academic mostly located in the United States, Germany, and the United Kingdom. The literature's quality assessment revealed that research focused on the evaluation of universities as a source of knowledge and in the effects of R&D investment on entrepreneurship. Secondary research in this area used secondary data from surveys conducted by institutions such as the Organisation for Economic Co-operation and Development (OECD). The discussion of the literature implemented initially Traditional Pearl Growing (TPG) using an article named "The emergence of the Knowledge Spillover Theory of Entrepreneurship" (Ghio, Guerini, E E Lehmann, et al., 2015).

An initial discussion of the literature overview enabled to state a base definition of knowledge spillovers. The base research emphasises using uncommercialised knowledge used by economic agents to exploit entrepreneurial opportunities (Audretsch and Lehmann, 2010; Korosteleva and Belitski, 2017). Thus, knowledge spillovers are geographically bounded to individuals and companies located near the sources of knowledge. Research at this point just mentioned how technological tools, such as the internet and ICTs, enabled access to knowledge spillovers outside companies' cluster. Researchers took into consideration the density of the population and the economic conditions of countries and regions. Research in this field emphasised the importance of universities and human capital on the technological development of nations. Also, research focused on evaluating the number of patents and manufacturing companies' performance categorised based on the type of industry following the Standard Industrial Classification (SIC). At some point, the research started to emphasise the exchange of knowledge spillovers on the supply chain of companies (Montoro-Sánchez et al., 2011; Ganotakis and

Love, 2012).

Literature at this point establishes that the primary mechanism of knowledge spillovers are the entrepreneurs that used uncommercialised knowledge from the industry or academia to start a company. Other research mentioned mechanisms are the mobility of human capital, and the exchange of knowledge between companies (Nieto and Quevedo, 2005; Nielsen, 2015). The literature review also revealed how to define absorptive capacity to assess intentional acquisition and transformation of knowledge spillovers into the creation of new products and services (Bandera, Bartolacci and Passerini, 2016; Ferenhof et al., 2016; Qian and Jung, 2017). The research highlighted the importance of the entrepreneurs' academic qualifications and background facilitated the exploit knowledge spillovers and opportunities (Stam, 2013; Nielsen, 2015).

The literature review development extended the scope to other journals and authors using other forms of research methodologies to analyse knowledge spillovers. The support for the qualitative analysis conducted on chapter V focused on narrowing down the concepts to support the development of a conceptual model. First knowledge spillovers main characteristic is that it is absorbed informally, making it difficult to measure (Arrow, 1972; Agarwal et al., 2010). Thus, research mainly classified tacit and explicit knowledge spillovers from the supply chain, and on the interaction with the market (Verspagen, 1997; Montoro-Sánchez et al., 2011; Spithoven and Teirlinck, 2015; Cantù, 2017). Tacit knowledge inherent from the founder's experience supports the managerial decision to evaluate the business idea and implement the most appropriate technological tools (Vivarelli, 2004; Santarelli and Vivarelli, 2007). The research pointed out how the entrepreneur's attendance influences this process to incubators and accelerator programmes, and networking events facilitate access to resources and knowledge (Hausberg and Korreck, 2017; Mrkajic, 2017).

Regarding absorptive capacity, the research assessed the competence of the human capital to conduct R&D and implement technological tools (Bouncken and Kraus, 2013; Hayter, 2013; Audretsch and Belitski, 2017). The main gap observed in the literature is the disconnection between evaluating directly the processes, mechanisms, or activities undertaken by entrepreneurs to extract and implement knowledge spillovers, as assumed by research in economics. Thus, knowledge spillovers research requires a ground model that can be used to evaluate this phenomenon directly among other disciplines.

Chapter III discusses the development of the conceptual model KST-QLCM that enables to explain start-ups' performance during the first ten years of operation based on the literature (Dey, 2016). The leading theory guides the development of an interview guide guided in the foundations of the KSTE and its related theories. The definition of the model used coding from the literature (Creswell and Plano Clark, 2018). The development of the research questions for the interview guide focused on asking entrepreneurs about their perception and the start-up operations (Yin, 2003; Kvale and Brinkmann, 2009).

The interview guide for the qualitative analysis started with the intention to evaluate the flow of knowledge spillovers. The model considered the characteristics of start-ups and entrepreneurs to assess the identification of the business idea (Bouncken and Kraus, 2013; Tsvetkova, Thill and Strumsky, 2014). The evaluation of the company's founders considered the assessment of the entrepreneurial experience and social capital (Markovitch, O'Connor and Harper, 2015; Schmidt, 2015). The questions regarding the accelerator programme and networking assessed the effect of these events on start-up's performance and the acquisition of knowledge (Cantù, 2017; Hervas-Oliver, Lleo and Cervello, 2017; Qian and Jung, 2017). The model followed up by evaluating the mechanisms and tools used by entrepreneurs to access to knowledge spillovers.

Knowledge spillovers' characteristics consist of that it is informally transferred, does not benefit its original creator, and is not linked to a monetary value (Agarwal, D Audretsch and Sarkar, 2010). The process also considered the new ventures absorptive capacity based on R&D investment to develop projects and hire human capital (Nieto and Quevedo, 2005; Fritsch and Changoluisa, 2017).

Additionally, the conceptual model chapter informed the identification of variables to conduct the quantitative phase. First, the model selected's dependent constructs were exploratory and exploitative innovation (Enkel et al., 2017; Limaj and Bernroider, 2017). These constructs focused on evaluating the creation or enhancement of products. Second, potential and realised absorptive capacity multidimensional constructs were used to assess the start-ups' processes required to acquire, assimilate, transform, and exploit knowledge spillovers (Tzokas et al., 2015; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Limaj and Bernroider, 2017). The formative incoming and network knowledge spillovers constructs evaluated the sources of knowledge, and the collaboration between organisations (Belderbos, René; Carree, Martin; Lokshin, 2004; Veugelers, 2016). Finally, the control variables evaluated the company's characteristics, the entrepreneurs, and the attendance to incubators and accelerator programmes.

Chapter IV covered the overall research methodology of the thesis. The discussion mentions the continuum of paradigms between an interpretivism and positivist philosophical overviews (Collis and Hussey, 2014). Both of these approaches enable the researcher to uncover an understanding of the phenomenon of knowledge spillovers. Thus, the section state that the pragmatic philosophical overview was the most appropriate overview to cover both spectrums. The research centred on the developing propositions and a model from the qualitative analysis, and to test hypotheses in the quantitative analysis (Sechrest and Sidani, 1995; Hoshmand and Lisa, 2003). The initial discussion led to selecting the most appropriate research methodologies to cover the research aim and statements of the doctoral thesis (Ivankova, Creswell and Stick, 2006; Creswell, 2014). The research is based on a pragmatic approach, considering not focusing on the objective and subjective assessment of the data, given that knowledge spillovers by nature are heterogeneous and stay under constant change (Tashakkori and Teddlie, 2003).

The discussion of the nature of the research leads to sequential exploratory research design (Creswell and Plano Clark, 2018). Thus, the qualitative strand focused on identifying the events and mechanisms used by entrepreneurs to capture knowledge spillovers (Booth, Diana and Sutton, 2012). This phase's research method was of multiple case studies of entrepreneur founders of high-tech start-ups that attended incubator and accelerator programmes in Greater London (Yin, 2006; Strang, 2015; Merriam, 2016). The bounded system selected for this study chosen was on business information centres and independent private incubators and accelerators (Zedtwitz, 2003; Grimaldi and Grandi, 2005). The sample selection was non-probabilistic based on self-selection (Saunders, Lewis and Thornhill, 2016). The data collection methods selected for this research were semi-structured interviews conducted on face-to-face meetings, mobile calls, and virtual meetings (Creswell and Plano Clark, 2018).

The quantitative strand focused on using inferential statistics through structural equation modelling using variables and constructs to test hypotheses (Strang, 2015). The population sampling was non-probabilistic based on homogeneous purposive sample (Saunders, Lewis and Thornhill, 2016). This phase's data collection procedure was conducted through surveys sent to Chief Executive Officers (CEOs) and founders of the company in the high-tech or medium technology sector in the United Kingdom (A Field, 2018). The research methodology research is set to conduct exploratory factor analysis to identify the most common variance between the variables (A Field, 2018). Afterwards, the study defined the use of confirmatory factor analysis to provides an initial evaluation of the model's reflective constructs (Blunch, 2013; A Field, 2018). The final report of the model defined the requirements to conduct an analysis using Partial Least Squares, including the incoming and network knowledge spillovers constructs (Hair, 2018).

Chapter V presents the qualitative analysis taking into consideration the conceptual model themes developed in chapter IV. The study focused on developing overarching dimensions, first-order dimensions and second-order themes using open and focused coding. The qualitative analysis builds a concrete model using focus coding to identify patterns to develop initial propositions (Saldana, 2015; Eisenhardt, 2016).

The stat-up theme identified the entrepreneur's tacit knowledge spillovers acquired from industry or academia that supplied the business idea necessary to create the start-up. This process sets the initial resources and activities needed to gain funding from angel capitalists and select adequate approaches to evaluate the business idea. Incubators and accelerator programmes facilitate entrepreneurs with mentorship and pitching events to promote engagement with local and international markets. The data revealed that there is no formal collaborations or alliances between start-ups.

The combination of the founder's social capital and attendance to networking events facilitated partnerships and alliances with firms and universities. The absorptive capacity process revealed that start-ups that engage with companies facilitate the training of human capitals to enhance the necessary skillet to engage in R&D and product innovation. The discussion revealed that absorptive capacity is conducted by hiring skilled human capital to implement technological knowledge, IT tools, and experiments.

The analysis revealed the capture of tacit and explicit knowledge spillovers from interactions between individuals and access to information from online sources. Furthermore, the study highlighted how start-ups main objective is to engage in product innovation in the first years of operation. For that matter, the entrepreneur intends to adopt technology to enhance current products or create entirely new products. The phase enabled to develop the qualitative empirical model (KST-QLEM2), which guided the identification of constructs and variables for the quantitative phase.

Chapter VI presents the quantitative analysis to use Chapter V's theoretical dimensions as a guideline to identify adequate quantitative constructs for the quantitative model. The screening of the responses from the survey sent via email used Mahalanobis distances and skewness and kurtosis assessment. The data evaluation led to the identification of 556 reliable responses (A Field, 2018). The participant's main classifications were based on the characteristics of the participants and the start-ups. An exploratory factor analysis using a factor extraction through principal components and Promax rotation led to identifying six main components with factors above 0.7. The initial assessment of the model conducted a confirmatory factor analysis to secure the data's validity and reliability using SPSS-AMOS.

Afterwards, the analysis used Partial Least Squares using the software SMART-PLS. The model included the incoming and networking knowledge spillovers formative constructs. The study conducted variations of the model to evaluate direct and moderating effects between constructs and compare samples using multiple group analysis based on gender, attendance to the incubators and accelerator programmes, and diversification. First, the base model 1a revealed direct effects of knowledge spillovers on potential absorptive capacity. Moreover, the study showed an effect of incoming knowledge spillovers on exploratory innovation. Model 1b included the evaluation of direct and moderating effects of turbulence and knowledge spillovers. Finally, model 1c developed the base model considering only the significant statistical effects between constructs and variables.

The analysis of model 2 proceeded to conduct a multiple group analysis based on incubators' and accelerators' attendance, the company's diversification, and gender. The findings suggested that IN/AC enhanced start-ups capability to absorb incoming knowledge spillovers during the PAC. Also, diversified companies showed that INKS could be acquired on RAC. Furthermore, initial evidence of product development cycles was suggested from PAC's direct statistical effect with EXI.

The analysis conducted a final assessment of the model, including the company's age, the entrepreneur's age, and firm size. The analysis revealed that the experience of the entrepreneurs would negatively influence start-ups engagement with exploitative innovation. On the other hand, the firm size would enhance its capability to engage in exploitative innovation.

The final analysis ran a multiple group analysis based on the type of industry (model 2) and the entrepreneurs' highest qualification. The variation of model 2 revealed that age and firm size do not affect the company. Companies in this category only absorb knowledge spillovers during potential absorptive capacity. Furthermore, companies perceive the effects of technological turbulence while engaging only on exploratory innovation.

On the other hand, medium-high technological start-ups can enhance their exploitative innovation capabilities by hiring human capital. Companies under this category are capable of absorbing incoming knowledge spillovers during the realised absorptive capacity processes. Furthermore, new ventures in this category can engage in both exploratory and exploitative innovation. Technological turbulence affects innovation during the development of the company's first product. Afterwards, constant technology change is used as a competitive advantage when enhancing existing products' features.

Finally, the entrepreneurs' academic qualification evaluated on model 3 revealed that founders with a bachelor's or master’s degree would gain an advantage of hiring human capital and absorb incoming knowledge spillovers during the engagement of exploratory innovation. Hence, entrepreneurs in this category are also positively affected by technological turbulence. The analysis revealed that PhD entrepreneurs would not choose to engage in exploitative innovation. Thus, they only have adverse moderating effects from technological turbulence. On the other hand, entrepreneurs with other qualifications or none choose not to engage in exploratory innovation.

The thesis closes with **Chapter VII** to discuss the qualitative and quantitative findings to develop the final model effects of Knowledge Spillovers on High-Tech start-ups (KMS-HTS). The chapter discusses these effects in three main phases of the entrepreneurial journey: 1) Identification of the Business Idea and Creation of the Company; 2) Establishment of the Company; 3) Scaling and development.

The first phase clearly stated the founders of the company would exchange knowledge to establish how to attain the necessary resources to develop prototypes and validate the business idea through surveys, interviews, and by asking experts in the field. All these processes are supported by knowledge spillovers obtained from human capital, the founders' experience, public industrial reports and journal articles. At this stage, incubators and accelerator programmes' primary role is to provide mentorship, access to the market, and investors' funding. The decision leads early founders with no previous experience on entrepreneurship in the urban centre of populated cities based on their needs to develop networks and alliances with companies and institutions. Thus, incubators and accelerator programmes can provide access to entrepreneurial communities and virtual platforms.

The main insights from the discussion at this phase were entrepreneurial knowledge spillovers can be attained from understanding how to cover a gap in the market. Furthermore, medium and knowledge-intensive companies seek to hire skilled human capital only from the industry or technological expertise. On the other hand, experienced entrepreneurs consider locating the company and human capital outside of expensive cities due to the required high operational costs and competition.

Phase 2 of the establishment of the company began to highlight differences between high and medium technology start-ups. High-tech start-ups choose to establish partnerships with universities and research institutions to conduct research and development. Thus, the primary sources of incoming knowledge spillovers are from hired human capital and engagement with experts in the field. Start-up in this category would emphasise the use of patents and technical reports to conduct experiments supported by investors' funding. On the other hand, medium high-technological start-ups would seek to engage directly with customers and suppliers to attain knowledge spillovers. These insights provide entrepreneurs with the knowledge to engage entirely on product innovation. The main driver is the inherent motivation of human capital to implement technological tools through the establishment of R&D agile project management teams.

Thus, medium high-tech companies would invest R&D on the development of technological tools towards prototyping. Therefore, knowledge spillovers can be obtained from virtual sources outside the boundaries of geographical proximity. Moreover, entrepreneurs use human capital knowledge to understand necessary regulation required to engage in local and international markets.

Phase 3 stated scaling and development noted that high technology start-ups fully commit to engaging in exploratory innovation by using patents and trademarks to protect knowledge. In these cases, entrepreneurs with masters or bachelor's degree are influenced by technological change. To compete in the market, founders will hire human capital with the necessary expertise to conduct experiments. The research also highlighted that companies in the future become a source of scientific knowledge spillovers through the development of patents and trademarks.

On the other hand, medium high-technology start-ups engage in exploratory innovation through an agile R&D project team. This process focuses on enhancing current products through exploitative innovation. Thus, start-ups would consider diversifying through the development of multiple prototypes. Entrepreneurs will use the scientific knowledge of human capital to implement technological tools and enter the market first and use technological turbulence to remain competitive and scale rapidly. In both cases, entrepreneurs seek to engage in creative destruction by raising the company's validation and revenue by millions. The chapter ends with a clear definition of a model that can be implemented correctly for high-tech and medium-tech start-ups.

8.3. Contribution to Knowledge

The doctoral thesis aimed to analyse the effects of knowledge spillovers on high-tech start-ups and identify the mechanisms and technologies implemented by entrepreneurs during the first ten years of operation. The overall results enabled to develop a model rigorously tested using mixed methods. This methodological approach led to the application of formative knowledge spillover constructs on of early start-ups and entrepreneurs. The central insight found is that knowledge spillovers have a significant impact on identifying the product or service and valuation of the company. Once the company has hired human capital and set alliances, the dependency of extraction of knowledge spillovers on geographical proximity decreases, as entrepreneurs would use technological tools to communicate between companies and extract information from online sources. The evidence sufficiently proves that product innovation is the key indicator that enables to assess start-ups performance. Therefore, prototypes and experiments are the main start-up's drivers to access funding from venture capitalists. Furthermore, technological tools and knowledge spillovers enable entrepreneurs to compete in the market and survive.

The contribution to the knowledge of the doctoral thesis is a validated model that enables to assess the effects of knowledge spillovers on high-tech start-ups at the individual level of the entrepreneur. Moreover, the research covers the gap of adapting multidisciplinary research on a single model that clearly states the definitions, mechanisms, and implementations of knowledge spillovers. The final discussion of each one of the research objectives is addressed in the following points.

- **To further explore the nature and effects of knowledge spillovers on start-ups that have attended incubators and accelerator programmes in Greater London.**

The research on knowledge spillovers is funded on the formation of clusters in metropolitan areas, based on start-ups' spatial proximity as sources of knowledge (Schmidt, 2015). The primary research area implements econometric models to generalise knowledge spillovers research on the development of new ventures (Hallin and Holmstro, 2012). Research has considered the variable of incubators to evaluate at a regional level the number based on the creation of new ventures and investment in R&D from universities (Colombelli, 2016; Abubakar and Mitra, 2017). However, the KSTE research started to slowly uncover its nature based on internal and external knowledge exchanges between companies (Ding, Liu and Song, 2013). Research on incubators and science and technology parks started to categorise vertical and horizontal knowledge spillovers from companies involved in the chain of value and information on incubators (Hájek and Stejskal, 2016; Audretsch and Lehmann, 2017; Cantù, 2017).

The doctoral research has critically identified the sources of knowledge spillovers, and the mechanisms used to implement it towards innovation. The analysis took a step further by identifying and categorising knowledge spillovers based on its tacit and explicit form. The level of detail in the model includes how and when knowledge spillovers directly affect the strategical decision and approach taken by entrepreneurs. Furthermore, the analysis extended the research to evaluate the impact of incubators and accelerator programmes.

The base understanding of the nature of knowledge spillovers took into consideration the type of tacit knowledge used by the company's founders and the hired human capital. Next, incubators and accelerator programmes have proven to develop partnerships that facilitate knowledge spillovers in alliances. This process highlights entrepreneurs and companies' intention to informally access knowledge to enhance the development of R&D projects and prototypes. During this process, knowledge spillovers cannot be gathered using IT, breaking geographical proximity boundaries. Finally, knowledge spillovers' effects lead to the phase of scaling and developing the company, where the start-up seeks to access knowledge spillovers to expand internationally.

- **To empirically inform the development of a qualitative model that defines the mechanisms and processes that high-tech start-ups undertake to use and implement knowledge spillovers during the first years of operation.**

This section explains the development of the first contribution to knowledge, which is developing an initial qualitative model that identifies the effects of knowledge spillovers on high-tech start-ups.

The research considered research linked to the KSTE and how start-ups are affected by knowledge spillovers. The initial perspective considered how knowledge spillovers took into account the founder's experience and the type of start-up. The qualitative conceptual model (KTS-QLCM), developed in Chapter III, identified all the types of events linked to the transformation and use of knowledge spillovers obtained from outside companies and institutions. First, the conceptual model took into account the entrepreneur's characteristics and the company (Montoro-Sánchez et al., 2011; Nielsen, 2015). The assessment also considers how many employees and years of activity of the start-up since foundation (Shu et al., 2014; Tsvetkova, 2015). The context of the research covered entrepreneurs that attended an incubator or accelerator programmes, and the location of the company (Bandera, Bartolacci and Passerini, 2016; Cantù, 2017). In the initial stages, the model assessed how entrepreneurs used knowledge spillovers to identify and evaluate the business idea (Nieto and Quevedo, 2005; Markovitch, O'Connor and Harper, 2015; Fritsch and Changoluisa, 2017).

The conceptual, qualitative model (KST-QLCM) evaluated how start-ups could obtain valuable information from networking events (Cantù, 2017; Hervas-Oliver, Lleo and Cervello, 2017). The process enabled to assess what type of knowledge spillovers collected from entrepreneurs, and the methods involved in recognising entrepreneurial opportunities (Connell et al., 2014; Cantù, 2017; Hervas-Oliver, Lleo and Cervello, 2017).

The initial assessment considers the principal methodologies and tools used to conduct research and development in the company (Lasch et al., 2013; Amoroso, Audretsch and Link, 2017; Cantù, 2017). The nature of knowledge spillovers evaluated it was free and enabled to enhance the performance of the company.

The empirical evidence of the qualitative analysis led to developing a proven initial qualitative empirical model (KST-QLEM2) that reached theoretical saturation. The initial insights led to identifying founders with PhD degrees led high-technology start-ups. This process identified that entrepreneurs would use academic research to evaluate the business idea. On the other hand, entrepreneurs with experience in the industry would use their expertise to evaluate the product or service from experts in the field and conduct market research. In some instances, the company would have an initial prototype that facilitates feedback from potential customers.

The entrance to incubators and accelerator programmes facilitated access to investment, exposure to the market, and to develop the necessary processes to grow the company. Most importantly, these institutions facilitated a physical location for start-ups to operate. Knowledge spillovers gathered through this process came from tacit knowledge spillovers by engaging with experts on the field; Also, explicit knowledge spillovers obtained from videos, reports, and virtual platforms.

The findings revealed that alliances and partnerships based on projects that are beneficial for both companies. By nature, these relationships are informal, enabling them to maintain a constant flow of technological knowledge spillovers. Furthermore, start-ups that have alliances with universities enabled to have access to academics, experts in the field, and graduate students' participation. However, engagement with universities is only possible only if the company's founders have a connection with academic and research institutions.

All these conditions set the company to enhance its absorptive capacity to implement knowledge spillovers. At first, entrepreneurs would allocate R&D budget towards hiring skilled human capital. The founder's managerial decision is fully committed to attaining technological knowledge spillovers from alliances and customers to remain competitive in the market. Start-ups would further enhance their capabilities by self-training employees and implementing technological tools to engage with communities and access explicit knowledge spillovers from online sources. The model concludes on the start-up's main objectives: to participate in the exploitation of technologies to develop products. Thus, entrepreneurs would implement practices and methodologies used by companies in alliances. This process is conducted by a dedicated R&D research project team that enables the company to gain funding and revenue access.

- **To quantitatively validate the development of novel knowledge spillovers model that formally incorporates knowledge spillover constructs and evaluates start-ups performance (Contribution to knowledge).**

The qualitative empirical model (KST-QLEM2) mode proved to identify themes to guide the development of an initial quantitative conceptual model defined in Chapter III (KST-QNCM). The research achieved to evaluate adequate variables and construct to use through the exploratory factor analysis. All the reflective constructs of innovation and knowledge spillovers had factor loadings above 0.5. The model also passed all the validity and reliability tests, making sure that all the constructs measured the different processes through the entrepreneurial journey. Overall, the quantitative analysis proved that knowledge spillovers positively affected the potential absorptive capacity of start-ups. Also, diversified start-ups can capture incoming knowledge spillovers during the realised absorptive capacity process. The model also showcased start-ups capability to engage in exploratory and exploitative innovation despite the rapid technological change. Moreover, the quantitative analysis conducted a qualitative assessment of the knowledge spillover formative constructs.

The 556 valid number of responses obtained on the research enabled developing two main models that explained how high and medium technology start-ups operate during the first ten years of operation. The discussion chapter enabled to state the processes and strategies taken by entrepreneurs to develop new products. First, the company's founders would exchange knowledge and decide wherever it is necessary to validate the business idea from knowledge spillovers. These again translated into the development of alliances and partnerships to transfer knowledge spillovers in partnerships. During this process, incubators and accelerator programmes would increase the entrepreneur’s capability to identify entrepreneurial opportunities from companies and the market.

The critical contribution to knowledge from the research was the practical application of knowledge spillovers dimensions as formative constructs (Belderbos, Gilsing, Lokshin, Carree, & Fernández Sastre, 2018; Laursen & Salter, 2006; Sisodiya et al., 2013). The model statistically proved that high-technological start-ups behaviour is to hire skilled human capital with scientific knowledge to conduct experiments. Under this category, the companies uni-directionally generate knowledge internally and seek to develop new products through trials of experiments. High-tech start-ups on this process would further create new knowledge through the development of patents and trademarks. On the other hand, medium high technology start-ups assign R&D project teams to develop prototypes and gather customers' insights. This process is supported by using IT and ICTs to gather knowledge spillovers from online sources. The quantitative analysis has proven that companies under this category would engage in exploratory and exploitative innovation. These new ventures' main goal is to enter the market and scale rapidly to remain competitive in the market. The process repeats once the start-up has located branches on foreign countries or started to engage in international markets. The model can apply for the location of the company as an SME with gained tacit knowledge.

- **To clearly define a proposed taxonomy of knowledge spillovers that affect entrepreneurs, and the mechanisms used to transform entrepreneurial opportunities into the development of products or services and incorporate technology (contribution to knowledge).**

The section explains the development of the main contributions to this research's knowledge provide a final model knowledge spillovers on high-tech start-ups (KSM-HTM); which has been validated and define taxonomy and effect of knowledge during the development of start-ups.

The revision of the literature and quantitative conceptual model defined in Chapter III (KST-QNCM) highlighted the starting base on the categories of incoming knowledge spillovers that uses had tacit and explicit knowledge variables (De Faria, Lima and Santos, 2010; Spithoven and Teirlinck, 2015). Most definitely variables of knowledge spillovers have been categorised by companies involved in the chain of value such as suppliers, competitors, customers, institutions, public and industrial (Belderbos et al., 2004; Montoro-Sánchez et al., 2011). On the other hand, the elusive network knowledge spillovers measured from the entrepreneur's importance to reading papers, participation on conferences, subscription to journals, interactions in the industry and engagement with online communities (Foss, Lyngsie and Zahra, 2013; Sisodiya, Johnson and Grégoire, 2013; Amoroso, Audretsch and Link, 2017).

The research successfully supported the literature to group these variables into formative constructs that could be used on structural equation modelling. Although researchers considered using these variables as reflective, the constructs of depth and breadth used on research from innovation justified the implementation of the formative constructs (Bengtsson et al., 2015; Cui et al., 2015; Lazzarotti et al., 2017; Jia et al., 2018; Gölgeci et al., 2019). These constructs enabled to evaluate the classification on the acquisition of external knowledge spillovers.

Previous research has ambiguously defined types of knowledge spillovers without defining definitive constructs or themes applicable for start-ups. The final discussion of the model (KSM-HTS) provides a detailed taxonomy of knowledge spillovers supported by the data. Tacit knowledge under incoming knowledge spillovers involves acquiring technological knowledge spillovers from hiring skilled human capital and using documents to implement technological tools towards the development of prototypes and experiments. Business knowledge is used to identify gaps in the market and understand the business processes necessary to implement technologies and engage in international markets. University knowledge is mostly related to access to resources from universities and academic publications. Public knowledge is found from patents and research documents available outside the alliance. Customer knowledge provides feedback that enables entrepreneurs to continuously enhance the functionality of products and prototypes and understand the market's behaviour. Information and technology gathered from online sources support the implementation of technological tools. Finally, international knowledge spillovers are obtained at the end of this process to expand its foreign countries.

The doctoral thesis has extended the KSTE by providing evidence that knowledge spillovers absorption is not restricted to geographical proximity and captured on virtual platforms (Nonaka, Toyama and Konno, 2000; Audretsch and Lehmann, 2010). The insights highlight that the founder of the company's network capital opens access to tacit and explicit knowledge spillovers that supported on the identification of the business idea and the establishment of the company (Hayter, 2013). Furthermore, entrepreneurs exchange previous experiences related to registering and fundraising (Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011). The main mechanisms involve conducting market research from conducting interviews, analysing surveys, asking experts in the field, and testing the product with customers. Afterwards, entrepreneurs that enter incubators or accelerator programmes obtain business knowledge from entrepreneurial communities and resources such as videos or virtual platforms (Audretsch and Belitski, 2017; Renski, 2017).

Start-ups that decide to participate in an accelerator or incubator programme can absorb knowledge spillovers successfully. On the other hand, the data suggests that the number of employees or years of operation of the new venture is not a restricted factor in developing new products. The capture process was evaluated on a two-stage process of the potential and realised absorptive capacity constructs (Ferreras-Méndez et al., 2016; Limaj & Bernroider, 2017; Tzokas et al., 2015).

8.4. Research Implication

8.4.1. Companies and Entrepreneurs

This research provides managers involved in start-up creation with insights about the knowledge and resources necessary to create a firm. The model advises entrepreneurs about the crucial managerial decisions required to remain competitive in turbulent markets. First, this research highlights how knowledge spillovers accumulated from industrial and academic sources influence start-ups' administrative decisions. These include selecting the company's headquarters' geographical location and the industrial sector to operate within. Secondly, it informs that incubators and accelerator programmes enhance start-up's acquisition of knowledge spillovers, determining the initial company processes and their more extensive network with companies. This research suggests that knowledge spillovers facilitate identifying entrepreneurial opportunities for obtaining funding, gaining insights on local and international markets, and engaging in collaboration with established companies. Finally, the study emphasises the importance of high-tech start-ups of hiring highly skilled capital to operate technological tools to collect knowledge and maintain collaborations and partnerships for constant product innovation. These insights are integrated into a framework that increases the opportunities for start-up survival. These insights are crucial to start-ups due to their limited resources and time necessary to remain competitive in the market and obtain vital funding and revenue.

Most importantly, the models on knowledge spillovers for medium and high technology start-ups clearly state adequate approaches to engage in exploratory and exploitative innovation. High-tech start-ups must establish a strong scientific knowledge base supported by the founder and the first team's experience. If this requirement is not met, the company can hire the required skilled human capital to support technological tools that support the development of products. The idea's valuation can be conducted by asking experts in the field and supporting the development of experiments. Companies should develop strong alliances with universities or research institutions to establish joint research projects. Furthermore, start-ups have to prevent knowledge leakage by implementing confidentiality agreements, trademarks or the development of future patents.

On the other hand, medium high-technological start-ups have to conduct the idea's valuation through surveys and interviews. Once the product or service concept is transparent, companies must seek to form alliances with incumbents and customers to support the development of prototypes. This first output enables the company to obtain initial funding from investors that have to be used to implement technological knowledge. Start-ups should excel in using IT and ICT tools to establish strong collaborations through an R&D project team focused on developing products. In these cases, skilled human capital should be focused on engineering to implement adequate technologies. The process should be conducted weekly cycles, where constant feedback from the market is used to develop an affordable product that can be sold and appreciated by customers. Start-ups can use their technological base to attaining valuable knowledge from online sources and virtual communities. Lastly, companies under this category must try to enter the market early and use it as an advantage to start an aggressive expansion to be able to compete with other companies.

Finally, the analysis has revealed that incubators and accelerator programmes' attendance should be considered if the founder needs finance and to expand their network. Thus, start-ups located in the urban core increase their opportunity to form new alliances and to gain exposure to the market. On the other hand, entrepreneurs with experience and social capital should locate the company outside the main cities to avoid companies' operational expenses and competition.

8.4.2. Future Research on Knowledge Spillovers

This model is not restricted to high-tech start-ups. In this case, the development of projects in social endeavours, sustainability, or companies that implement solutions on a chain of value could implement these processes. The research has proven that the required technological base gap can be covered initially by hiring skilled human capital. Once the organisations have acquired the necessary human capital, entrepreneurs would be able to capture knowledge spillovers. The developed model could have been used to expand the understanding of knowledge spillovers and performance of start-ups.

There are types of unintentional knowledge spillovers on which start-ups are exposed through their entrepreneurial journey that has been assessed at the regional level (Hallin and Holmstro, 2012; Ritala et al., 2015). However, recent research started to evaluate unintentional knowledge spillovers at the individual level based on its potential absorption and implementation using factor analysis (Fallah, Howe and Ibrahim, 2004; Ding, Liu and Song, 2013; Ritala et al., 2015). Thus, future research could consider the evaluation of knowledge sharing in alliances but detailed on the exchange on project teams (Shu et al., 2014).

Research on knowledge spillovers could expand on the development of mediator constructs and overarching dimensions to understand knowledge spillovers' true nature. Studies have evaluated independent variables on econometric models to assess knowledge spillovers from suppliers, customers, competitors, public institutions, and industrial (Cassiman and Veugelers, 2002; Kaiser, 2002; Belderbos et al., 2004; Montoro-Sánchez et al., 2011; Hájek and Stejskal, 2018). There have been attempts to consider knowledge spillovers as a reflective factor for conducting confirmatory factor analysis (Blind and Mangelsdorf, 2013; Stejskal and Hajek, 2015; Hájek and Stejskal, 2018). Thus, future models could consider knowledge sharing or alternative constructs that could equally measure this phenomenon while not assessing absorptive capacity variables. Furthermore, this research has provided strong qualitative evidence to formulate new indispensable reflective constructs of customers knowledge spillovers, university knowledge spillovers, and knowledge spillovers in alliances. A new formulation of variables and questions could be tested using exploratory factor analysis.

The research has set the foundation on the identification and valuation of the business idea for early entrepreneurs. Future research should consider developing a reflective construct that evaluates how knowledge spillovers are used at the beginning of the entrepreneurial process. This research has provided initial qualitative evidence motivating entrepreneurs to break up the knowledge filter and start a company. This research alights with the effects of entrepreneurial ecosystems on entrepreneurs (Autio et al., 2018).

The more fundamental insight of the doctoral research lies in using virtual platforms as a space that can be used to share knowledge (Acs et al., 2017). Future research on start-ups can potentially include a reflective construct to assess the use of IT and ICTs towards product innovation. These processes focused on medium-tech start-ups can be pushed to link with studies on open innovation and reengineering. The research could potentially evaluate the use of Web 2.0 and 3.0 technologies on the implementation of knowledge towards product innovation and entrepreneurial ecosystems (Huang et al., 2014; Autio et al., 2018).

The research has provided a qualitative assessment of the importance of distance between the sources of knowledge and start-up's locations. This approach could take a step further by evaluating quantitatively the cluster of companies located in a city based on actual distances (Audretsch and Lehmann, 2017). Research has taken studies based on interviews with companies in industry clusters and economic indicators (Baptista and Mendonça, 2010; Connell et al., 2014). However, future research can be focused on the evaluation of high-tech start-ups.

The research has highlighted R&D expenditure was estimated to be from 30 to 50 per cent from the qualitative phase. However, it is recommended to include a variable that asks entrepreneurs an estimate in the budget they assigned to product innovation (Abubakar and Mitra, 2017; Hájek and Stejskal, 2018). The risk of asking entrepreneurs at this stage is that some companies would not have enough initial financing to think about investing. This assessment can also be conducted by evaluating the engineering skillset of human capital (Audretsch and Stephan, 2000a; Acosta, Coronado and Flores, 2011; Blind and Mangelsdorf, 2013).

The research has clearly stated how start-ups aim to become the leading companies in their respective industries. This insight has provided evidence of direct engagement on creative destruction (Agarwal et al., 2010). The transition is more robust when entrepreneurs begin to use international knowledge spillovers to expand to foreign countries (Hohberger, Almeida and Parada, 2015; Cantù, 2017). Thus, future research could examine the transition that entrepreneurs take into expanding the company into an SME through their aggressive expiation in the market.

Potential and realised absorptive capacity has been a proven and reliable construct that has been used on the assessment of SMEs performance and started the evaluation on start-ups (Zahra and George, 2002; Forés and Camisón, 2016; Dabic et al., 2019; Vlačić et al., 2019). The statistical evidence of PAC and EXI's direct effect on diversified companies have provided evidence of product development cycles on medium high-tech start-ups. In exploring this research, questions of absorptive capacity could be adapted in the model to consider the involvement of project teams.

The quantitative and quantitative data has proven start-ups engagement on the implementation of knowledge spillovers. In most cases, exploratory and exploitative innovation has proven to be adequate dependent constructs to assess the companies approach to develop revolutionary prototypes or to enhance the functionality of existing products (Enkel et al., 2017; Limaj and Bernroider, 2017; Su and Yang, 2018). The model has proven that high and medium technological star-ups take different approaches to engage in the market. The doctoral research also highlighted that entrepreneurs might continue to enhance prototypes through product development cycles. Thus, it is possible to extend deeper into this analysis by questioning if an exploratory innovation construct could be considered a mediator that serves as a channel to develop the first product. Once completed, the study can be extended to understand in detail how R&D project management teams implement existing technologies and methodologies.

The doctoral research provides critical findings that would support policymakers in establishing regulations that support the entrepreneurs. First, incubators' influence and accelerator programmes aim to facilitate the securement of funding and guide entrepreneurs on how to set their internal processes to run the company effectively (Mrkajic, 2017; Sedita et al. Thus, policies from the government should focus on establishing indicators to track down the performance and growth of companies (Sedita et al., 2017). Potential signs of growth should include the R&D allocated to support human capital and evaluate start-ups' involvement in the market. These evaluations have to consider the selection criteria to evaluate new ventures based on their technological activities. For example, biotechnology companies should be assessed on their participation in grants or research projects with universities. On the other hand, companies on computer programing evaluation rely on the number of companies involved in software development. Further evaluation of entrepreneurial activities should consider the expansion of new ventures to international markets.

8.5. Limitations

Like any research, none comes without its limitations. First, the quantitative assessment on knowledge spillovers had to be initially limited to the use of current surveys and research that identified compelling variables based on the sources of knowledge spillovers (Montoro-Sánchez et al., 2011; Amoroso, Audretsch and Link, 2017). However, research at the regional level lacked to evaluate the effects on knowledge spillovers directly and instead must determine the importance of this foundation for companies.

This research overcomes this limitation by conducting qualitative research that enabled insights into the potential mechanism and types of knowledge spillovers that may be involved during this process (Schmidt, 2015; Cantù, 2017; Hervas-Oliver, Lleo and Cervello, 2017). The literature and the qualitative discussion led to identifying incoming and network knowledge spillovers, and the evaluation on knowledge depth and breadth (Ferreras-Méndez et al., 2015; Ferreras-Méndez, Fernández-Mesa and Alegre, 2016; Limaj and Bernroider, 2017).

Due to the development of a new model, including formative constructs, the analysis had to be limited to use secure and proven measurements to secure the model's reliability and validity. The researcher could have taken risks and tested using EFA to develop new reflective constructs based on the data from the qualitative analysis. However, due to the limited time during the doctoral research and the intensity of implementing mixed methods, examining the tests of constructs will use this model as a base for future research. However, the present document has sufficed with a substantial collection of data from both the qualitative and quantitative phases to empirically test the contribution to the Knowledge Spillover Theory of Entrepreneurship.

Second, data collection on the qualitative analysis started to see differentiations on the forms of operation between start-ups in different industries. During the quantitative analysis, the gathering of data used the NACE list to classify the start-ups based on their economic activities (European Commision, 2008; Timmermans, 2009). However, the number of responses enabled the researcher to categorise the responses into high and medium technology companies and to conduct the structural equation modelling successfully. However, the qualitative data showed that biotechnology, medicine, or manufacturing companies would have their specific practices and deviate for other start-ups. Thus, the research has been able to generalise the findings for start-ups and might be missing detail on every one of these industries. Research limitations could be passed if the researcher has access to a larger pool of companies in a specific sector to narrow down the analysis.

Third, the researcher intended to research the perspective of entrepreneurs while undertaking incubators or accelerator programmes. However, this approach required to obtain full approval from the managers and organisers of these institutions. However, due to managers' lack of engagement from incubators and accelerator programmes, the researcher decided to interview entrepreneurs directly. This decision was supported by recognising that qualitative data also enables analysing events from the past (Dey, 2016). This change of sampling selection proved to increase the response rate for the qualitative and quantitative phases. Thus, the research reduced the depth of analysing the processes of support start-ups during these programmes but gained even more by uncovering what happens during the first ten years of the start-up's operations since funding.

Moreover, the qualitative analysis provided initial insights that start-ups at this stage may have been already expanding to foreign countries. Thus, the quantitative analysis wanted to test start-ups performance during the third phase of developing using control variables of ownership and market type (Kostopoulos et al., 2011; Abubakar and Mitra, 2017; Su and Yang, 2018). However, the statistical analysis did not show a difference between the samples of companies. Thus, it is recommended that quantitative research include a control variable that enables identifying which companies attended incubator programmes on the main cities that are considered entrepreneurial ecosystems; in this case, it would have been Greater London.

Bibliography

Abubakar, Y.A. and Mitra, J. (2017). *Knowledge spillovers and high-impact growth: Comparing local and foreign firms in the UK*. Available from https://doi.org/10.1007/s10843-016-0195-7.

Acosta, M., Coronado, D. and Flores, E. (2011). University Spillovers and New Business Location in High-Technology Sectors: Spanish Evidence. *Small Business Economics*, 36 (3), 365–376. Available from http://link.springer.com/journal/volumesAndIssues/11187.

Acs., Z.J. (2010). *The Knowledge Spillover Theory of Entrepreneurship*. International Library of Entrepreneurship series. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1154700&site=ehost-live&scope=site.

Ács, Z. et al. (2016). The missing link: knowledge diffusion and entrepreneurship in endogenous growth. *Global Entrepreneurship, Institutions and Incentives*, (December), 108–128. Available from https://doi.org/10.4337/9781784718053.00014.

Acs, Z.J. (2013). Jaffe-Feldman-Varga: The Search for Knowledge Spillovers. In: Zhang, T., and Stough, R.R., eds. *Universities, Knowledge Transfer and Regional Development: Geography, Entrepreneurship and Policy*. George Mason U: Hackensack, N.J. and Singapore: World Scientific, 36–56. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1496460&site=ehost-live&scope=site.

Acs, Z.J. and Audretsch, D.B. (2008). R&D, Firm Size and Innovative Activity. In: Acs, Z.J., ed. *Entrepreneurship, Growth and Public Policy: Prelude to a Knowledge Spillover Theory of Entrepreneurship*. George Mason U and Max Planck Institute of Economics: Cheltenham, U.K. and Northampton, Mass.: Elgar, 30–48. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1102204&site=ehost-live&scope=site.

Acs, Z.J. and Gifford, S. (2008). Innovation of Entrepreneurial Firms. In: Acs, Z.J., ed. *Entrepreneurship, Growth and Public Policy: Prelude to a Knowledge Spillover Theory of Entrepreneurship*. George Mason U and Max Planck Institute of Economics: Cheltenham, U.K. and Northampton, Mass.: Elgar, 49–64. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1102205&site=ehost-live&scope=site.

Acs, Z.J. et al. (2004). *The Missing Link: The Knowledge Filter and Entrepreneurship in Endogenous Growth*. Unlisted: C.E.P.R. Discussion Papers, CEPR Discussion Papers: 4783. Available from http://www.cepr.org/pubs/dps/DP4783.asp.

Acs, Z.J. et al. (2005). *The Knowledge Spillover Theory of Entrepreneurship*. Unlisted: C.E.P.R. Discussion Papers, CEPR Discussion Papers: 5326. Available from http://www.cepr.org/pubs/dps/DP5326.asp.

Acs, Z.J., Audretsch, D.B. and Feldman, M.P. (2008). R&D Spillovers and Recipient Firm Size. In: Acs, Z.J., ed. *Entrepreneurship, Growth and Public Policy: Prelude to a Knowledge Spillover Theory of Entrepreneurship*. George Mason U and Max Planck Institute of Economics: Cheltenham, U.K. and Northampton, Mass.: Elgar, 88–94. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1102208&site=ehost-live&scope=site.

Acs, Z.J., Audretsch, D.B. and Lehmann, E.E. (2009). The Knowledge Spillover Theory of Entrepreneurship. *Small Business Economics*, 32 (1), 15–30. Available from 10.1111/etap.12024.

Acs, Z.J. et al. (2009). The Knowledge Spillover Theory of Entrepreneurship. *Small Business Economics*, 32 (1), 15–30. Available from https://doi.org/10.1007/s11187-008-9157-3.

Acs, Z.J. et al. (2010). The Knowledge Spillover Theory of Entrepreneurship. In: Acs, Z.J., ed. *Entrepreneurship and Regional Development*. George Mason U: Elgar Reference Collection. International Library of Entrepreneurship, vol. 16. Northampton, Mass. and Cheltenham, U.K.: Elgar, 137–152. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1252069&site=eh

ost-live&scope=site.

Acs, Z.J. et al. (2012). The Knowledge Spillover Theory of Entrepreneurship. In: Henrekson, M., and Sanandaji, T., eds. *Institutional Entrepreneurship*. George Mason U: Elgar Research Collection. International Library of Entrepreneurship, vol. 24. Cheltenham, U.K. and Northampton, Mass.: Elgar, 137–152. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1396756&site=ehost-live&scope=site.

Acs, Z.J., Audretsch, D.B. and Lehmann, E.E. (2013). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, 41 (4), 757–774. Available from 10.1007/s11187-013-9505-9.

Acs, Z.J. et al. (2017). The lineages of the entrepreneurial ecosystem approach. *Small Business Economics*, 49 (1). Available from https://doi.org/10.1007/s11187-017-9864-8.

Adams, J. and Griliches, Z. (1996). Measuring science: An exploration. *Proceedings Of The National Academy Of Sciences Of The United States Of America*, 93 (23), 12664–12670. Available from https://doi.org/10.1073/pnas.93.23.12664.

Agarwal, R. and Braguinsky, S. (2015). Industry Evolution And Entrepreneurship: Steven Klepper's Contributions To Industrial Organization, Strategy, Technological Change, And Entrepreneurship. *Strategic Entrepreneurship Journal*, 9 (4), 380–397. Available from https://doi.org/10.1002/sej.1179.

Agarwal, R., Audretsch, D. and Sarkar, M.B. (2007). The Process Of Creative Construction: Knowledge Spillovers, Entrepreneurship, And Economic Growth. *Strategic Entrepreneurship Journal*, 1 (1), 263–286. Available from https://doi.org/10.1002/sej.

Agarwal, R. et al. (2010). Knowledge Spillovers and Strategic Entrepreneurship. *Strategic Entrepreneurship Journal*, 4 (4), 271–283. Available from https://doi.org/10.1002/sej.96.

Agarwal, R., Audretsch, D.B. and Sarkar, M.B. (2010). Knowledge Spillovers and Strategic Entrepreneurship. *Strategic Entrepreneurship Journal*, 4 (4), 271–283. Available from https://doi.org/10.1002/sej.

Agarwal, R., Audretsch, D. and Sarkar, M.B. (2010). Knowledge Spillovers And Strategic Entrepreneurship. *Strategic Entrepreneurship Journal*, 4 (4, SI), 271–283. Available from https://doi.org/10.1002/sej.96.

Agrawal, A., Cockburn, I. and Rosell, C. (2010). Not Invented Here? Innovation in company towns. *Journal Of Urban Economics*, 67 (1), 78–89. Available from https://doi.org/10.1016/j.jue.2009.10.004.

Ahn, J.M., Minshall, T. and Mortara, L. (2015). Open innovation: a new classification and its impact on firm performance in innovative SMEs. *Journal of Innovation Management*, 3 (2), 33. Available from https://doi.org/10.24840/2183-0606_003.002_0006.

Ali, M., Seny Kan, K.A. and Sarstedt, M. (2016). Direct and configurational paths of absorptive capacity and organizational innovation to successful organizational performance. *Journal of Business Research*, 69 (11), 5317–5323. Available from https://doi.org/10.1016/j.jbusres.2016.04.131.

Amoroso, S., Audretsch, D.B. and Link, A.N. (2017). Sources of knowledge used by entrepreneurial firms in the European high-tech sector. *Eurasian Business Review*, 1–16. Available from https://doi.org/10.1007/s40821-017-0078-4.

Andersson, M. and LooF, H. (2012). Small business innovation: firm level evidence from Sweden. *Journal Of Technology Transfer*, 37 (5), 732–754. Available from https://doi.org/10.1007/s10961-011-9216-9.

Armington, C. and Acs, Z.J. (2002). The Determinants of Regional Variation in New Firm Formation. *Regional Studies. Journal of the Regional Studies Association*, 36; Jg. 20 (1), 33–47. Available from https://doi.org/10.1080/00343400120099843.

Arrow, K.J. (1972). Economic Welfare and the Allocation of Resources for Invention. *Readings in Industrial Economics*, 219–236. Available from https://doi.org/10.1007/978-1-349-15486-9_13.

Assenza, P. (2015). If You Build It Will They Come? The Influence of Spatial Configuration on Social and Cognitive Functioning and Knowledge Spillover in Entrepreneurial Co-Working and Hacker Spaces. *Journal of Management Policy and Practice*, 16 (3), 35–48. Available from http://www.na-businesspress.com/JMPP/AssenzaP_Web16_3_.pdf.

Audretsch, D. and Caiazza, R. (2016). Technology transfer and entrepreneurship: cross-national analysis. *Journal Of Technology Transfer*, 41 (6), 1247–1259. Available from https://doi.org/10.1007/s10961-015-9441-8.

Audretsch, D. and Link, A. (2017). Embracing an Entrepreneurial Ecosystem: An Analysis of the Governance of Research Joint Ventures. *UNCG Economics Working Papers*, (August). Available from https://ideas.repec.org/p/ris/uncgec/2017_011.html.

Audretsch, D., Dohse, D. and Niebuhr, A. (2010). Cultural diversity and entrepreneurship: a regional analysis for Germany. *Annals of Regional Science*, 45 (1), 55–85. Available from 10.1007/s00168-009-0291-x.

Audretsch, D., Sanders, M. and Zhang, L. (2017). International product life cycles, trade and development stages. *The Journal of Technology Transfer*. Available from https://doi.org/10.1007/s10961-017-9588-6.

Audretsch, D.B. (2002). The dynamic role of small firms: Evidence from the U.S. *Small Business Economics*, 18 (1–3), 13–40. Available from https://doi.org/10.1023/A:1015105222884.

Audretsch, D.B. (2006). The Knowledge Spillover Theory of Entrepreneurship and Economic Growth. In: Audretsch, D.B., ed. *The Emergence of Entrepreneurial Economics*. Max Planck Institute of Economics and IN U: Cheltenham, U.K. and Northampton, Mass.:, 37–54. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=0951605&site=ehost-live&scope=site.

Audretsch, D.B. and Belitski, M. (2017). Entrepreneurial ecosystems in cities: establishing the framework conditions. *Journal of Technology Transfer*, 42 (5), 1030–1051. Available from https://doi.org/10.1007/s10961-016-9473-8.

Audretsch, D.B. and Belitski, M. (2019). The Limits to Collaboration Across Four of the Most Innovative UK Industries. *British Journal of Management*, 00, 1–26. Available from https://doi.org/10.1111/1467-8551.12353.

Audretsch, D.B. and Keilbach, M. (2007a). The localisation of entrepreneurship capital: Evidence from Germany. *Papers in Regional Science*, 86 (3), 351–365. Available from 10.1111/j.1435-5957.2007.00131.x.

Audretsch, D.B. and Keilbach, M. (2007b). The theory of knowledge spillover entrepreneurship. *Journal of Management Studies*, 44 (7), 1242–1254. Available from https://doi.org/10.1111/j.1467-6486.2007.00722.x.

Audretsch, D.B. and Keilbach, M. (2008). Resolving the knowledge paradox: Knowledge-spillover entrepreneurship and economic growth. *Research Policy*, 37 (10), 1697–1705. Available from https://doi.org/10.1016/j.respol.2008.08.008.

Audretsch, D.B. and Lehmann, E. (2006). Entrepreneurial Access and Absorption of Knowledge Spillovers: Strategic Board and Managerial Composition for Competitive Advantage. *Journal of Small Business Management*, 44 (2), 155–166. Available from https://doi.org/10.1111/j.1540-627X.2006.00161.x.

Audretsch, D.B. and Lehmann, E.E. (2005). Does the Knowledge Spillover Theory of Entrepreneurship hold for regions? *Research Policy*, 34 (8), 1191–1202. Available from https://doi.org/10.1016/j.respol.2005.03.012.

Audretsch, D.B. and Lehmann, E.E. (2010). Does the Knowledge Spillover Theory of Entrepreneurship Hold for Regions? In: Acs, Z.J., ed. *Entrepreneurship and Regional Development*. Unlisted: Elgar Reference Collection. International Library of Entrepreneurship, vol. 16. Northampton, Mass. and Cheltenham, U.K.: Elgar, 433–444. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1252082&site=eh

ost-live&scope=site.

Audretsch, D.B. and Lehmann, E.E. (2017). *The knowledge spillover theory of entrepreneurship and the strategic management of places*. Available from https://doi.org/10.1002/9781118970812.

Audretsch, D.B. and Stephan, P.E. (1999). Knowledge spillovers in biotechnology: sources and incentives. *Journal Of Evolutionary Economics*, 9 (1), 97–107. Available from https://doi.org/10.1007/s001910050076.

Audretsch, D.B. and Stephan, P.E. (2000a). Knowledge spillovers in biotechnology: sources and incentives. In: Cantner, U and Hanusch, H and Klepper, S, ed. *Economic Evolution, Learning, And Complexity*. 2000. TIERGARTENSTR 17, D-69121 HEIDELBERG, GERMANY: PHYSICA-VERLAG GMBH & CO, 127–137.

Audretsch, D.B. and Stephan, P.E. (2000b). Knowledge spillovers in biotechnology: sources and incentives. *Journal Of Evolutionary Economics*, 9 (1), 127–137. Available from https://doi.org/10.1007/s001910050076.

Audretsch, D.B. and Stephan, P.E. (2006). Knowledge Spillovers in Biotechnology: Sources and Incentives. In: Audretsch, D.B., ed. *Entrepreneurship, Innovation and Economic Growth*. Max Planck Institute of Economics and IN U: Cheltenham, U.K. and Northampton, Mass.:, 70–80. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=0951604&site=ehost-live&scope=site.

Audretsch, D.B. and Vivarelli, M. (1996). Firms size and R&D spillovers: Evidence from Italy. *Small Business Economics*, 8 (3), 249–258. Available from https://doi.org/10.1007/BF00388651.

Audretsch, D.B., Lehmann, E.E. and Warning, S. (2005). University spillovers and new firm location. *Research Policy*, 34 (7), 1113–1122. Available from 10.1016/j.respol.2005.05.009.

Audretsch, D.B., Keilbach, M. and Lehmann, E. (2006). The Knowledge Spillover Theory of Entrepreneurship and Economic Growth. *Economia e Politica Industriale*, 33 (3), 25–45. Available from http://www.francoangeli.it/riviste/sommario.asp?IDRivista=13.

Audretsch, D.B., Dohse, D. and Niebuhr, A. (2008). *Cultural Diversity and Entrepreneurship: A Regional Analysis for Germany*. Unlisted: C.E.P.R. Discussion Papers, CEPR Discussion Papers: 6945. Available from http://www.cepr.org/pubs/dps/DP6945.asp.

Audretsch, D.B., Huelsbeck, M. and Lehmann, E.E. (2012). Regional competitiveness, university spillovers, and entrepreneurial activity. *Small Business Economics*, 39 (3, SI), 587–601. Available from https://doi.org/10.1007/s11187-011-9332-9.

Audretsch, D.B., Belitski, M. and Desai, S. (2015). Entrepreneurship and economic development in cities. *Annals of Regional Science*, 55 (1), 33–60. Available from https://doi.org/10.1007/s00168-015-0685-x.

Audretsch, D.B., Kuratko, D.F. and Link, A.N. (2015). Making sense of the elusive paradigm of entrepreneurship. *Small Business Economics*, 45 (4), 703–712. Available from https://doi.org/10.1007/s11187-015-9663-z.

Audretsch, D.B. et al. (2018). Entrepreneurial ecosystems: economic, technological, and societal impacts. *Journal of Technology Transfer*, 44 (2), 313–325. Available from https://doi.org/10.1007/s10961-018-9690-4.

Autio, E. et al. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12 (1), 72–95. Available from https://doi.org/10.1002/sej.1266.

Avnimelech, G. and Schwartz, D. (2009). Structural changes in mature Venture Capital industry: Evidence from Israel. *Innovation: Management, Policy and Practice*, 11 (1), 60. Available from https://doi.org/10.5172/impp.453.11.1.60.

Azad, N. and Ahmadi, F. (2015). The customer relationship management process: its measurement and impact on performance. *Uncertain Supply Chain Management*, 3 (1), 43–50. Available from https://doi.org/10.5267/j.uscm.2014.9.002.

Backman, M. and Loof, H. (2015). The geography of innovation and entrepreneurship. *Annals Of Regional Science*, 55 (1), 1–6. Available from https://doi.org/10.1007/s00168-015-0713-x.

Bandera, C., Bartolacci, M.R. and Passerini, K. (2016). Knowledge Management and Entrepreneurship: *International Journal of Knowledge Management*, 12 (3), 1–14. Available from https://doi.org/10.4018/IJKM.2016070101.

Baptista, R. and Mendonça, J. (2010). Proximity to knowledge sources and the location of knowledge-based start-ups. *The Annals of Regional Science*, 45 (1), 5–29. Available from https://doi.org/10.1007/s00168-009-0289-4.

Barrett, P. (2007). Structural equation modelling: Adjudging model fit. *Personality and Individual Differences*, 42 (5), 815–824. Available from https://doi.org/10.1016/j.paid.2006.09.018.

Bazeley, P. (2014). *Qualitative data analysis : practical strategies*, Repr. Los Angeles: Sage Publications. Available from https://www.worldcat.org/title/qualitative-data-analysis-practical-strategies/oclc/903371750&referer=brief_results#.WurePHtb2CM.mendeley [Accessed 29 September 2017].

Becker, J.M., Klein, K. and Wetzels, M. (2012). Hierarchical Latent Variable Models in PLS-SEM: Guidelines for Using Reflective-Formative Type Models. *Long Range Planning*, 45 (5–6), 359–394. Available from https://doi.org/10.1016/j.lrp.2012.10.001.

Becker, J.M. et al. (2013). Discovering unobserved heterogeneity in structural equation models to avert validity threats. *MIS Quarterly: Management Information Systems*, 37 (3), 665–694. Available from https://doi.org/10.25300/MISQ/2013/37.3.01.

Belderbos, René; Carree, Martin; Lokshin, N. (2004). Belderbos-Cooperative R&D and firm performance. 1477–1492.

Belderbos, R. et al. (2004). Heterogeneity in R&D cooperation strategies. *International Journal of Industrial Organization*, 22 (8–9), 1237–1263. Available from https://doi.org/10.1016/j.ijindorg.2004.08.001.

Belderbos, R. et al. (2018). The antecedents of new R&D collaborations with different partner types: On the dynamics of past R&D collaboration and innovative performance. *Long Range Planning*, 51 (2), 285–302. Available from https://doi.org/10.1016/j.lrp.2017.10.002.

Bengtsson, L. et al. (2015). Open to a Select Few? Matching Partners and Knowledge Content for Open Innovation Performance. *Creativity and Innovation Management*, 24 (1), 72–86. Available from https://doi.org/10.1111/caim.12098.

Benitez, J. et al. (2020). How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research. *Information and Management*, 57 (2), 103168. Available from https://doi.org/10.1016/j.im.2019.05.003.

Bentahar, O. and Cameron, R. (2015). Design and implementation of a mixed method research study in project management. *Electronic Journal Of Business Research Methods*, 13 (1), 3–15. Available from http://web.a.ebscohost.com.ezp.waldenulibrary.org/ehost/search/advanced?sid=2d567c58-d245-4b74-bf4c-285a67f1d8fa@sessionmgr4003&vid=19&hid=4214.

Bentler, P.M. and Hu, L. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, 3 (4), 424–453.

Beugelsdijk, S. (2007). The Regional Environment and a Firm ' s Innovative Performance : A Plea ... *Economic Geography*.

Beugelsdijk, S. and Mudambi, R. (2013). MNEs as border-crossing multi-location enterprises: The role of discontinuities in geographic space. *Journal Of International Business Studies*, 44 (5, SI), 413–426. Available from https://doi.org/10.1057/jibs.2013.23.

Bickman, L. and Rog, D. (2009). *The SAGE Handbook of Applied Social Research Methods*. 2455 Teller Road, Thousand Oaks California 91320 United States : SAGE Publications, Inc. Available from https://doi.org/10.4135/9781483348858 [Accessed 23 May 2018].

Blessing, L.T.M. and Chakrabarti, A. (2009). *DRM, a Design Research Methodology*. Available from https://doi.org/10.1007/978-1-84882-587-1.

Blind, K. and Mangelsdorf, A. (2013). Alliance formation of smes: Empirical evidence from standardization committees. *IEEE Transactions on Engineering Management*, 60 (1), 148–156. Available from https://doi.org/10.1109/TEM.2012.2192935.

Blumberg, B., Cooper, D. and Schindler, P. (2014). *Business research methods*. London: McGraw-Hill Education.

Blunch, N. (2013). *Introduction to structural equation modeling using IBM SPSS statistics and AMOS*, 2. ed. London: SAGE. Available from https://www.worldcat.org/title/introduction-to-structural-equation-modeling-using-ibm-spss-statistics-and-amos/oclc/835397646&referer=brief_results#.XNbQx4o9ENU.mendeley [Accessed 11 May 2019].

Booth, A., Diana, P. and Sutton, A. (2012). *Systematic approaches to a successful literature review*.

Bouncken, R.B. and Kraus, S. (2013). Innovation in knowledge-intensive industries: The double-edged sword of coopetition. *Journal of Business Research*, 66 (10), 2060–2070. Available from https://doi.org/10.1016/j.jbusres.2013.02.032.

Braunerhjelm, P. et al. (2010). The missing link: knowledge diffusion and entrepreneurship in endogenous growth. *Small Business Economics*, 34 (2), 105–125. Available from 10.1007/s11187-009-9235-1.

Breugst, N., Patzelt, H. and Rathgeber, P. (2015). Journal of Business Venturing How should we divide the pie ? Equity distribution and its impact on entrepreneurial teams ☆. *Journal of Business Venturing*, 30 (1), 66–94. Available from https://doi.org/10.1016/j.jbusvent.2014.07.006.

Brinckmann, J., Salomo, S. and Gemuenden, H.G. (2011). Financial Management Competence of Founding Teams and Growth of New Technology-Based Firms. *Entrepreneurship: Theory and Practice*, 35 (2), 217–243. Available from https://doi.org/10.1111/j.1540-6520.2009.00362.x.

Brown, T.A. (2015). *Confirmatory factor analysis for applied research*, Second edition. New York ;;London: The Guilford Press. Available from https://www.worldcat.org/title/confirmatory-factor-analysis-for-applied-research/oclc/926256050&referer=brief_results#.Xtj_dmkcmJw.mendeley [Accessed 4 June 2020].

Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? *Qualitative Research*, 6 (1), 97–113. Available from https://doi.org/10.1177/1468794106058877.

Bryman, A. and Bell, E. (2015). Business Research Methods.

Buchanan, D. and Bryman, A. (2009). *The SAGE handbook of organizational research methods*. Los Angeles: SAGE.

Burke, J.R. and Onwuegbuzie, A.J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33 (7), 14–26. Available from https://doi.org/10.3102/0013189X033007014.

Burns, R.B. (Robert B. (2000). *Introduction to research methods*, 4th ed. Thousand Oaks Ca: SAGE. Available from https://www.worldcat.org/title/introduction-to-research-methods/oclc/300934469&referer=brief_results#.WuluLIALYLA.mendeley [Accessed 2 May 2018].

Byrne, B.M. (2008). Testing for multigroup equivalence of a measuring instrument: A walk through the process. *Psicothema*, 20 (4), 872–882.

Calantone, R. and Rubera, G. (2012). When should RD&E and marketing collaborate? The moderating role of exploration exploitation and environmental uncertainty. *Journal of Product Innovation Management*, 29 (1), 144–157. Available from https://doi.org/10.1111/j.1540-5885.2011.00884.x.

Calcagnini, G. et al. (2016). The role of universities in the location of innovative start-ups. *Journal of technology transfer*, 41 (4), 670–693. Available from https://doi.org/10.1007/s10961-015-9396-9.

Caliendo, M., Künn, S. and Weissenberger, M. (2020). Catching up or lagging behind? The long-term business and innovation potential of subsidized start-ups out of unemployment. *Research Policy*, 49 (10), 104053. Available from https://doi.org/10.1016/j.respol.2020.104053.

Camisón, C. and Forés, B. (2010). Knowledge absorptive capacity: New insights for its conceptualization and measurement. *Journal of Business Research*, 63 (7), 707–715. Available from https://doi.org/10.1016/j.jbusres.2009.04.022.

Cantù, C. (2017). Entrepreneurial knowledge spillovers discovering opportunities through understanding mediated spatial relationships. *Industrial Marketing Management*, 61, 30–42. Available from https://doi.org/10.1016/j.indmarman.2016.07.002.

Cassiman, B. and Veugelers, R. (2002). R&D cooperation and spillovers: Some empirical evidence from Belgium. *American Economic Review*, 92 (4), 1169–1184. Available from https://doi.org/10.1257/00028280260344704.

Castro Soeiro, F. et al. (2016). Network-based innovation: the case for mobile gaming and digital music. *European Business Review*, 28 (2), 155–175. Available from https://doi.org/10.1108/EBR-07-2015-0072.

Castro Soeiro, F., Santos, M. and Alves, J. (2016). Network-based innovation: the case for mobile gaming and digital music. *European Business Review*, 28 (2), 155. Available from https://doi.org/10.1108/EBR-07-2015-0072.

Chakraborty, N. (2012). Activities and Reasons for Using Social Networking Sites by Research Scholars in NEHU : A Study on Facebook and ResearchGate. *Planner-2012*, 19–27.

Chaudhary, S. and Batra, S. (2018). Absorptive capacity and small family firm performance: exploring the mediation processes. *Journal of Knowledge Management*, 22 (6), 1201–1216. Available from https://doi.org/10.1108/JKM-01-2017-0047.

Chen, I.-F. and Chang, S.-C. (2016). The intra business group effects of alliance network extensions. *Management Decision*, 54 (6), 1420–1442. Available from https://doi.org/10.1108/MD-06-2015-0223.

Chen, J., Chen, Y. and Vanhaverbeke, W. (2011). The influence of scope, depth, and orientation of external technology sources on the innovative performance of Chinese firms. *Technovation*, 31 (8), 362–373. Available from https://doi.org/10.1016/j.technovation.2011.03.002.

Cheng, S. and Li, H. (2012). New firm formation facing cultural and racial diversity. *Papers in regional science*, 91 (4), 759+. Available from https://doi.org/10.1111/j.1435-5957.2011.00404.x.

Chun Sung-bae; Mun, H. (2012). Determinants of R & D cooperation in small and medium-sized enterprises. *Small Business Economics*, 419–436. Available from https://doi.org/10.1007/s11187-010-9312-5.

Clarysse, B. et al. (2005). Spinning out new ventures : a typology of incubation strategies from European research institutions. *Journal of Business Venturing*, 20 (2), 183–216. Available from https://doi.org/10.1016/j.jbusvent.2003.12.004.

Cockburn, I.M. (2004). The Changing Structure Of The Pharmaceutical Industry. *The American Economic Review*, 1 (1), 10–22. Available from https://doi.org/10.1377/hlthaff.23.1.10.

Cohen, S.L. et al. (2017). Why are Some Accelerators More Effective ? Bounded Rationality and Venture Development tin. *Academy of Management Annual Meeting Proceedings*.

Cohen, W.M. and Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35 (1), 128. Available from https://doi.org/10.2307/2393553.

Collins, K.M.T., Onwuegbuzie, A.J. and Johnson, R.B. (2012). Securing a Place at the Table: A Review and Extension of Legitimation Criteria for the Conduct of Mixed Research. *American Behavioral Scientist*, 56 (6), 849–865. Available from https://doi.org/10.1177/0002764211433799.

Collis, J. and Hussey, R. (2014). *Business research : a practical guide for undergraduate & postgraduate students*.

Colombelli, A. (2016). The impact of local knowledge bases on the creation of innovative start-ups in Italy. *Small Business Economics*, 47 (2), 383–396. Available from https://doi.org/10.1007/s11187-016-9722-0.

Colombo, M.G. and Piva, E. (2020). Start-ups launched by recent STEM university graduates: The impact of university education on entrepreneurial entry. *Research Policy*, 49 (6), 103993. Available from https://doi.org/10.1016/j.respol.2020.103993.

Connell, J. et al. (2014). Industry clusters: an antidote for knowledge sharing and collaborative innovation? *Journal of Knowledge Management*, 18 (1), 137–151. Available from https://doi.org/10.1108/JKM-08-2013-0312.

Connell, J., Kriz, A. and Thorpe, M. (2014). Industry clusters: an antidote for knowledge sharing and collaborative innovation? *Journal of Knowledge Management*, 18 (1), 137–151. Available from https://doi.org/10.1108/JKM-08-2013-0312.

Cook, D., Mulrow, C. and Haynes, R.B. (1997). Synthesis of best evidence for clinical decisions. *Annals of Internal Medicine*, 126, 376–380. Available from https://doi.org/10.7326/0003-4819-126-5-199703010-00006.

Costello, A.B. and Osborne, J.W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research and Evaluation*, 10 (7).

Coxon, Matthew; Kelly, Nathan; Page, S. (2016). Rigour in Research: Theory in the Research Approach. *Virtual Reality*, 20 (4), 203–212. Available from https://doi.org/10.1080/14767333.2013.821968.

Creswell, J. (2012). *Research Design, 3rd Ed. + Qualitative Research Design, 3rd. Ed. + Action Research, 3rd Ed.*, 3rd ed. Sage Pubns.

Creswell, J.W. (2014). *Research design : qualitative, quantitative, and mixed methods approaches*, 4th ed. Los Angeles: SAGE Publications. Available from http://www.worldcat.org/title/research-design-qualitative-quantitative-and-mixed-methods-approaches/oclc/897980962&referer=brief_results#.WWc-jRu3uIM.mendeley [Accessed 13 July 2017].

Creswell, J.W. and Plano Clark, V.L. (2018). *Designing and conducting mixed methods research*. Available from https://www.worldcat.org/title/designing-and-conducting-mixed-methods-research/oclc/1021373803&referer=brief_results#.WuiaR99B280.mendeley [Accessed 1 May 2018].

Cui, T. et al. (2015). Information technology and open innovation: A strategic alignment perspective. *Information and Management*, 52 (3), 348–358. Available from https://doi.org/10.1016/j.im.2014.12.005.

Curry, L.A., Nembhard, I.M. and Bradley, E.H. (2009). Qualitative and mixed methods provide unique contributions to outcomes research. *Circulation*, 119 (10), 1442–1452. Available from https://doi.org/10.1161/CIRCULATIONAHA.107.742775.

Da Rin, M. and Penas, M.F. (2017). Venture capital and innovation strategies. *Industrial and Corporate Change*, 26 (5), 781–800. Available from https://doi.org/10.1093/icc/dtw052.

Dabic, M. et al. (2019). Evolving Absorptive Capacity: The Mediating Role of Systematic Knowledge Management. *IEEE Transactions on Engineering Management*, 1–11. Available from https://doi.org/10.1109/tem.2019.2893133.

Dasgupta, N. (1990). Petty-trading in Calcutta: A socio-political analysis of a third world city. *PQDT - UK & Ireland*. Available from https://search.proquest.com/docview/301556934?accountid=14987.

De Clercq, D., Hessels, J. and Van Stel, A. (2008). Knowledge spillovers and new ventures' export orientation. *Small Business Economics*, 31 (3), 283–303. Available from 10.1007/s11187-008-9132-z.

De Faria, P., Lima, F. and Santos, R. (2010). Cooperation in innovation activities: The importance of partners. *Research Policy*, 39 (8), 1082–1092. Available from https://doi.org/10.1016/j.respol.2010.05.003.

De Figueiredo, R.J.P., Meyer-Doyle, P. and Rawley, E. (2013). Inherited Agglomeration Effects in Hedge Fund Spawns. *Strategic Management Journal*, 34 (7), 843–862. Available from https://doi.org/10.1002/smj.

de Jong, J.P.J. and Marsili, O. (2015). The distribution of Schumpeterian and Kirznerian opportunities. *Small Business Economics*, 44 (1), 19–35. Available from https://doi.org/10.1007/s11187-014-9585-1.

Debrulle, J., Maes, J. and Sels, L. (2014). Start-up absorptive capacity: Does the owner's human and social capital matter? *International Small Business Journal: Researching Entrepreneurship*, 32 (7), 777–801. Available from https://doi.org/10.1177/0266242612475103.

Del Giudice, M., Carayannis, E.G. and Maggioni, V. (2017). Global knowledge intensive enterprises and international technology transfer: emerging perspectives from a quadruple helix environment. *Journal of Technology Transfer*, 42 (2), 229–235. Available from https://doi.org/10.1007/s10961-016-9496-1.

Denzin, N. (2005). *The SAGE handbook of qualitative research*, 3. ed. Thousand Oaks Calif.: Sage Publications. Available from https://www.worldcat.org/title/sage-handbook-of-qualitative-research/oclc/466791018&referer=brief_results#.W5E_JM72sz8.mendeley [Accessed 6 September 2018].

Denzin, N.K. and Lincoln, Y.S. (2018). *The Sage handbook of qualitative research*, Fifth edition. Available from https://www.worldcat.org/title/sage-handbook-of-qualitative-research/oclc/953441930&referer=brief_results#.WwPnh-oUaD0.mendeley [Accessed 22 May 2018].

Desrochers, P. (2001). Local Diversity, Human Creativity, and Technological Innovation. *Growth and Change*, 32 (3), 369–394. Available from https://doi.org/10.1111/0017-

4815.00164.

Desrochers, P. (2005). Entrepreneurial Geographies : Support Networks in Three High-Technology Industries. *Economic Geography*, 81 (2), 201–228.

Desrochers, P., Kenney, M. and Patton, D. (2009). Entrepreneurial Geographies: Support Networks in Three High-Technology Industries. *Economic Geography*, 81 (2), 201–228. Available from https://doi.org/10.1111/j.1944-8287.2005.tb00265.x.

Dey, I. (2016). *Qualitative data analysis : a user friendly guide for social scientists.* [Place of publication not identified]: Routledge. Available from https://www.worldcat.org/title/qualitative-data-analysis-a-user-friendly-guide-for-social-scientists/oclc/949987340&referer=brief_results#.WvlfHhGByQU.mendeley [Accessed 14 May 2018].

Ding, X., Liu, H. and Song, Y. (2013). Are internal knowledge transfer strategies. (August 2015). Available from https://doi.org/10.1108/13673271311300769.

Division, S. (2011). ISIC REV . 3 Technology Intensity Definition. Available from https://doi.org/10.1787/sti.

Doloreux, D. (2004). Regional innovation systems in Canada: A comparative study. *Regional Studies*, 38 (5), 481–494. Available from https://doi.org/10.1080/0143116042000229267.

Doyle, I.M.P. et al. (2012). (12) UnIted States Patent. 2 (12). Available from https://doi.org/10.1126/science.Liquids.

Doyle, L., Brady, A.M. and Byrne, G. (2009). An overview of mixed methods research. *Journal of Research in Nursing*, 14 (2), 175–185. Available from https://doi.org/10.1177/1744987108093962.

Duan, L., Nasri, F. and Paknejad, J. (2018). A data-driven method for rating management information systems journals in the same scale of the Association of Business Schools Journal Guide. *Expert Systems*, 35 (6), 1–12. Available from https://doi.org/10.1111/exsy.12309.

Dyerson, R. and Pilkington, A. (2005). Gales of creative destruction and the opportunistic incumbent: The case of electric vehicles in California. *Technology Analysis & Strategic Management*, 17 (4), 391–408. Available from https://doi.org/10.1080/09537320500357160.

E. Porter, M. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, 14 (1), 15–34. Available from https://doi.org/10.1177/089124240001400105.

Eisenhardt, K.M. (2016). Building Theories from Case Study Research Published by : Academy of Management Stable URL : http://www.jstor.org/stable/258557 Linked references are available on JSTOR for this article : Building Theories from Case Study Research. 14 (4), 532–550.

Ellison, B.G., Glaeser, E.L. and Kerr, W.R. (2010). What Causes Industry Agglomeration ? Evidence from Coagglomeration Patterns. *The American Economic Review*, 100 (June), 1195–1213.

Enkel, E. et al. (2017). Exploratory and exploitative innovation: To what extent do the dimensions of individual level absorptive capacity contribute? *Technovation*, 60–61 (August 2016), 29–38. Available from https://doi.org/10.1016/j.technovation.2016.08.002.

European Commision. (2008). *ISIC REV. 3 TECHNOLOGY INTENSITY DEFINITION Classification of manufacturing industries into categories based on R&D intensities*. Available from https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF.

Eveleens, C.P., van Rijnsoever, F.J. and Niesten, E.M.M.I. (2017). *How network-based incubation helps start-up performance: a systematic review against the background of management theories*. Springer US. Available from https://doi.org/10.1007/s10961-016-9510-7.

Expósito-Langa, M., Molina-Morales, F.X. and Tomás-Miquel, J.V. (2015). How shared vision moderates the effects of absorptive capacity and networking on clustered firms’ innovation. *Scandinavian Journal of Management*, 31 (3), 293–302. Available from https://doi.org/10.1016/j.scaman.2015.06.001.

Fallah, M., Howe, J. and Ibrahim, S.E. (2004). Knowledge spillover and innovation in technological clusters. (November 2014).

Ferenhof, H.A. (2016). Recognizing Knowledge Leakage and Knowledge Spillover and Their Consequences. *International Journal of Knowledge and Systems Science*, 7 (3), 46–58. Available from https://doi.org/10.4018/IJKSS.2016070104.

Ferenhof, H.A. et al. (2016). Recognizing Knowledge Leakage and Knowledge Spillover and Their Consequences. *International Journal of Knowledge and Systems Science*, 7 (3), 46–58. Available from https://doi.org/10.4018/IJKSS.2016070104.

Ferreras-Méndez, J.L. et al. (2015). Depth and breadth of external knowledge search and performance: The mediating role of absorptive capacity. *Industrial Marketing Management*, 47, 86–97. Available from https://doi.org/10.1016/j.indmarman.2015.02.038.

Ferreras-Méndez, J.L., Fernández-Mesa, A. and Alegre, J. (2016). The relationship between knowledge search strategies and absorptive capacity: A deeper look. *Technovation*, 54, 48–61. Available from https://doi.org/10.1016/j.technovation.2016.03.001.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics*, 5th edition. Available from https://www.worldcat.org/title/discovering-statistics-using-ibm-spss-statistics/oclc/1019445490&referer=brief_results#.XNbRbiaOkXI.mendeley [Accessed 11 May 2019].

Field, A.P. (2018). *Discovering statistics using IBM SPSS statistics*.

Flatten, T.C. et al. (2011). A measure of absorptive capacity: Scale development and validation. *European Management Journal*, 29 (2), 98–116. Available from https://doi.org/10.1016/j.emj.2010.11.002.

Flor, M.L., Cooper, S.Y. and Oltra, M.J. (2018). External knowledge search, absorptive capacity and radical innovation in high-technology firms. *European Management*

Journal, 36 (2), 183–194. Available from https://doi.org/10.1016/j.emj.2017.08.003.

Forés, B. and Camisón, C. (2016). Does incremental and radical innovation performance depend on different types of knowledge accumulation capabilities and organizational size? *Journal of Business Research*, 69 (2), 831–848. Available from https://doi.org/10.1016/j.jbusres.2015.07.006.

Foss, N.J., Lyngsie, J. and Zahra, S.A. (2013). The Role of External Knowledge Sources and Organizational Design in The Process of Opportunity Exploitation. *Strategic Management Journal*, 34 (12), 1453–1471. Available from https://doi.org/10.1002/smj.

Frederiksen, L., Wennberg, K. and Balachandran, C. (2016). Mobility and Entrepreneurship: Evaluating the Scope of Knowledge-Based Theories of Entrepreneurship. *Entrepreneurship: Theory and Practice*, 40 (2), 359–380. Available from https://doi.org/10.1111/etap.12223.

Fritsch, M. and Changoluisa, J. (2017). New business formation and the productivity of manufacturing incumbents: Effects and mechanisms. *Journal of Business Venturing*, 32 (3), 237–259. Available from https://doi.org/10.1016/j.jbusvent.2017.01.004.

Ganotakis, P. and Love, J.H. (2012). The Innovation Value Chain in New Technology-Based Firms: Evidence from the UK. *Journal Of Product Innovation Management*, 29 (5), 839–860. Available from https://doi.org/10.1111/j.1540-5885.2012.00938.x.

García-Sánchez, E., García-Morales, V.J. and Martín-Rojas, R. (2018). Analysis of the influence of the environment, stakeholder integration capability, absorptive capacity, and technological skills on organizational performance through corporate entrepreneurship. *International Entrepreneurship and Management Journal*, 14 (2), 345–377. Available from https://doi.org/10.1007/s11365-017-0436-9.

Gebauer, H., Worch, H. and Truffer, B. (2012). Absorptive capacity, learning processes and combinative capabilities as determinants of strategic innovation. *European Management Journal*, 30 (1), 57–73. Available from https://doi.org/10.1016/j.emj.2011.10.004.

Ghio, N., Guerini, M., Lehmann, E.E., et al. (2015). The emergence of the knowledge spillover theory of entrepreneurship. *Small Business Economics*, 44 (1), 1–18. Available from https://doi.org/10.1007/s11187-014-9588-y.

Ghio, N., Guerini, M., Lehmann, E., et al. (2015). The emergence of the knowledge spillover theory of entrepreneurship. *Small Business Economics*, 44 (1), 1–18. Available from 10.1007/s11187-014-9588-y.

Ghio, N., Guerini, M. and Rossi-Lamastra, C. (2016). University knowledge and the creation of innovative start-ups: an analysis of the Italian case. *Small Business Economics*, 47 (2), 293–311. Available from https://doi.org/10.1007/s11187-016-9720-2.

Ghio, N., Guerini, M. and Rossi-Lamastra, C. (2019). The creation of high-tech ventures in entrepreneurial ecosystems: exploring the interactions among university knowledge, cooperative banks, and individual attitudes. *Small Business Economics*, 52 (2), 523–543. Available from https://doi.org/10.1007/s11187-017-9958-3.

Gimenez-Fernandez, E.M., Sandulli, F.D. and Bogers, M. (2020). Unpacking liabilities of newness and smallness in innovative start-ups: Investigating the differences in innovation performance between new and older small firms. *Research Policy*, 49 (10), 104049. Available from https://doi.org/10.1016/j.respol.2020.104049.

Glaeser, E.L. and Kerr, W.R. (2009). Local Industrial Conditions and Entrepreneurship : How Much of the Spatial Distribution Can We Explain ? *Journal of Economic Behavior & Strategic Management*, 18 (3), 623–663.

Gnyawali, D.R. and Srivastava, M.K. (2013). Complementary effects of clusters and networks on firm innovation: A conceptual model. *Journal of Engineering and Technology Management - JET-M*, 30 (1), 1–20. Available from https://doi.org/10.1016/j.jengtecman.2012.11.001.

Gölgeci, I. et al. (2019). European MNE subsidiaries’ embeddedness and innovation performance: Moderating role of external search depth and breadth. *Journal of Business Research*, 102 (May), 97–108. Available from https://doi.org/10.1016/j.jbusres.2019.05.011.

Good, M. et al. (2018). The technology transfer ecosystem in academia. An organizational design perspective. *Technovation*, (March 2017), 1–16. Available from https://doi.org/10.1016/j.technovation.2018.06.009.

Gräbner, M.E. and Eisenhardt, K.M. (2007). Theory building from cases: opportunities and challenges. *Academy of Management Journal*, 50 (1), 25–32. Available from https://doi.org/10.5465/AMJ.2007.24160888.

Greenstone, M., Hornbeck, R. and Moretti, E. (2010). Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings. *Journal of Political Economy*, 118 (3), 536–598. Available from https://doi.org/10.1086/653714.

Greenstone, M. et al. (2016). Identifying Agglomeration Spillovers : Evidence from Winners and Losers of Large Plant Openings Published by : The University of Chicago Press Stable URL : http://www.jstor.org/stable/10.1086/653714 Identifying Agglomeration Spillovers : Evidence from Win. 118 (3), 536–598.

Grewal, D. et al. (2011). Franchise Partnership and International Expansion: A Conceptual Framework and Research Propositions. *Entrepreneurship: Theory and Practice*, 35 (3), 533–557. Available from https://doi.org/10.1111/j.1540-6520.2011.00444.x.

Grimaldi, R. and Grandi, A. (2005). Business incubators and new venture creation: An assessment of incubating models. *Technovation*, 25 (2), 111–121. Available from https://doi.org/10.1016/S0166-4972(03)00076-2.

Guerrero, M. and Urbano, D. (2014). Academics' start-up intentions and knowledge filters: An individual perspective of the knowledge spillover theory of entrepreneurship. *Small Business Economics*, 43 (1), 57–74. Available from https://doi.org/10.1007/s11187-013-9526-4.

Hadzilias, E.A. (2011). Qualitative and Mixed Research Methods. *Riga T*.

Hair, J. et al. (2016). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) - Joseph F. Hair, Jr., G. Tomas M. Hult, Christian Ringle, Marko Sarstedt*.

Hair, J.F. (2010). *Multivariate data analysis : a global perspective.*, 7th ed. Upper Saddle

River: Pearson Education. Available from https://www.worldcat.org/title/multivariate-data-analysis-a-global-perspective/oclc/804446543&referer=brief_results#.XtkCGHOVbCo.mendeley [Accessed 4 June 2020].

Hair, J.F. (2018). *Advanced issues in partial least squares structural equation modeling*. Thousand Oaks [etc.]: SAGE. Available from https://www.worldcat.org/title/advanced-issues-in-partial-least-squares-structural-equation-modeling/oclc/1028588882&referer=brief_results#.XYNa9jttbJo.mendeley [Accessed 19 September 2019].

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2012). Partial Least Squares: The Better Approach to Structural Equation Modeling? *Long Range Planning*, 45 (5–6), 312–319. Available from https://doi.org/10.1016/j.lrp.2012.09.011.

Hair, J.F. et al. (2012). The Use of Partial Least Squares Structural Equation Modeling in Strategic Management Research: A Review of Past Practices and Recommendations for Future Applications. *Long Range Planning*, 45 (5–6), 320–340. Available from https://doi.org/10.1016/j.lrp.2012.09.008.

Hair, J.F. et al. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)*, 2a. ed. Los Angeles: SAGE. Available from https://www.worldcat.org/title/primer-on-partial-least-squares-structural-equations-modeling-pls-sem/oclc/958286065&referer=brief_results#.XtkALO08exI.mendeley [Accessed 4 June 2020].

Hájek, P. and Stejskal, J. (2016). Knowledge Spillover Effects in German Knowledge-Intensive Industries. (August), 29–30.

Hájek, P. and Stejskal, J. (2018). R & D cooperation and knowledge spillover effects for sustainable business innovation in the chemical industry. *Sustainability (Switzerland)*, 10 (4). Available from https://doi.org/10.3390/su10041064.

Hallin, C. and Holmstro, C. (2012). Revisiting the external impact of MNCs : An empirical study of the mechanisms behind knowledge spillovers from MNC subsidiaries. 21, 167–179. Available from https://doi.org/10.1016/j.ibusrev.2010.12.003.

Hart, M., Bonner, K. and Levie, J. (2015). Global Entrepreneurship Monitor United Kingdom 2015 Monitoring Report List of Figures and Tables.

Hashi, I. (2013). The impact of innovation activities on firm performance using a multi-stage model : Evidence from the Community Innovation Survey 4. 42, 353–366. Available from https://doi.org/10.1016/j.respol.2012.09.011.

Hausberg, P. and Korreck, S. (2017). Business Incubators and Accelerators: Review and Research Agenda. *Academy of Management Annual Meeting Proceedings*.

Hausberg, P. and Korreck, S. (no date). Business Incubators and Accelerators : Review and Research Agenda tin.

Hayter, C.S. (2013). Conceptualizing knowledge-based entrepreneurship networks: Perspectives from the literature. *Small Business Economics*, 41 (4), 899–911. Available from https://doi.org/10.1007/s11187-013-9512-x.

Helmers, C. and Rogers, M. (2010). Innovation and the survival of new firms in the UK. *Review of Industrial Organization*, 36 (3), 227–248. Available from https://doi.org/10.1007/s11151-010-9247-7.

Hennink, M.M., Hutter, I. and Bailey, A. (2011). *Qualitative research methods*. London: SAGE. Available from https://www.worldcat.org/title/qualitative-research-methods/oclc/945194529&referer=brief_results#.Wc5xEkeG6vc.mendeley [Accessed 29 September 2017].

Henseler, J. and Chin, W.W. (2010). A comparison of approaches for the analysis of interaction effects between latent variables using partial least squares path modeling. *Structural Equation Modeling*, 17 (1), 82–109. Available from https://doi.org/10.1080/10705510903439003.

Henseler, J. and Sarstedt, M. (2013). Goodness-of-fit indices for partial least squares path modeling. *Computational Statistics*, 28 (2), 565–580. Available from https://doi.org/10.1007/s00180-012-0317-1.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2016). Testing measurement invariance of composites using partial least squares. *International Marketing Review*, 33 (3), 405–431. Available from https://doi.org/10.1108/IMR-09-2014-0304.

Hervas-Oliver, J.-L.L., Lleo, M.M. and Cervello, R. (2017). The dynamics of cluster entrepreneurship: Knowledge legacy from parents or agglomeration effects? The case of the Castellon ceramic tile district. *Research Policy*, 46 (1), 73–92. Available from https://doi.org/10.1016/j.respol.2016.10.006.

Ho, S.-C.C. et al. (2011). Internet-based selling technology and e-commerce growth: A hybrid growth theory approach with cross-model inference. *Information Technology and Management*, 12 (4), 409–429. Available from https://doi.org/10.1007/s10799-010-0078-x.

Ho, S.C., Kauffman, R.J. and Liang, T.P. (2011). Internet-based selling technology and e-commerce growth: A hybrid growth theory approach with cross-model inference. *Information Technology and Management*, 12 (4), 409–429. Available from https://doi.org/10.1007/s10799-010-0078-x.

Hohberger, J., Almeida, P. and Parada, P. (2015). The direction of firm innovation: The contrasting roles of strategic alliances and individual scientific collaborations. *Research Policy*, 44 (8), 1473–1487. Available from https://doi.org/10.1016/j.respol.2015.04.009.

Hoshmand, T. and Lisa. (2003). Can lessons of history and Logical analisis ensure progress in Psychological science. *Theory & Psychology*, 13 (1), 39–44.

Hu, L.T. and Bentler, P.M. (1999a). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6 (1), 1–55. Available from https://doi.org/10.1080/10705519909540118.

Hu, L.T. and Bentler, P.M. (1999b). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6 (1), 1–55. Available from https://doi.org/10.1080/10705519909540118.

Huang, F. et al. (2014). Openness and Appropriation: Empirical Evidence From Australian Businesses. *IEEE Transactions On Engineering Management*, 61 (3), 488–498. Available from https://doi.org/10.1109/TEM.2014.2320995.

Huang, K.F. et al. (2015). Absorptive capacity and autonomous R&D climate roles in firm innovation. *Journal of Business Research*, 68 (1), 87–94. Available from https://doi.org/10.1016/j.jbusres.2014.05.002.

Huang, P. et al. (2012). IT Knowledge Spillovers and Productivity: Evidence from Enterprise Software. *Workshop on Information Systems and Economics (WISE)*, 0–41. Available from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243886%5Cn/citations?view_op=view_citation&continue=/scholar?hl=en&as_sdt=1,5&scilib=1&scioq=inter-industry+IT+spillovers+after+the+dot-com+bust&citilm=1&citation_for_view=3btIsOMAAAAJ:ufrVoPGSRksC&hl=en.

Huggins, R. and Thompson, P. (2015). Entrepreneurship, Innovation and Regional Growth: A Network Theory. *Small Business Economics*, 45 (1), 103–128. Available from https://doi.org/10.1007/s11187-015-9643-3.

Ii, A. et al. (2014). The Community Innovation Survey 2014 Methodological recommendations. (995), 10–33.

Islam, M., Fremeth, A. and Marcus, A. (2018). Signaling by early stage startups: US government research grants and venture capital funding. *Journal of Business Venturing*, 33 (1), 35–51. Available from https://doi.org/10.1016/j.jbusvent.2017.10.001.

Ivankova, N. V, Creswell, J.W. and Stick, S.L. (2006). Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods*, 18 (1), 3–20. Available from https://doi.org/10.1177/1525822X05282260.

Jacobs, J. (2016). *Economy of cities*. New York, NY : Vintage Books. Available from https://www.worldcat.org/title/economy-of-cities/oclc/953848211&referer=brief_results#.XJY9Yw6w3F8.mendeley [Accessed 23 March 2019].

Jansen, J.J.P., Van Den Bosch, F.A.J. and Volberda, H.W. (2005). Managing potential and realized absorptive capacity: How do organizational antecedents matter? *Academy of Management Journal*, 48 (6), 999–1015. Available from https://doi.org/10.5465/AMJ.2005.19573106.

Jansen, J.J.P., Bosch, F.A.J. Van Den and Volberda, H.W. (2006). Exploratory Innovation , Exploitative Innovation , and Performance : Effects of Organizational Antecedents and Environmental Moderators Exploratory Innovation , Exploitative Innovation , and Performance : Effects of Organizational Antecedents and Environm. (May 2014). Available from https://doi.org/10.1287/mnsc.1060.0576.

Jesson, J., Matherson, L. and Lancey, F. (2011). *Doing Your Literature Review : Traditional and Systematic Techniques*. Los Angeles Calif. ;;London: SAGE.

Jia, X. et al. (2018). How leadership matters in organizational innovation: a perspective of openness. *Management Decision*, 56 (1), 6–25. Available from https://doi.org/10.1108/MD-04-2017-0415.

Jiménez-Barrionuevo, M.M., García-Morales, V.J. and Molina, L.M. (2011). Validation of an instrument to measure absorptive capacity. *Technovation*, 31 (5–6), 190–202. Available from https://doi.org/10.1016/j.technovation.2010.12.002.

Jin, J.L., Shu, C. and Zhou, K.Z. (2019). Product newness and product performance in new ventures: Contingent roles of market knowledge breadth and tacitness. *Industrial Marketing Management*, 76 (October), 231–241. Available from https://doi.org/10.1016/j.indmarman.2018.08.009.

Johnson, B. and Onwuegbuzie, A. (2004). Mixed methods research - a research paradigm whose time has come. *Education Researcher*, 33 (7), 14–26.

Johnson, R.B., Onwuegbuzie, A.J. and Turner, L.A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, 1 (2), 112–133. Available from https://doi.org/10.1177/1558689806298224.

Journal, A.I., Xiao, L. and North, D. (2018). The role of Technological Business Incubators in supporting business innovation in China : a case of regional adaptability ? *Entrepreneurship & Regional Development*, 5626, 1–29. Available from https://doi.org/10.1080/08985626.2017.1364789.

Kaiser, U. (2002). Measuring knowledge spillovers in manufacturing and services: an empirical assessment of alternative approaches. *Research Policy*, 31 (1), 125–144. Available from https://doi.org/10.1016/S0048-7333(00)00159-1.

Kauffman, R., Ho, S.-C. and Liang, T.-P. (2011). Internet-based selling technology and e-commerce growth : a hybrid growth theory approach with cross-model inference. *Information Technology and Management*, 409–429. Available from https://doi.org/10.1007/s10799-010-0078-x.

Kelava, A. (2016). *A Review of Confirmatory Factor Analysis for Applied Research (Second Edition)* . Available from https://doi.org/10.3102/1076998616631747.

Kerr, W.R. (2010). Breakthrough inventions and migrating clusters of innovation. *JOURNAL OF URBAN ECONOMICS*, 67 (1), 46–60. Available from https://doi.org/10.1016/j.jue.2009.09.006.

Kirchhoff, B. a. et al. (2007). The influence of University R & D expenditures on new business formations and employment growth. *Entrepreneurship: Theory and Practice*, 31 (4), 543–559. Available from https://doi.org/10.1111/j.1540-6520.2007.00187.x.

Ko, W.W. and Liu, G. (2015a). Understanding The Process of Knowledge Spillover: Learning to Become Social Enterprises. *Strategic Entrepreneurship Journal*, 1 (1), 263–285. Available from https://doi.org/10.1002/sej.

Ko, W.W. and Liu, G. (2015b). Understanding the Process of Knowledge Spillovers: Learning to Become Social Enterprises. *STRATEGIC ENTREPRENEURSHIP JOURNAL*, 9 (3), 263–285. Available from https://doi.org/10.1002/sej.1198.

Ko, W.W. and Liu, G. (2019). How Information Technology Assimilation Promotes Exploratory and Exploitative Innovation in the Small- and Medium-Sized Firm Context : The Role of Contextual Ambidexterity and Knowledge Base. 0 (0), 1–25. Available from https://doi.org/10.1111/jpim.12486.

Kontolaimou, A., Giotopoulos, I. and Tsakanikas, A. (2016). A typology of European countries based on innovation efficiency and technology gaps: The role of early-stage entrepreneurship. *Economic Modelling*, 52, 477–484. Available from https://doi.org/10.1016/j.econmod.2015.09.028.

Koo, J. (2005). Agglomeration and spillovers in a simultaneous framework. *Annals of Regional Science*, 39 (1), 35–47. Available from https://doi.org/10.1007/s00168-004-0210-0.

Korosteleva, J. and Belitski, M. (2017). Entrepreneurial dynamics and higher education institutions in the post-Communist world. *Regional Studies*, 51 (3), 439–453. Available from https://doi.org/10.1080/00343404.2015.1103370.

Kostopoulos, K. et al. (2011). product vs process. *Journal of Business Research*, 64 (12), 1335–1343. Available from https://doi.org/10.1016/j.jbusres.2010.12.005.

Krammer, S.M.S. (2014). Assessing the relative importance of multiple channels for embodied and disembodied technological spillovers. *Technological Forecasting and Social Change*, 81 (1), 272–286. Available from https://doi.org/10.1016/j.techfore.2013.02.006.

Kuhn, T. (1962). *The structure of scientific revolutions.* Chicago ;;London: University of Chicago Press. Available from http://www.worldcat.org/title/structure-of-scientific-revolutions/oclc/498872360&referer=brief_results#.WWdCrnkXGnQ.mendeley [Accessed 13 July 2017].

Kuratko, D.F. and Hornsby, J.S. (Jeffrey S. (2018). *New venture management : the entrepreneur's roadmap*, Second edition. Available from https://www.worldcat.org/title/new-venture-management-the-entrepreneurs-roadmap/oclc/968212221&referer=brief_results#.W_6AnVIuzkY.mendeley [Accessed 28 November 2018].

Kvale, S. and Brinkmann, S. (2009). *InterViews : learning the craft of qualitative research interviewing*, 2nd ed. Thousand Oaks: Sage Publications. Available from https://www.worldcat.org/title/interviews-an-introduction-to-qualitative-research-interviewing/oclc/588111114&referer=brief_results#.WwK88FiBx9Q.mendeley [Accessed 21 May 2018].

Laborda, L., Guasch, J.L. and Sotelsek, D. (2011). *Entrepreneurship capital and technical efficiency : the role of new business / firms as a conduit of knowledge spillovers*. Unlisted: The World Bank, Policy Research Working Paper Series: 5739. Available from http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2011/07/27/000158349_20110727092420/Rendered/PDF/WPS5739.pdf.

Landstrom, H., Harirchi, G. and Astrom, F. (2012). Entrepreneurship: Exploring the knowledge base. *Research Policy*, 41 (7, SI), 1154–1181. Available from https://doi.org/10.1016/j.respol.2012.03.009.

Lasch, F. et al. (2013). Regional determinants of ICT new firm formation. *Small Business Economics*, 40 (3), 671–686. Available from https://doi.org/10.1007/s11187-011-9382-z.

Lau, A.K.W. and Lo, W. (2015). Regional innovation system, absorptive capacity and innovation performance: An empirical study. *Technological Forecasting and Social Change*, 92, 99–114. Available from https://doi.org/10.1016/j.techfore.2014.11.005.

Laursen, K. and Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27 (2), 131–150. Available from https://doi.org/10.1002/smj.507.

Laursen, K. and Salter, A.J. (2014). The paradox of openness : Appropriability , external search and collaboration. *Research Policy*, 43 (5), 867–878. Available from https://doi.org/10.1016/j.respol.2013.10.004.

Lazzarotti, V. et al. (2017). Openness and innovation performance: An empirical analysis of openness determinants and performance mediators. *European Journal of Innovation Management*, 20 (3), 463–492. Available from https://doi.org/10.1108/EJIM-06-2016-0061.

Lee, R.P., Johnson, J.L. and Grewal, R. (2008). Intern . J . of Research in Marketing Understanding the antecedents of collateral learning in new product alliances ☆. 25, 192–200. Available from https://doi.org/10.1016/j.ijresmar.2008.03.002.

Leech, N.L. and Onwuegbuzie, A.J. (2009). A typology of mixed methods research designs. *Quality and Quantity*, 43 (2), 265–275. Available from https://doi.org/10.1007/s11135-007-9105-3.

Lhuillery, S. (2011). Absorptive capacity , efficiency effect and competitors ' spillovers. 649–663. Available from https://doi.org/10.1007/s00191-011-0228-2.

Liao, S.H., Fei, W.C. and Chen, C.C. (2007). Knowledge sharing, absorptive capacity, and innovation capability: An empirical study of Taiwan's knowledge-intensive industries. *Journal of Information Science*, 33 (3), 340–359. Available from https://doi.org/10.1177/0165551506070739.

Limaj, E. and Bernroider, E.W.N. (2017). The roles of absorptive capacity and cultural balance for exploratory and exploitative innovation in SMEs. *Journal of Business Research*, 94 (November 2017), 137–153. Available from https://doi.org/10.1016/j.jbusres.2017.10.052.

Liñán, F. and Fayolle, A. (2015). A systematic literature review on entrepreneurial intentions: citation, thematic analyses, and research agenda. *International Entrepreneurship and Management Journal*, 11 (4), 907–933. Available from https://doi.org/10.1007/s11365-015-0356-5.

Link, A.N. and Sarala, R.M. (2019). Advancing conceptualisation of university entrepreneurial ecosystems: The role of knowledge-intensive entrepreneurial firms. *International Small Business Journal: Researching Entrepreneurship*. Available from https://doi.org/10.1177/0266242618821720.

Lockett, A. and Wright, M. (2005). Resources , capabilities , risk capital and the creation of university spin-out companies. *RESEARCH POLICY*, 34 (7), 1043–1057. Available from https://doi.org/10.1016/j.respol.2005.05.006.

Looi, C.K. et al. (2010). Leveraging mobile technology for sustainable seamless learning: A research agenda. *British Journal of Educational Technology*, 41 (2), 154–169. Available from https://doi.org/10.1111/j.1467-8535.2008.00912.x.

Lowry, P.B. and Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transactions on Professional Communication*, 57 (2), 123–146. Available from https://doi.org/10.1109/TPC.2014.2312452.

Lukeš, M., Longo, M.C. and Zouhar, J. (2018). Do business incubators really enhance entrepreneurial growth? Evidence from a large sample of innovative Italian start-ups. *Technovation*, 83 (July 2018), 25–34. Available from https://doi.org/10.1016/j.technovation.2018.07.008.

Maldonado, T. et al. (2018). Taking Stock of the Absorptive Capacity Construct and its Dimensions in the Context of Technological Innovation: A Meta-Analytic Approach. *IEEE Transactions on Engineering Management*, 1–15. Available from https://doi.org/10.1109/TEM.2018.2817388.

Malecki, E.J. (2018). Entrepreneurship and entrepreneurial ecosystems. *Geography Compass*, (July 2017), e12359. Available from https://doi.org/10.1111/gec3.12359.

Malhotra, N.K. (2020). *Marketing research : an applied orientation*, 7th ed., global ed. Harlow: Pearson. Available from https://www.worldcat.org/title/marketing-research-an-applied-orientation/oclc/1134662940&referer=brief_results#.XtkAvuN3yMU.mendeley [Accessed 4 June 2020].

Markman, G.D. et al. (2005). Entrepreneurship and university-based technology transfer. *Journal Of Business Venturing*, 20 (2), 241–263. Available from https://doi.org/10.1016/j.jbusvent.2003.12.003.

Markovitch, D.G., O'Connor, G.C. and Harper, P.J. (2015). Beyond invention: the additive impact of incubation capabilities to firm value. *R&D Management*, 47 (3), 352–367. Available from https://doi.org/10.1111/radm.12152.

Martín-de Castro, G. (2015). Knowledge management and innovation in knowledge-based and high-tech industrial markets: The role of openness and absorptive capacity. *Industrial Marketing Management*, 47, 143–146. Available from https://doi.org/10.1016/j.indmarman.2015.02.032.

Masaki M. (2011). How to Factor-Analysis Your Data: Do's, Don'ts, and How-to's. *International Journal of Psychological Research*, 3 (1), 97–110.

Maxwell. (2013). Full-Text. *Qualitative research design : an interactive approach*, 201.

Maxwell, J.A. (2013). *Qualitative research design : an interactive approach*, 3. ed. Thousand Oaks Calif.: SAGE Publications. Available from https://www.worldcat.org/title/qualitative-research-design-an-interactive-approach/oclc/812831622&referer=brief_results#.WwKogCmsNyw.mendeley [Accessed 21 May 2018].

Maxwell, J.A. and Loomis, D.M. (2003). Mixed method design: An alternative approach. *Handbook of Mixed Methods in the Social and Behavioral Sciences*, 1 (January 2003), 241–271.

McIntosh, C.N., Edwards, J.R. and Antonakis, J. (2014). Reflections on Partial Least Squares Path Modeling. *Organizational Research Methods*, 17 (2), 210–251. Available from https://doi.org/10.1177/1094428114529165.

McKeever, E., Anderson, A. and Jack, S. (2014). Entrepreneurship and mutuality: social capital in processes and practices. *Entrepreneurship and Regional Development*, 26 (5–6), 453–477. Available from https://doi.org/10.1080/08985626.2014.939536.

Meho, L. and Yang, K. (2007). Impact of Data Sources on Citation Counts and Rankings of LIS Faculty: Web of Science Versus Scopus and Google Scholar. *Journal of the Association for Information Science and Technology*, 58 (13), 2105–2125. Available from https://doi.org/10.1002/asi.

Merriam, S. (2016). *Qualitative research : a guide to design and implementation*. Available from https://www.worldcat.org/title/qualitative-research-a-guide-to-design-and-implementation/oclc/904335810&referer=brief_results#.Wui4abv8tUU.mendeley

[Accessed 1 May 2018].

Mingers, J. and Yang, L. (2017a). Evaluating journal quality: A review of journal citation indicators and ranking in business and management. 323–337.

Mingers, J. and Yang, L. (2017b). Evaluating journal quality: A review of journal citation indicators and ranking in business and management. *European Journal of Operational Research*, 257 (1), 323–337. Available from https://doi.org/10.1016/j.ejor.2016.07.058.

Minola, T., Hahn, D. and Cassia, L. (2019). The relationship between origin and performance of innovative start-ups: the role of technological knowledge at founding. *Small Business Economics*. Available from https://doi.org/10.1007/s11187-019-00189-y.

Montoro-Sánchez, A. et al. (2011). Effects of knowledge spillovers on innovation and collaboration in science and technology parks. *Journal of Knowledge Management*, 15 (6), 948–970. Available from https://doi.org/10.1108/13673271111179307.

Mrkajic, B. (2017). Business incubation models and institutionally void environments. *Technovation*, 68 (September), 44–55. Available from https://doi.org/10.1016/j.technovation.2017.09.001.

Musteen, M., Datta, D.K. and Butts, M.M. (2014). Do International Networks and Foreign Market Knowledge Facilitate SME Internationalization? Evidence From the Czech Republic. *Entrepreneurship: Theory and Practice*, 38 (4), 749–774. Available from https://doi.org/10.1111/etap.12025.

Nair, S. et al. (2017). The behaviour of participants in business incubation: Exploring the role of docility. *Academy of Management Annual Meeting Proceedings*.

Naldi, L., Criaco, G. and Patel, P.C. (2020). Related and unrelated industry variety and the internationalization of start-ups. *Research Policy*, 49 (10), 104050. Available from https://doi.org/10.1016/j.respol.2020.104050.

Narula, R. (2014). The limits of `new’ multinational enterprises: institutions, systems, and `members-only’ location advantages. In: CuervoCazurra, A and Ramamurti, R, ed.

Understanding Multinationals From Emerging Markets. 2014. THE PITT BUILDING, TRUMPINGTON ST, CAMBRIDGE CB2 1RP, CAMBS, ENGLAND: CAMBRIDGE UNIV PRESS, 81–107.

Narula, R. and Santangelo, G.D. (2009). Location, collocation and R&D alliances in the European ICT industry. *Research Policy*, 38 (2), 393–403. Available from https://doi.org/10.1016/j.respol.2008.11.005.

Nicolopoulou, K. et al. (2016). An incubation perspective on social innovation:the London Hub-a social incubator. *R&D Management*, 47 (3), 368–384.

Nielsen, K. (2015). Human capital and new venture performance: the industry choice and performance of academic entrepreneurs. *Journal of Technology Transfer*, 40 (3), 453–474. Available from https://doi.org/10.1007/s10961-014-9345-z.

Nieto, M. and Quevedo, P. (2005). Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort. *Technovation*, 25 (10), 1141–1157. Available from https://doi.org/10.1016/j.technovation.2004.05.001.

Nonaka, I. (2008). *The knowledge-creating company*. Boston Mass.: Harvard Business Press. Available from http://www.worldcat.org/title/knowledge-creating-company/oclc/488802619 [Accessed 16 September 2017].

Nonaka, I. and Takeuchi, H. (1995). *The knowledge-creating company : how Japanese companies create the dynamics of innovation*. New York : Oxford University Press. Available from http://www.worldcat.org/title/knowledge-creating-company-how-japanese-companies-create-the-dynamics-of-innovation/oclc/951425276 [Accessed 23 September 2017].

Nonaka, I., Toyama, R. and Konno, N. (2000). SECI, Ba and Leadership: A Unified Model of Dynamic Knowledge Creation. *Long Range Planning*, 33 (1), 5–34. Available from https://doi.org/10.1016/S0024-6301(99)00115-6.

Norman, P.M. (2002). Protecting knowledge in strategic alliances Resource and relational characteristics. 13, 177–202.

O'Brien, R.M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity*, 41 (5), 673–690. Available from https://doi.org/10.1007/s11135-006-9018-6.

O'Gorman, C., Byrne, O. and Pandya, D. (2008). How scientists commercialise new knowledge via entrepreneurship. *Journal Of Technology Transfer*, 33 (1), 23–43. Available from https://doi.org/10.1007/s10961-006-9010-2.

O'Regan, N. and Sims, M.A. (2008). Identifying high technology small firms: A sectoral analysis. *Technovation*, 28 (7), 408–423. Available from https://doi.org/10.1016/j.technovation.2008.02.010.

OECD Directorate for Science Technology and Industry. (2011). ISIC REV. 3 technology intensity definition: Classification of manufacutring. 6. Available from https://doi.org/10.1787/sti.

Okhuysen, G.A. and Eisenhardt, K.M. (2002). Integrating Knowledge in Groups: How Formal Interventions Enable Flexibility. *Organization Science*, 13 (4), 355–457. Available from https://pubsonline.informs.org/doi/abs/10.1287/orsc.13.4.370.2947.

Okoli, C. and Schabram, K. (2010). A Guide to Conducting a Systematic Literature Review of Information Systems Research. *Working Papers on Information Systems*, 10 (26), 1–51. Available from https://doi.org/10.2139/ssrn.1954824.

Pauwels, C. et al. (2016). Understanding a new generation incubation model : The accelerator. *Technovation*, 51, 13–24. Available from https://doi.org/10.1016/j.technovation.2015.09.003.

Petruzzelli, A.M. et al. (2007). Technology districts: proximity and knowledge access. *Journal of Knowledge Management*, 11 (5), 98–114. Available from https://doi.org/10.1108/13673270710819834.

Petruzzelli, A.M., Albino, V. and Carbonara, N. (2008). Technology districts : proximity and knowledge access. *Journal Of Knowledge Management*, 11 (5), 98–114. Available from https://doi.org/10.1108/13673270710819834.

Podsakoff, P.M. et al. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology*, 88 (5), 879–903. Available from https://doi.org/10.1037/0021-9010.88.5.879.

Prashantham, S. and Young, S. (2011). Post-Entry Speed of International New Ventures. *Entrepreneurship: Theory and Practice*, 35 (2), 275–292. Available from https://doi.org/10.1111/j.1540-6520.2009.00360.x.

Prokop, V. and Stejskal, J. (2016). The Drivers of Company Innovation Activities in German Industries. In: Aaltio, I and Eskelinen, MT, ed. *Proceedings Of The 11th European Conference On Innovation And Entrepreneurship*. Proceedings of the European Conference on Entrepreneurship and Innovation. 2016. CURTIS FARM, KIDMORE END, NR READING, RG4 9AY, ENGLAND: ACAD CONFERENCES LTD, 569–577.

Qian, H. and Acs, Z.J. (2013). An absorptive capacity theory of knowledge spillover entrepreneurship. *Small Business Economics*, 40 (2), 185–197. Available from https://doi.org/10.1007/s11187-011-9368-x.

Qian, H. and Jung, H. (2017). Solving the knowledge filter puzzle: absorptive capacity, entrepreneurship and regional development. *Small Business Economics*, 48 (1), 99–114. Available from https://doi.org/10.1007/s11187-016-9769-y.

Qiu, T. and Yang, Y. (2018). Knowledge spillovers through quality control requirements on innovation development of global suppliers: The firm size effects. *Industrial Marketing Management*, 73 (January), 171–180. Available from https://doi.org/10.1016/j.indmarman.2018.02.008.

Rasmussen, E.S. and Tanev, S. (2015). The emergence of the lean global start-up as a new type of firm. *Technology Innovation Management Review*, 5 (11), 12–19. Available from www.timreview.ca.

Renski, H. (2009). New Firm Entry , Survival , and Growth in the United States : A ... *Journal of the American Planning Association.*, 75 (1), 60–77. Available from https://doi.org/10.1080/01944360802558424.

Renski, H. (2014). The Influence of Industry Mix on Regional New Firm Formation in the United States. *Regional Studies*, 48 (8), 1353–1370. Available from https://doi.org/10.1080/00343404.2012.722202.

Renski, H. (2017). New Firm Entry, Survival, and Growth in the United States: A Comparison of Urban, Suburban, and Rural Areas. *Journal of the American Planning Association*, 4363 (June), 60–77. Available from https://doi.org/10.1080/01944360802558424.

Ries, E. (2017). *The lean startup : how today's entrepreneurs use continuous innovation to create radically successful businesses*. Available from https://www.worldcat.org/title/lean-startup-how-todays-entrepreneurs-use-continuous-innovation-to-create-radically-successful-businesses/oclc/1041660363&referer=brief_results#.XJp5HadLpUg.mendeley [Accessed 26 March 2019].

Ritala, P. et al. (2015). Knowledge sharing, knowledge leaking and relative innovation performance: An empirical study. *Technovation*, 35, 22–31. Available from https://doi.org/10.1016/j.technovation.2014.07.011.

Roberts, N. and Dinger, M. (2016). The Impact of Virtual Customer Community Interactivity on Organizational Innovation: An Absorptive Capacity Perspective. *IEEE Transactions on Professional Communication*, 59 (2), 110–125. Available from https://doi.org/10.1109/TPC.2016.2561118.

Rodríguez-Pose, A. and Hardy, D. (2015). Cultural diversity and entrepreneurship in England and Wales. *Environment and Planning A*, 47 (2), 392–411. Available from https://doi.org/10.1068/a130146p.

Romer, P.M. (1990). Endogenous Technological Change. *Journal of Political Economy*, 98 (5), S71–S102. Available from https://doi.org/10.2139/ssrn.314999.

Rothaermel, F.T. and Ku, D.N. (2008). Intercluster innovation differentials: The role of research universities. *IEEE Transactions on Engineering Management*, 55 (1), 9–22. Available from https://doi.org/10.1109/TEM.2007.912815.

Rothaermel, F.T. and Thursby, M. (2005). University-incubator firm knowledge flows: Assessing their impact on incubator firm performance. *Research Policy*, 34 (3), 305–320. Available from https://doi.org/10.1016/j.respol.2004.11.006.

Rothaermel, F.T., Agung, S.D. and Jiang, L. (2007). University entrepreneurship : a taxonomy of the literature. *Industrial and Corporate Change*, 16 (4), 691–791. Available from https://doi.org/10.1093/icc/dtm023.

Saldana, J. (2015). Coding manual for qualitative researchers. *Sage Journal*, 0–42. Available from https://doi.org/10.1093/oxfordhb/9780199811755.001.0001.

Saldaña, J. (2016). *The coding manual for qualitative researchers*, 3. ed. London: SAGE. Available from https://www.worldcat.org/title/coding-manual-for-qualitative-researchers/oclc/981707121&referer=brief_results#.WxEi-5yqxgM.mendeley [Accessed 1 June 2018].

Santarelli, E. and Vivarelli, M. (2007). Entrepreneurship and the process of firms' entry, survival and growth. *Industrial and Corporate Change*, 16 (3), 455–488. Available from https://doi.org/10.1093/icc/dtm010.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2016). *Research methods for business students*. Available from https://www.worldcat.org/title/research-methods-for-business-students/oclc/919299531&referer=brief_results#.WuiNacUjN_g.mendeley [Accessed 1 May 2018].

Scaringella, L., Miles, R.E. and Truong, Y. (2017). Customers involvement and firm absorptive capacity in radical innovation: The case of technological spin-offs. *Technological Forecasting and Social Change*, 120, 144–162. Available from https://doi.org/10.1016/j.techfore.2017.01.005.

Schendel, D. and Hitt, M. (2010). Knowledge Spillovers and Strategic Entrepreneurship. *Strategic Entrepreneurship Journal*, 4 (4, SI), 269–270. Available from https://doi.org/10.1002/sej.95.

Schlosser, R.W. et al. (2006). Use of information-seeking strategies for developing systematic reviews and engaging in evidence-based practice: the application of traditional and comprehensive Pearl Growing. A review. *International Journal of Language & Communication Disorders*, 41 (5), 567–582. Available from https://doi.org/10.1080/13682820600742190.

Schmidt, S. (2015). Balancing the spatial localisation `Tilt': Knowledge spillovers in processes of knowledge-intensive services. *GEOFORUM*, 65, 374–386. Available from https://doi.org/10.1016/j.geoforum.2015.05.009.

Schoonenboom, J. and Johnson, R.B. (2017). How to Construct a Mixed Methods Research Design. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 107–131. Available from https://doi.org/10.1007/s11577-017-0454-1.

Schwartz-Shea, P. and Yanow, D. (2012). *Interpretive research design : concepts and processes*. London: Routledge. Available from http://www.worldcat.org/title/interpretive-research-design-concepts-and-processes/oclc/776815465&referer=brief_results#.WWdeGTFeb8A.mendeley [Accessed 13 July 2017].

Sechrest, L. and Sidani, S. (1995). Quantitative and qualitative methods:. Is There an Alternative? *Evaluation and Program Planning*, 18 (1), 77–87. Available from https://doi.org/10.1016/0149-7189(94)00051-X.

Sedita, S.R. et al. (2017). Measuring the effect of business incubators on the innovation performance of start-ups. *Academy of Management Journal*.

Shafique, I. and Kalyar, M. (2018). Linking Transformational Leadership, Absorptive Capacity, and Corporate Entrepreneurship. *Administrative Sciences*, 8 (2), 9. Available from https://doi.org/10.3390/admsci8020009.

Shankar, R.K. and Shepherd, D.A. (2018). Accelerating strategic fi t or venture emergence : Di ff erent paths adopted by corporate accelerators. (October 2017), 1–19. Available from https://doi.org/10.1016/j.jbusvent.2018.06.004.

Shu, C. et al. (2014). The Knowledge Spillover Theory of Entrepreneurship in Alliances. *Entrepreneurship: Theory and Practice*, 38 (4), 913–940. Available from https://doi.org/10.1111/etap.12024.

Sisodiya, S.R., Johnson, J.L. and Grégoire, Y. (2013). Industrial Marketing Management Inbound open innovation for enhanced performance : Enablers and opportunities. *Industrial Marketing Management*, 42 (5), 836–849. Available from https://doi.org/10.1016/j.indmarman.2013.02.018.

Son, H., Chung, Y. and Hwang, H. (2019). Do technology entrepreneurship and external relationships always promote technology transfer? Evidence from Korean public research organizations. *Technovation*, 82–83 (June 2016), 1–15. Available from https://doi.org/10.1016/j.technovation.2019.02.005.

Song, G. et al. (2017). Technological Forecasting & Social Change The effects of network reliance on opportunity recognition : A moderated mediation model of knowledge acquisition and entrepreneurial orientation. *Technological Forecasting & Social Change*, 117, 98–107. Available from https://doi.org/10.1016/j.techfore.2017.01.004.

Spender, J.C. et al. (2017). Startups and open innovation: a review of the literature. *European Journal of Innovation Management*, 20 (1), 4–30. Available from https://doi.org/10.1108/EJIM-12-2015-0131.

Spigel, B. and Harrison, R. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12 (1), 151–168. Available from https://doi.org/10.1002/sej.1268.

Spithoven, A. and Teirlinck, P. (2015). Internal capabilities, network resources and appropriation mechanisms as determinants of R&D outsourcing. *Research Policy*, 44 (3), 711–725. Available from https://doi.org/10.1016/j.respol.2014.10.013.

Spithovenm, A. and Knockaert, M. (2012). Technology intermediaries in low tech sectors: The case of collective research centres in belgium. *Innovation: Management, Policy and Practice*, 14 (3), 375–387. Available from https://doi.org/10.5172/impp.2012.14.3.375.

Squicciarini, M. (2009). Science parks: Seedbeds of innovation? A duration analysis of firms' patenting activity. *Small Business Economics*, 32 (2), 169–190. Available from https://doi.org/10.1007/s11187-007-9075-9.

Srivastava, M.K., Gnyawali, D.R. and Hatfield, D.E. (2015). Behavioral implications of absorptive capacity: The role of technological effort and technological capability in leveraging alliance network technological resources. *Technological Forecasting and Social Change*, 92, 346–358. Available from https://doi.org/10.1016/j.techfore.2015.01.010.

Stam, E. (2013). Knowledge and Entrepreneurial Employees: A Country-Level Analysis. *Small Business Economics*, 41 (4), 887–898. Available from https://doi.org/10.1007/s11187-013-9511-y.

Stejskal, J. and Hajek, P. (2015). Modelling Knowledge Spillover Effects Using Moderated and Mediation Analysis – The Case of Czech High-Tech Industries Modelling Knowledge Spillover Effects Using Moderated and Mediation Analysis – The Case of Czech High-Tech Industries. (August). Available from https://doi.org/10.1007/978-3-319-21009-4.

Stough, R.R. et al. (2013). Knowledge Spillovers and Commercialization in Universities and Their Regions. In: Baycan, T., ed. *Knowledge Commercialization and Valorization in Regional Economic Development*. George Mason U: Cheltenham, U.K. and Northampton, Mass.: Elgar, 46–60. Available from http://search.ebscohost.com/login.aspx?direct=true&db=ecn&AN=1466827&site=ehost-live&scope=site.

Strang, K.D. (2009). Using recursive regression to explore nonlinear relationships and interactions : A tutorial applied to a multicultural education study. *Practical Assessment, Research & Evaluation*, 14 (3), 1–21.

Strang, K.D. (2015). *The Palgrave Handbook of Research Design in Business and Management*, 1st editio. PALGRAVE MACMILLAN®. Available from https://www.worldcat.org/title/palgrave-handbook-of-research-design-in-business-and-management/oclc/967394837&referer=brief_results#.WZVusObbTXo.mendeley

[Accessed 17 August 2017].

Stuetzer, M. et al. (2017). Entrepreneurship culture, knowledge spillovers and the growth of regions. *Regional Studies*, (March), 1–11. Available from https://doi.org/10.1080/00343404.2017.1294251.

Su, Z. and Yang, H. (2018). Managerial Ties and Exploratory Innovation: An Opportunity-Motivation-Ability Perspective. *IEEE Transactions on Engineering Management*, 65 (2), 227–238. Available from https://doi.org/10.1109/TEM.2017.2782730.

Suddaby, R., Bruton, G.D. and Si, S.X. (2015). Entrepreneurship through a qualitative lens: Insights on the construction and/or discovery of entrepreneurial opportunity. *Journal of Business Venturing*, 30 (1), 1–10. Available from https://doi.org/10.1016/j.jbusvent.2014.09.003.

Szerb, L. et al. (2018). The relevance of quantity and quality entrepreneurship for regional performance: the moderating role of the entrepreneurial ecosystem. *Regional Studies*, 0 (0), 1–13. Available from https://doi.org/10.1080/00343404.2018.1510481.

Tabacaru, S. et al. (2016). Bundled database subscriptions: Challenges, opportunities, and assessment. *Serials Review*, 42 (1), 31–38. Available from https://doi.org/10.1080/00987913.2016.1142928.

Tashakkori, A. and Teddlie, C. (2003). *Handbook of mixed methods in social & behavioral research*, [Nachdr.]. Thousand Oaks Calif. [u.a.]: SAGE Publications. Available from https://www.worldcat.org/title/handbook-of-mixed-methods-in-social-behavioral-research/oclc/315948333&referer=brief_results#.WulzusudscQ.mendeley [Accessed 2 May 2018].

Tashakkori, A. and Teddlie, C. (2010). *Sage handbook of mixed methods in social & behavioral research*, 2nd ed. Sage: SAGE Publications. Available from http://www.worldcat.org/title/sage-handbook-of-mixed-methods-in-social-behavioral-research/oclc/882191221&referer=brief_results#.Wb9Yjbes16w.mendeley

[Accessed 18 September 2017].

Terjesen, S. and Patel, P.C. (2017). In Search of Process Innovations: The Role of Search Depth, Search Breadth, and the Industry Environment. *Journal of Management*, 43 (5), 1421–1446. Available from https://doi.org/10.1177/0149206315575710.

Thomé, A.M.T., Scavarda, L.F. and Scavarda, A.J. (2016). Conducting systematic literature review in operations management. *Production Planning & Control*, 27 (5), 408–420. Available from https://doi.org/10.1080/09537287.2015.1129464.

Thorpe, R. and Holt, R. (2008). *The Sage dictionary of qualitative management research*. Los Angeles : Sage Publications. Available from https://www.worldcat.org/title/sage-dictionary-of-qualitative-management-research/oclc/706872575&referer=brief_results#.WultzqVaP0M.mendeley [Accessed 2 May 2018].

Timmermans, B. (2009). The Effect of Entrepreneurial Firm Diversity on Firm Survival: An Analysis of Starts-ups in Technology Based and Knowledge Intensive Industries. (October), 1–22.

Todorova, G. and Durisin, B. (2007). Absorptive Capacity : Valuing a Reconceptualization Linked references are available on JSTOR for this article : NOTE ABSORPTIVE CAPACITY : VALUING A. *Academy of Management Review*, 32 (3), 774–786.

Tranfield, D., Denyer, D. and Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review *. *British Journal of Management*, 14, 207–222. Available from https://doi.org/10.1111/1467-8551.00375.

Triguero, A. and Fernández, S. (2018). Determining the effects of open innovation : the role of knowledge and geographical spillovers Determining the effects of open innovation : the role of knowledge and geographical spillovers. 3404. Available from https://doi.org/10.1080/00343404.2017.1395004.

Tseng, C.-Y., Pai, D.C. and Hung, C.-H. (2011). Knowledge absorptive capacity and innovation performance in KIBS. *Journal of Knowledge Management*, 15 (6), 971–983. Available from https://doi.org/10.1108/13673271111179316.

Tsvetkova, A. (2015). Innovation, Entrepreneurship, and Metropolitan Economic Performance: Empirical Test of Recent Theoretical Propositions. *Economic Development Quarterly*, 29 (4), 299–316. Available from https://doi.org/10.1177/0891242415581398.

Tsvetkova, A., Thill, J.-C.C. and Strumsky, D. (2014). Metropolitan innovation, firm size, and business survival in a high-tech industry. *Small Business Economics*, 43 (3), 661–676. Available from https://doi.org/10.1007/s11187-014-9550-z.

Tufool, A. and Gerard, G. (2016). Appropriability And The Retrieval Of Knowledge After Spillovers. *Strategic Management Journal*, 37 (7), 1263–1279. Available from https://doi.org/10.1002/smj.

Tzokas, N. et al. (2015). Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech SMEs. *Industrial Marketing Management*, 47, 134–142. Available from https://doi.org/10.1016/j.indmarman.2015.02.033.

Ullman, J.B. and Bentler, P.M. (2003). Structural Equation Modeling. *Handbook of Psychology*, 607–634. Available from https://doi.org/doi:10.1002/0471264385.wei0224.

Valentine, J., Hedges, L. and Cooper, H. (2009). The handbook of research synthesis and meta-analysis.

van Oort, F.G. and Atzema, O. (2004). On the conceptualization of agglomeration economies: The case of new firm formation in the Dutch ICT sector. *Annals Of Regional Science*, 38 (2), 263–290. Available from https://doi.org/10.1007/s00168-004-0195-8.

van Oort, F.G. and Bosma, N.S. (2013). Agglomeration Economies, Inventors and Entrepreneurs as Engines of European Regional Economic Development. *Annals of Regional Science*, 51 (1), 213–244. Available from http://link.springer.com/journal/volumesAndIssues/168.

Vanderstraeten, J., Matthyssens, P. and Campus, C. (2004). Measuring the performance of business incubators A critical analysis of effectiveness approaches and performance measurement systems. *White paper*, (January), 1–26.

Venkatesh, V. and Brown, S.A. (2013). Bridging the qualitative–quantitative divide: Guidelines for conducting mixed methods Research in information systems. *MIS quarterly*, 37 (1), 21–54.

Verspagen, B. (1997). Measuring Intersectoral Technology Spillovers: Estimates from the European and US Patent Office Databases. *Economic Systems Research*, 9 (1), 47–65. Available from https://doi.org/10.1080/09535319700000004.

Veugelers, B.C. and R. (2016). R & D Cooperation and Spillovers : Some Empirical Evidence from Belgium Author (s): Bruno Cassiman and Reinhilde Veugelers Source : The American Economic Review , Vol . 92 , No . 4 (Sep ., 2002), pp . 1169-1184 Published. *The American Economic Review, Vol. 92, No. 4 (Sep., 2002), pp. 1169-1184*, 92 (4), 1169–1184. Available from http://www.jstor.org/stable/3083305.

Vivarelli, M. (2004). Are all the potential entrepreneurs so good? *Small Business Economics*, 23 (1), 41–49. Available from https://doi.org/10.1023/B:SBEJ.0000026023.11752.a9.

Vlačić, E. et al. (2019). Exploring the impact of the level of absorptive capacity in technology development firms. *Technological Forecasting and Social Change*, 138 (September 2017), 166–177. Available from https://doi.org/10.1016/j.techfore.2018.08.018.

Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. *Journal of applied management accounting research*, 10 (1), 69–80. Available from https://doi.org/10.1675/1524-4695(2008)31.

Walker, J.T. et al. (2019). The impact of journal re-grading on perception of ranking systems: Exploring the case of the Academic Journal Guide and Business and

Management scholars in the UK. *Research Evaluation*, 28 (3), 218–231. Available from https://doi.org/10.1093/reseval/rvz010.

Wang, J. and Shapira, P. (2012). Partnering with universities: a good choice for nanotechnology start-up firms? *Small Business Economics*, 38 (2), 197–215. Available from 10.1007/s11187-009-9248-9.

Wang, Z. and Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert Systems with Applications*, 39 (10), 8899–8908. Available from https://doi.org/10.1016/j.eswa.2012.02.017.

Welter, F. et al. (2017). Everyday Entrepreneurship—A Call for Entrepreneurship Research to Embrace Entrepreneurial Diversity. *Entrepreneurship: Theory and Practice*, 41 (3), 311–321. Available from https://doi.org/10.1111/etap.12258.

Wennberg, K., Wiklund, J. and Wright, M. (2011). The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs. *Research Policy*, 40 (8, SI), 1128–1143. Available from https://doi.org/10.1016/j.respol.2011.05.014.

Wiklund, J., Wright, M. and Zahra, S.A. (2019). Conquering Relevance: Entrepreneurship Research's Grand Challenge. *Entrepreneurship Theory and Practice*, 43 (3), 419–436. Available from https://doi.org/10.1177/1042258718807478.

Winston-Smith-Sheryl-Hannigan-Thomas-and-Gasiorowski-Laura_Peering-Inside. (no date).

Wong, P.K., Lee, L. and Foo, M. Der. (2008). Occupational Choice: The Influence of Product vs. Process Innovation. *Small Business Economics*, 30 (3), 267–281. Available from http://link.springer.com/journal/volumesAndIssues/11187.

Woodward, D., Figueiredo, O. and Guimarães, P. (2006). Beyond the Silicon Valley: University R&D and high-technology location. *Journal of Urban Economics*, 60, 15–32. Available from https://doi.org/10.1016/j.jue.2006.01.002.

Worren, N., Moore, K. and Cardona, P. (2002). Modularity, strategic flexibility, and firm performance: A study of the home appliance industry. *Strategic Management Journal*, 23 (12), 1123–1140. Available from https://doi.org/10.1002/smj.276.

Wyrwich, M. (2014). Ready, set, go! Why are some regions entrepreneurial jump starters? *Annals of Regional Science*, 53 (2), 487–513. Available from https://doi.org/10.1007/s00168-014-0629-x.

Yan, W., Khoo, L.P. and Chen, C.H. (2005). A QFD-enabled product conceptualisation approach via design knowledge hierarchy and RCE neural network. *Knowledge-Based Systems*, 18 (6), 279–293. Available from https://doi.org/10.1016/j.knosys.2004.09.001.

Yang, C.H., Chen, C.J. and Shyu, J.Z. (2008). Innovation intermediary for creating regional knowledge capabilities in knowledge cluster. *2008 IEEE International Conference on Industrial Engineering and Engineering Management, IEEM 2008*, 831–835. Available from https://doi.org/10.1109/IEEM.2008.4737986.

Yin, R.K. (2003). *Case study research : design and methods*, 3rd ed. Thousand Oaks Calif.: Sage Publications.

Yin, R.K. (2006). Case Study Reserach - Design and Methods. *Clinical Research*, 2, 8–13. Available from https://doi.org/10.1016/j.jada.2010.09.005.

Ying, L. and Liang, Y. (2008). A mechanism framework for cluster enterprise innovation: A view of co-governance. *Proceedings - International Conference on Management of e-Commerce and e-Government, ICMeCG 2008*, 283–288. Available from https://doi.org/10.1109/ICMECG.2008.9.

Yuan, K.H., Wen, Y. and Tang, J. (2019). Regression Analysis with Latent Variables by Partial Least Squares and Four Other Composite Scores: Consistency, Bias and Correction. *Structural Equation Modeling*, 27 (3), 333–350. Available from https://doi.org/10.1080/10705511.2019.1647107.

Zaborek, P. (2014). Application of multiple case study method in doctoral dissertation. (September). Available from https://doi.org/10.13140/2.1.4478.0806.

Zahra, S.A. and George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27 (2), 185–203. Available from https://doi.org/10.5465/AMR.2002.6587995.

Zainuba, M. and Rahal, A. (2015). Assessing the Validity of Business and Management Journals Ranking List: An Alternative Approach for Determining Journal Quality. *Annals of Management Science*, 4 (2), 1–28. Available from https://doi.org/10.24048/ams4.no2.2015-1.

Zapata, C. (2010). Industry environmental performance and regulation in the automobile industry. *PQDT - UK & Ireland*. Available from https://search.proquest.com/docview/1314574483?accountid=14987.

Zedtwitz, M. von. (2003). Classification and management of incubators: aligning strategic objectives and competitive scope for new business facilitation. *International Journal of Entrepreneurship and Innovation Management*, 3 (1/2), 176. Available from https://doi.org/10.1504/IJEIM.2003.002227.

Zobel, A.K. (2017). Benefiting from Open Innovation: A Multidimensional Model of Absorptive Capacity*. *Journal of Product Innovation Management*, 34 (3), 269–288. Available from https://doi.org/10.1111/jpim.12361.

Zvi Griliches. (1992). The Search for R&D Spillovers. *The Scandinavian Journal of Economics*, 94 (Supplement), 29–47. Available from https://doi.org/10.2307/3440244.

APPENDICES

Appendix A Literature Review Procedure

A.1- Planning and Initial definition of the Research Problem

The initial scope of the study was established at the beginning of the study. Thus, the author decided to continue using the variables of knowledge Spillover, lean-start-up and new enterprises (Booth, Diana and Sutton, 2012; Bryman and Bell, 2015); the terms were defined as the study continued. The approach using a systematic review protocol taken was for narrowing down the initial research proposal based upon covering the gap between the process of knowledge Spillover and the mechanisms used by entrepreneurs at the individual level and to specific high-tech industries (Qian and Acs, 2013; Ko and Liu, 2015a). The protocol to select the papers is illustrated in table A.1.

Table A.1 - Systematic Review Protocol Template

Background The Knowledge Spillover Theory of Entrepreneurship unravels the effects of knowledge flows on from incumbent companies and universities to create new firms that influence regions' economic growth (Audretsch and Lehmann, 2005). The research is focused on how knowledge Spillover is used at the individual level to create business value. The research seeks to take into considerations all the variables that are involved in this process.
Criteria for inclusion and exclusion of studies Including all the entrepreneurs that hold knowledge spillovers, and have identified a way to commercialise it in the market based upon their perceived value (Hart, Bonner and Levie, 2015). All studies that conduct research on entrepreneurs and the exchange of knowledge at the individual, company, regional and country levels.
Method of Review Use of bibliographic databases and web sites linked to the business management discipline (Blumberg, Cooper and Schindler, 2014). EBSCO (Main): Covers a range of 3,800 journals, including the abstract and full texts and 1,100 peer-reviewed journals. ETHOS: Access to the British Library, which contains more than 450,000 UK doctoral thesis. Web of Science (WoS): Considered the standard tool for searching for academic research and a reliable source for

searching though the connections between authors (Meho and Yang, 2007).

ProQuest is considered a source for dissertations, information form the government, newspapers, and publications (Tabacaru et al., 2016).

Google Scholar: It is considered the central search engine for finding articles related to many disciplines, it allows to expand the search through international sources and other documents from many disciplines (Meho and Yang, 2007). Evaluation of the journals' quality using the ranking from the Chattered Association of Business Schools (ABS) and on the assessment of its indexes (Mingers and Yang, 2017a).

The main webpage that will be used to evaluate the quality of papers and authors' ongoing research is https://www.researchgate.net. The website is an online network that allows researchers current studies, projects, and activities among academics and professionals through a semi-public profile, considering that the information collected has to be verified (Chakraborty, 2012). The main functionality used is to follow and network the experts in the area of Knowledge Spillover and entrepreneurship area.

Study Quality Assessment and extraction of data

All the documentation is skimmed, followed by a comprehensive discussion and synthesis of the main theories and concepts (Booth, Diana and Sutton, 2012). All the content has to cover the "Criteria of Inclusion and Exclusion of Studies". The extraction of data is based on interpretive intent, with the end to represent my data through primary themes and models (Booth, Diana and Sutton, 2012).

A.2- Scope of research

The literature review process was conducted by assessing the papers collected from the scope literature review to define the main themes and codes based on the articles' keywords. For that matter, the researcher conducted a search starting by using a Traditional Pearl Growing (TPG) (Schlosser et al., 2006). The process is followed by:

- identify a relevant article in the topic,
- Identify the terms used to determine the concept in the research database,
- Find new articles that are relevant to the study and
- repeats the process until there are no more articles that are part of the research scope.

The discussion followed the Flow chart of literature review, where all articles are assessed by exclusion criteria established in figure A.1. (Collis and Hussey, 2014). The difference with other techniques used in the systematic literature review is that the researcher focuses on extending the pool of keywords used for each research (Schlosser et al., 2006). The initial assessment of the main concepts and theories were illustrated on a mind map provided initial support on the development of discussions(See Appendix A.4).

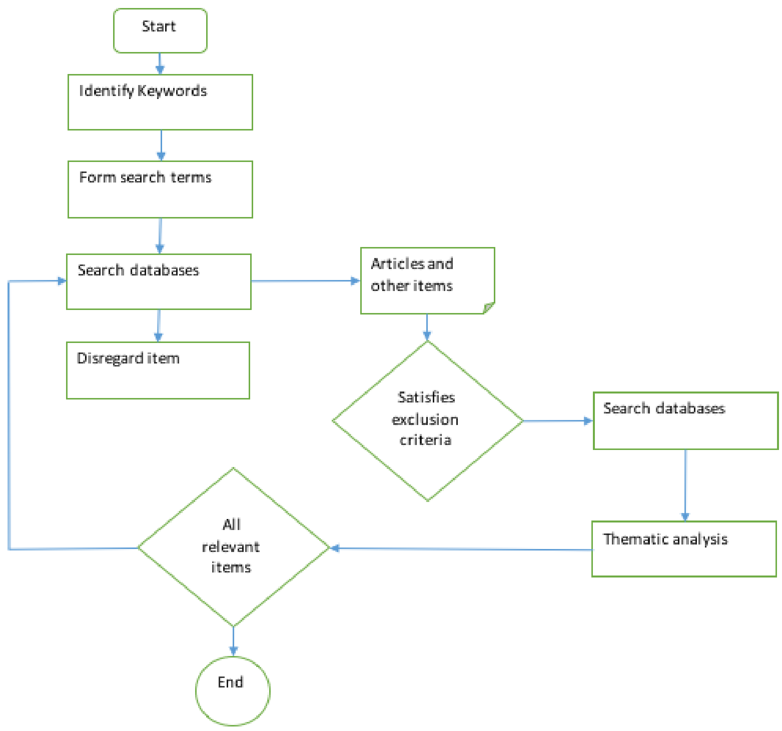


Figure A.1 - Flow Chart of literature review search, based on Collis & Hussey (2014)

The relevant article used for this search was "the emergence of the Knowledge Spillover Theory of Entrepreneurship" (Ghio, Guerini, E Lehmann, et al., 2015) which has conducted a literature review from 1999 to 2013. The initial keywords selected from the pearl were used to find more relevant articles that would enable to develop a conceptual model (Booth, Diana and Sutton, 2012). The selection of new keywords was added and recorded queries conducted on the databases. TPG allowed identifying relevant articles that enabled to link the KSTE with research conducted on start-ups and incubators (Collis and Hussey, 2014).

The author conducted a scoping search based on the electronic databases to identify existing literature, assess the quality and the number of preliminary studies, and identify the initial key terms of search and develop a search strategy (Booth, Diana and Sutton, 2012). The selection the variables and concepts were based from the research question, and took into consideration synonyms using the Boolean operators "AND" and "OR" to narrow the search (Collis and Hussey, 2014; Bryman and Bell, 2015); the primary variable of the combination was knowledge spillover.

The literature analysis retrieved relevant information from academic articles such as the name of the authors, year of publication, geography, and academic discipline (Jesson, Matherson and Lancey, 2011). The search also included grey literature such as research reports, working papers, and conferences (Jesson, Matherson and Lancey, 2011). The collection of all the search terms on the first literature review are displayed in table A.2.

Table A.2 -Initial search counts from individual searches

Individual search terms	Search count			
	ProQuest	EBSCO host	ETHOS	Web of Science
(Knowledge Spillover)	145	3092	62	309
(Knowledge Spillover*)	145	3101	62	316
(Lean startup)	24	167	-	72
(Lean startup*)	24	72	-	78
(Entrepreneurship)	2021	99941	580	18784
(Entrepreneurship*)	2024	99963	580	18819
(Business value)	1852	30417	1395	33682
(Business value*)	1882	29495	1395	33614
combined search	search count			
	ProQuest	EBSCO	ETHOS	Web of Science
(knowledge spillover) AND entrepreneurship	3	124	2	87
Knowledge spillover AND entrepreneurship	3	279	3	268
(knowledge spillover) AND (Business value)	-	-	-	-
(knowledge spillover) AND business value*	5	-	1	9
Knowledge spillover AND business value		3	2	47
(knowledge spillover) AND (New enterprise)	-	-	-	-
(knowledge spillover*) AND New enterprise	4	21	1	19
Knowledge spillover AND new enterprise	46	34	3	73
Total	61	461	12	503
Percentage	5.88%	44.46%	1.16%	48.51%

The initial screening shows that the combination of knowledge spillover and entrepreneurship un the EBSCO database returns the majority of results, while the combination of business value and entrepreneurship, leading to suggest that these two areas of knowledge are intertwined.

The initial findings on the combination of variables suggested an increased number of responses when the initial keywords used. However, the combination of these concepts led to reducing the number of results. The most common of matches found links between the term knowledge spillovers and entrepreneurship. The primary online databases with knowledge spillovers articles are the Web of Science and EBSCO. Once the literature was conducted, updated from the literature, enables to expand the research on knowledge spillovers. The recording of all the combination of words is illustrated in table A.3.

Table A.3 -Recording of the combination of words

Database	Date	Keywords	Results
Web of Science	11/03/2017	("knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	52
Web of Science	18/03/2017	"knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	52
EBSCO	21/03/2017	"knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	104
ABI/INFORM (ProQuest)	30/03/2017	"knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	324
Web of Science	11/04/2017	"knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	54
Web of Science	11/04/2017	"knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "high tech" OR "hightech" OR "low tech" OR "lowtech")	128
EBSCO	12/04/2017	"knowledge spillovers" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	107
EBSCO	12/04/2017	"knowledge spillovers*" AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	171
Web of Science	24/04/2017	knowledge spillovers* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	129

Database	Date	Keywords	Results
EBSCO	27/04/2017	knowledge spillover* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	176
EBSCO	05/05/2017	knowledge spillover* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	186
Web of Science	19/05/2017	knowledge spillover* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	129
EBSCO	27/04/2017	knowledge spillover* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	178
Web of Science	22/05/2017	knowledge spillover* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	129
EBSCO	23/05/2017	knowledge spillover* AND ("new ventues" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	188
Web of Science	23/05/2017	"knowledge spillover*" AND ("information and communications technology")	8
Web of Science	23/05/2017	"knowledge spillover*" AND "ICT".	28
EBSCO	23/05/2017	"knowledge spillovers" AND "startup*" AND "incubator".	6
Web of Science	25/05/2017	"knowledge spillover*" AND "startup*" AND "incubator".	0
Web of Science	25/05/2017	"knowledge spillover*" AND ("startup*" OR "incubators")	16
EBSCO	25/05/2017	"knowledge spillover*" AND ("startup*" OR "incubators")	113
ETHOS	27/05/2017	"knowledge spillover*".	24
ETHOS	27/05/2017	knowledge spillover*	64
ETHOS	27/05/2017	knowledge spillover	62
Google Scholar	30/05/2017	"knowledge spillovers" AND "systematic literature review."	169
ProQuest	31/05/2017	knowledge spillovers* AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	560
ProQuest	31/05/2017	knowledge spillovers* AND "incubator" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator")	49

Database	**Date**	**Keywords**	**Results**
EBSCO	02/06/2017	"knowledge spillover*" AND "incubator*" AND ("new venture*" OR "new business*" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation"	2
ProQuest	09/06/2017	knowledge spillover*" AND "incubator*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	88
ProQuest	19/06/2017	"knowledge spillover*" AND "incubator*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	60
ProQuest	14/06/2017	"knowledge spillover*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation")	455
ProQuest	15/06/2017	"knowledge spillover*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	489
ProQuest	16/06/2017	"knowledge spillover*" AND "Incubator*".	121
ProQuest	21/06/2017	"knowledge spillover*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	496
Web of Science	20/06/2017	"knowledge spillover*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	109
ProQuest	29/06/2017	"knowledge spillover*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	382
ProQuest	03/07/2017	"knowledge spillover*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	498
ProQuest	03/07/2017	"knowledge spillovers*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	432
ProQuest	12/07/2017	"knowledge spillovers*" AND ("new ventures" OR "new business" OR "startup" OR "startups" OR "start up" OR "start-up" OR "start-ups" OR "new firm creation" OR "new firm formation" OR "incubator*")	433

A.3- Appraisal and Quality Assessment

The references obtained from the combination of words included most of the research from academic journals or articles (See Figure 2.1). EBSCO showed an increased number of publications during this time. Further analysis of the papers' appraisal and quality assessment revealed that academic between 2007 and 2009 showed an increased number of research on knowledge spillovers and entrepreneurship in the United States. Releveled that academic research conducted towards understanding the importance of investment in R&D in alliances and universities (Beugelsdijk, 2007; Kirchhoff et al., 2007; Narula and Santangelo, 2009). The research was realised by authors who didn't develop the Knowledge Spillover Theory of Entrepreneurship (Ghio, Guerini, E Lehmann, et al., 2015).

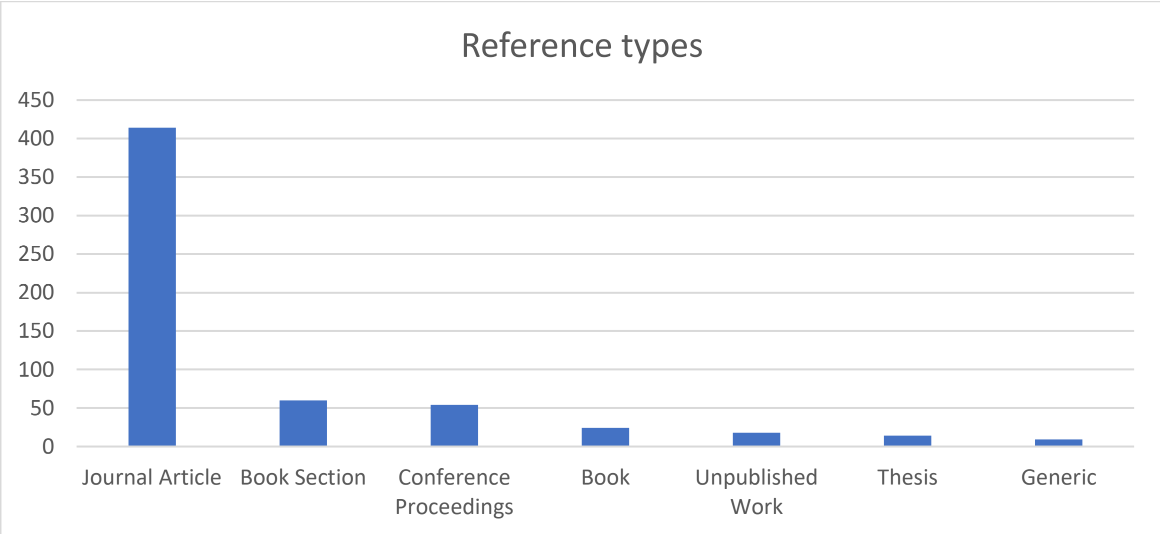


Figure A. 2 - Number of references types by source.

This data suggests that there may be possible that empirical studies conducted at the regional level come from economic indicators from countries from the OECD (Armington and Acs, 2002; Audretsch and Keilbach, 2007a, 2008; Audretsch, Huelsbeck and Lehmann, 2012). These examples were also based on economic databases from European countries such as Germany. Furthermore, research conducted before the beginning of the doctoral thesis has obtained between thirty to seventy publications on knowledge spillovers (See table A.3).

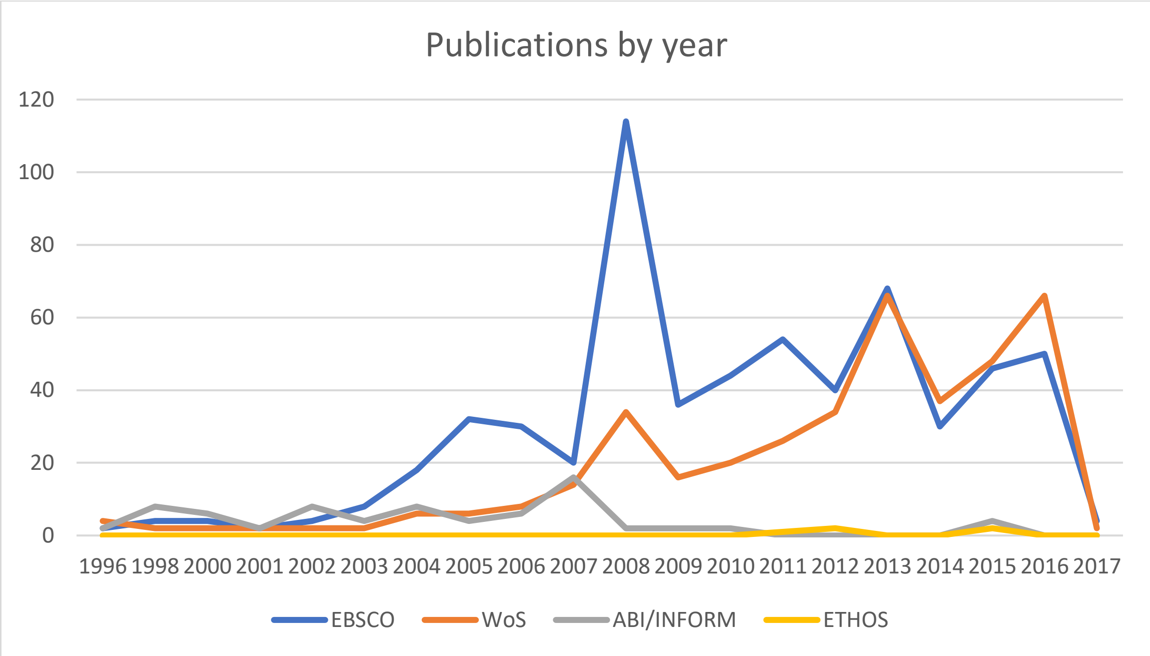


Figure A.3 - Number of publications by year up to 2017.

Figure A.4 shows that the leading authors in EBSCO and Web of Science are the researchers that started and developed the Knowledge Spillover Theory of Entrepreneurship based on the number of citations provided by this academic database. However, the number of papers showed from sources such as ABI/INFORM had authors from different disciples equally cited. The leading academic in economics has been the first authors or co-authors of multiple publications conducted at the regional level See figure 2.3). However, the Web of Science and ABI/INFORM databases showed two to four publications from authors on other fields such as business and engineering (See figure A.5 and A.6).

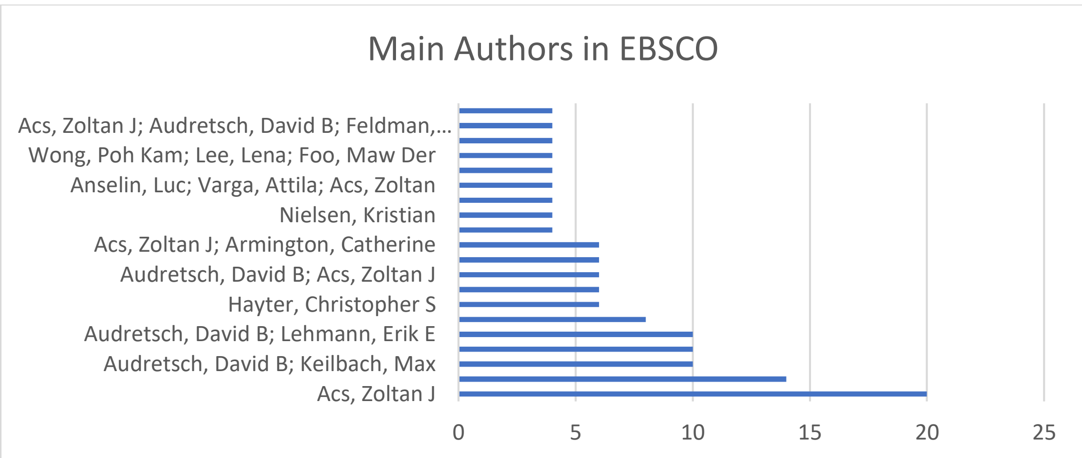


Figure A.4 - Main authors from EBSCO database

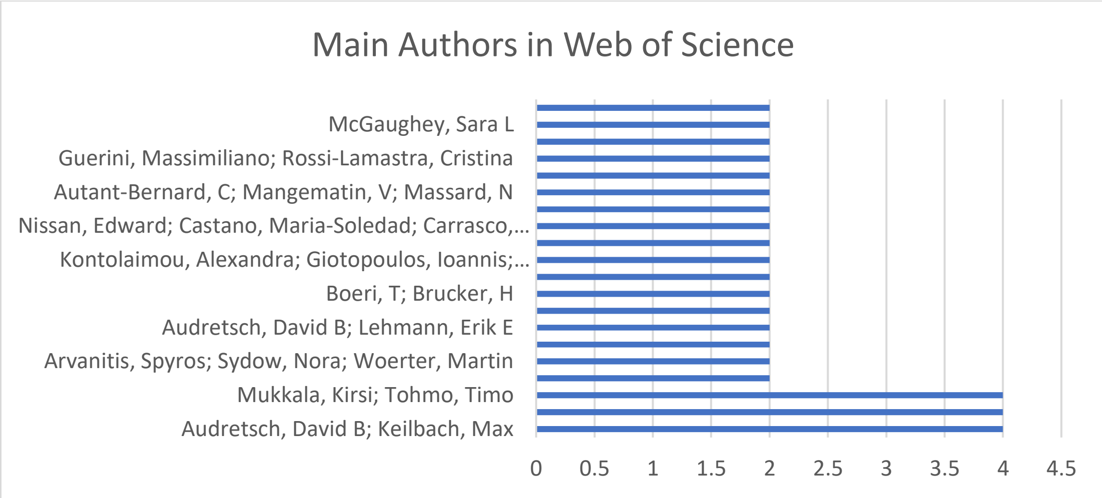


Figure A.5 - Main authors from the Web of Science database

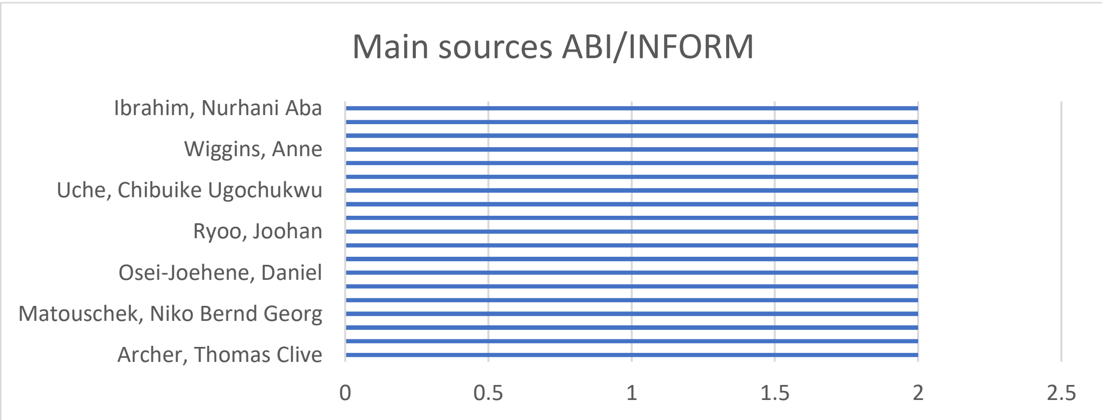


Figure A.6 - Main authors from Main au ABI/INFORM databases.

Finally, the central countries that published papers from knowledge spillovers were based on Germany, the United States and the United Kingdom (See figure A.3). This initial view can direct that many of the most relevant research on knowledge spillovers is based in this region. The reasons for these trends are caused toe to the availability of secondary data available from public entities such as the OECD and AEGIS survey, which evaluate the economic activities of new ventures (Amoroso, Audretsch and Link, 2017). Figure A.7. clearly illustrates that the United States, Germany, and the United Kingdom are the most predominant countries researching the KTSE. The leading researchers in the economics discipline such as Audtretch, Acs, Kelibach, and Lehman operate in these countries (Figure A4, A.5).

In addition, countries like the Netherlands and Italy studies expand knowledge spillovers research by assessing case studies or evaluating models in different industries.

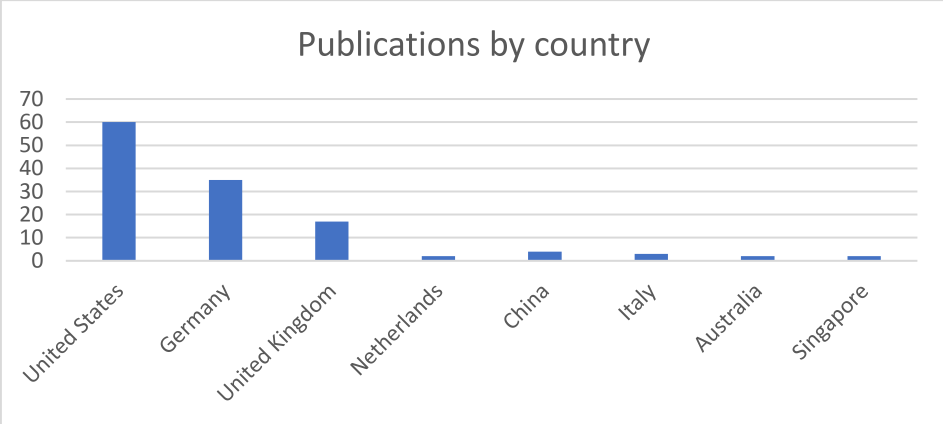


Figure A.7 - Main countries of conducted research on knowledge spillovers

A.3- Rankings of journals

This section summarises the academic article journals and rankings based on the ABS ranking, and on the Harzing Journal Quality List considering most of the literature after developing the thesis (Zainuba and Rahal, 2015; Mingers and Yang, 2017b). The Academic Journal Guide (AGJ) provides a list of metrics from journal articles that have been published in the last ten years and conducted by the Association of Business Schools (ABS), which is a private organisation (Walker et al., 2019). This list is assessed by a panel of experts categorising papers based on a ranking discipline in business and management in the United Kingdom. For instance, 4* are considered elite journals, while 1* starts are regarded as modest journals (Duan, Nasri and Paknejad, 2018; Walker et al., 2019).

Papers were also assessed based on the SCImago journal rank indicator (Zainuba and Rahal, 2015). This metric provides insights on the quality of the paper-based not only on the journal's ranking but also on its citations and on the applicability of the article by other researchers (Mingers and Yang, 2017b; Duan, Nasri and Paknejad, 2018). The h-index considers the impact of the journal by considering the number of citations obtained from journal articles (Zainuba and Rahal, 2015; Mingers and Yang, 2017b). SCImago also categorises the papers on quartiles by discipline, being Q1 the top journals, all the way to Q4 considered modest (Mingers and Yang, 2017b; Good et al., 2018). The quality list of journal articles used in all this research is presented in Table A.4.

Table A.4 - Recording of the combination of words

Name of the journal	Number of articles	SCImago				ABS (Harzing list - 2020)		
		h-index	Quartile	Relevant discipline	SJR (2019)	Ranking	Discipline	WL
Tourism Management	1	179	Q1	Strategy and Management	3.068	4	Tourism	
American Economic Review	3	277	Q1	Economics and Econometrics	13.773	4*	Economics	Yes
Academy of Management Review	3	260	Q1	Strategy and Management	7.482	4*	Gen & Strat	Yes
Strategic Management Journal	11	269	Q1	Strategy and Management, Business and International Management	8.43	4*	Gen & Strat	Yes
Research Policy	25	224	Q1	Management of Technology and Innovation	3.246	4	Economics	
Strategic Entrepreneurship Journal	17	32	Q1	Strategy and Management	3.245	4	Gen & Strat	Yes
Journal of Political Economy	3	179	Q1	Economics and Econometrics	21.239	4*	Economics	Yes
Journal of Product Innovation Management	12	135	Q1	Management of Technology and Innovation	3.128	4	Innovation	
Journal of Management Studies	3	172	Q1	Management of Technology and Innovation	4.608	4	Gen & Strat	Yes
Journal of Management	4	208	Q1	Strategy and Management	6.982	4*	Gen & Strat	Yes
Journal of International Business Studies	7	184	Q1	Management of Technology and Innovation	4.994	4*	IB	Yes
Journal of Economic Geography	2	69	Q1	Economics and Econometrics	2.192	4	Economics	
Journal of Business Venturing	9	170	Q1	Management of Technology and Innovation	4.977	4	Entrep	Yes
Entrepreneurship Theory and Practice	20	140	Q1	Business and International Management	3.566	4	Entrep	Yes
Economic Geography	4	79	Q1	Geography, Planning and Development	3.79	4	Economics	
Academy of Management Journal	4	304	Q1	Management of Technology and Innovation	11.19	4*	Gen & Strat	Yes
R and D Management	6	99	Q1	Management of Technology and Innovation	1.249	3	Innovation	
Urban studies	1	138	Q1	Urban Studies	1.618	3	PSM	
Scandinavian Journal of Economics	1	63	Q2	Economics and Econometrics	1.044	3	Economics	
Technovation	23	121	Q1	Management of Technology and Innovation	2.795	3	Innovation	
Technological Forecasting and Social Change	8	103	Q1	Management of Technology and Innovation	1.815	3	Innovation	
Strategic organization	1	51	Q1	Strategy and Management	2.987	3	Gen & Strat	
Small Business Economics	77	120	Q1	Business, Management and Accounting	1.929	3	Economics	
Regional Studies	18	111	Q1	Social Sciences	1.543	3	PSM	
Papers in Regional Science	5	59	Q1	Geography, Planning and Development	0.91	3	Economics	
Journal of Urban Economics	6	102	Q1	Urban Studies	2.356	3	Economics	
Journal of Small Business Management	3	103	Q1	Strategy and Management	1.561	3	Entrep	
Journal of Regional Science	1	74	Q1	Development	0.999	3	Economics	
Journal of International Management	1	66	Q1	Business and International Management	1.549	3	IB	
Journal of Business Research	12	179	Q1	Marketing	1.871	3	Marketing	
International Small Business Journal	2	78	Q1	Business and International Management	1.848	3	Entrep	
International Journal of Industrial Organization	4	80	Q1	Strategy and Management	1.105	3	OS/OB, HRM/R	
Industrial Marketing Management	7	125	Q1	Marketing	2.084	3	Marketing	
Industrial and Corporate Change	4	104	Q1	Economics and Econometrics	1.12	3	Economics	
IEEE Transactions on Engineering Management	9	89	Q1	Strategy and Management	1.066	3	OR, MS, POM	
Expert Systems with Applications	1	184	Q1	Engineering	1.494	3	MIS, KM	
Entrepreneurship & Regional Development	15	83	Q1	Business and International Management	1.368	3	Entrep	
World Economy	2	64	Q1	Political Science	0.592	2	Economics	
Annals of Regional Science	1	59	Q1	Social Sciences	0.75	2	Economics	
Scientometrics	2	106	Q1	Social Sciences	1.21	2	Innovation	
Scandinavian Journal of Management	1	54	Q2	Strategy and Management	0.585	2	Gen & Strat	
Review of World Economics	1	49	Q1	Economics, Econometrics and Finance	0.597	2	Economics	
Review of Industrial Organization	2	54	Q2	Management of Technology and Innovation	0.406	2	Economics	
Oxford Review of Economic Policy	1	80	Q1	Management, Monitoring, Policy and Law	1.47	2	Economics	
Journal of Knowledge Management	9	106	Q1	Management of Technology and Innovation	1.752	2	MIS, KM	
Journal of Information Science	1	60	Q1	Library and Information Sciences	0.669	2	MIS, KM	
Journal of Evolutionary Economics	5	69	Q1	Business, Management and Accounting	0.608	2	Economics	
International Journal of Entrepreneurship and Innovation Management	2	22	Q2	Management of Technology and Innovation	0.217	2	Entrep	
European Management Journal	3	99	Q1	Strategy and Management	1.308	2	Gen & Strat	
European Business Review	1	39	Q1	Business, Management and Accounting	0.599	2	Gen & Strat	
Economics of Innovation and New Technology	3	49	Q1	Management of Technology and Innovation	0.923	2	Entrep	
Annals of Regional Science	11	59	Q1	Social Sciences	0.75	2	Economics	
Science amp; Technology Progress and Policy	4							
Virtual Reality	1	41	Q1	Software	0.654			
Other	26							
Conference, Proceedings	40							
White paper or working paper	10							
Urban Geography	1	64	Q1	Urban Studies	1.801			
University Evolution, entrepreneurial activity and regional competitiveness	1							
University Entrepreneurship and Technology Transfer	1							
Uncertain Supply Chain Management	1	12	Q3	Business and International Management	0.415			
Book, handbook	14							
Journal of Technology Transfer	30	73	Q1	Business and International Management	1.657			
Technology Innovation Management Review	1							
Name of the journal		**SCImago**				**ABS (Harzing list - 2020)**		

	Number of articles	h-index	Quartile	Relevant discipline	SJR (2019)	Ranking	Discipline	WL
Technology Analysis and Strategic Management	1	64	Q2	Strategy and Management	0.627			
Sustainability	1	68	Q2	Management, Monitoring, Policy and Law	0.581			
Structural Change and Economic Dynamics	1	45	Q2	Economics and Econometrics	0.621			
SSRN	1							
South Asian Journal of Management	1							
Service Industry Journal	1	88	Q1	Strategy and Management	0.779			
Revista de Cercetare si interventie sociala	1	15	Q3	Sociology and Political Science	0.214			
Regional Science and Urban Economics	2	73	Q1	Urban Studies	1.235			
Production Planning and Control	1	70	Q1	Strategy and Management	1.394			
Knowledge-Based Systems	1	107	Q1	Management Information Systems	1.754			
Journal of the American Planning Association	1	90	Q1	Urban Studies	1.554			
Journal of Strategic Innovation & Sustainability	1							
Journal of Organizational Computing and Electronic Commerce	1							
Journal of Management Policy and Practice	1							
Journal of Economic Behavior & Strategic Management	1							
Issues in Political Economy	1							
Investigaciones Regionales	2	13	Q3	Development	0.36			
International Journal of Knowledge Management	1	22	Q3	Management of Technology and Innovation	0.223			
International Journal of Knowledge and Systems Science	1	3	Q3	Management of Technology and Innovation	0.183			
International Entrepreneurship and Management Journal	8	50	Q1	Management of Technology and Innovation	1.164			
Innovation-Management Policy & Practice	3	27	Q1	Management of Technology and Innovation	0.964			
Information Technology and Management	2	35	Q2	Business, Management and Accounting	0.415			
IEEE Transactions on Professional Communication	2	42	Q2	Electrical and Electronics Engineering	0.379			
European Planning Studies	9	75	Q1	Geography, Planning and Development	0.953			
Eurasian Business Review	1	14	Q1	Business, Management and Accounting	0.687			
Environment and Planning A	2	121	Q1	Geography, Planning and Development	1.785			
Entrepreneurship, Growth and Public Policy: Prelude to a Knowledge Spillover Theory of Entrepreneurship	36							
Economic Development Quarterly	7	45	Q1	Development	0.755			
British Journal of Management	3	103	Q1	Management of Technology and Innovation	1.522			
Academy of Management Annual Meeting Proceedings	18							
TOTAL	620							

(grey) Not applicable

The collected literature has a total of 620 academic sources. From the sources, 60.97% of items ranked under the ABS list, while 74.52% of journals are listed in SCImago (See FigureA.8). Under the ABS ranking, the research used 20.65% articles categorised as leading journals, 33.06% as top journals, and 7.26% considered as well regarded. The comparison also highlights that SCImago has ranked 13.55 % more journals that are not in the ABS list. This difference shows that aside from business, other disciplines are conducting research that implicitly describes and analyses knowledge spillovers. Journal articles on the 71.45% percentile registered in SCImago are considered top journals in their respective fields. Finally, 25% of literature not recorded in these sources come from books, conference proceedings, unregistered journals, white papers, thesis or reports from economic organisations. Although these sources are not entirely academic, they provide early insights on researchers' attempts to evaluate knowledge spillovers on different disciplines or provide support for the development of government policies.

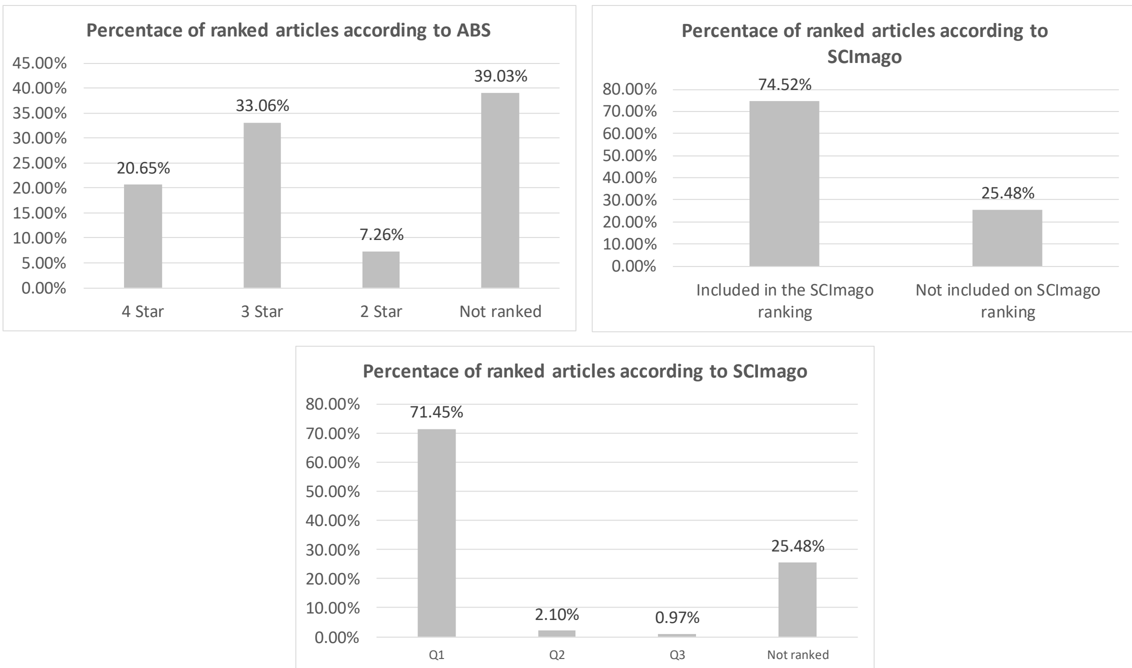


Figure A. 8 - Percentages of ranked articles according to ABS and SCImago

The KSTE focused on explaining regions' economic growth to assess the increase in gross domestic production (Acs et al., 2009; Qian and Acs, 2013; Audretsch and Lehmann, 2017). For that matter, 44% of the journal articles under the ABS ranking of journals fall in economics. Other most relevant areas that research knowledge spillovers fall on 44.69 % of journals linked to entrepreneurship, innovation, and general and strategy. These figures suggest that these are disciplines that can expand the understanding of knowledge spillovers aside from evaluating economic models. Also, 18.88% of articles fall into international business, marketing, knowledge management, operations and production. Examples include research in the manufacturing sector or the evaluation of start-ups involvement with incubators or evaluating clients' involvement with companies (Nieto and Quevedo, 2005; Azad and Ahmadi, 2015; Cantù, 2017). The data supports that the KSTE is strong in the area of economic, but generated a potential gap with other disciplines that could be covered. The distribution of all the groups is illustrated in figure A.9.

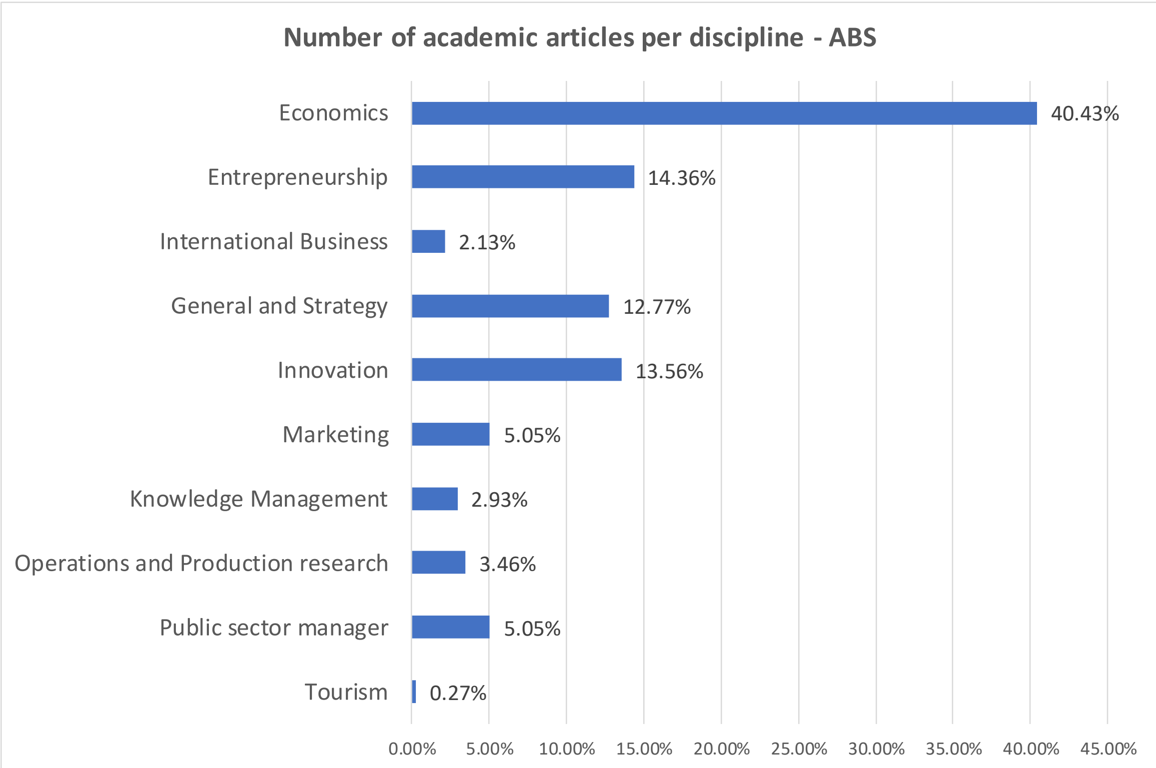


Figure A.9 - Percentages of ranked articles categorised by discipline based on the ABS

Following the ABS ranking, the assessment by discipline shows that 23.03% of the academic journals are four stars, while 61 % are categorised as 3*. However, it is worth mentioning that economics has 152 papers, the highest total of references across the disciplines. Journal articles linked to research on knowledge spillovers in strategy present 87.50% publications categorised as 4*. This finding suggests that research in this area is rigorous and is only limited to discussing significant breakthroughs in business. The disciplines of entrepreneurship and innovation present a similar trend, with 53.70% and 23.53% of publications published in leading journals. Entrepreneurship comes as the third most regarded discipline that evaluates the performance of start-ups.

On the other hand, most of the innovation papers are published in 3* journals, 72.55%. These figures suggest that leading publications on start-ups and knowledge spillovers focus on entrepreneurs' processes and strategies. However, research on technology and innovation implementation may become a more predominant discipline to cover the research gaps from other disciplines. The rest of the subjects seem not to be strongly linked to the KSTE since publications per discipline did not exceed a total of 20 papers. Most of these disciplines have articles published on 3* articles except for the area of knowledge management; The summary of the publication rankings illustrated in figure A.10 and Table A.5.

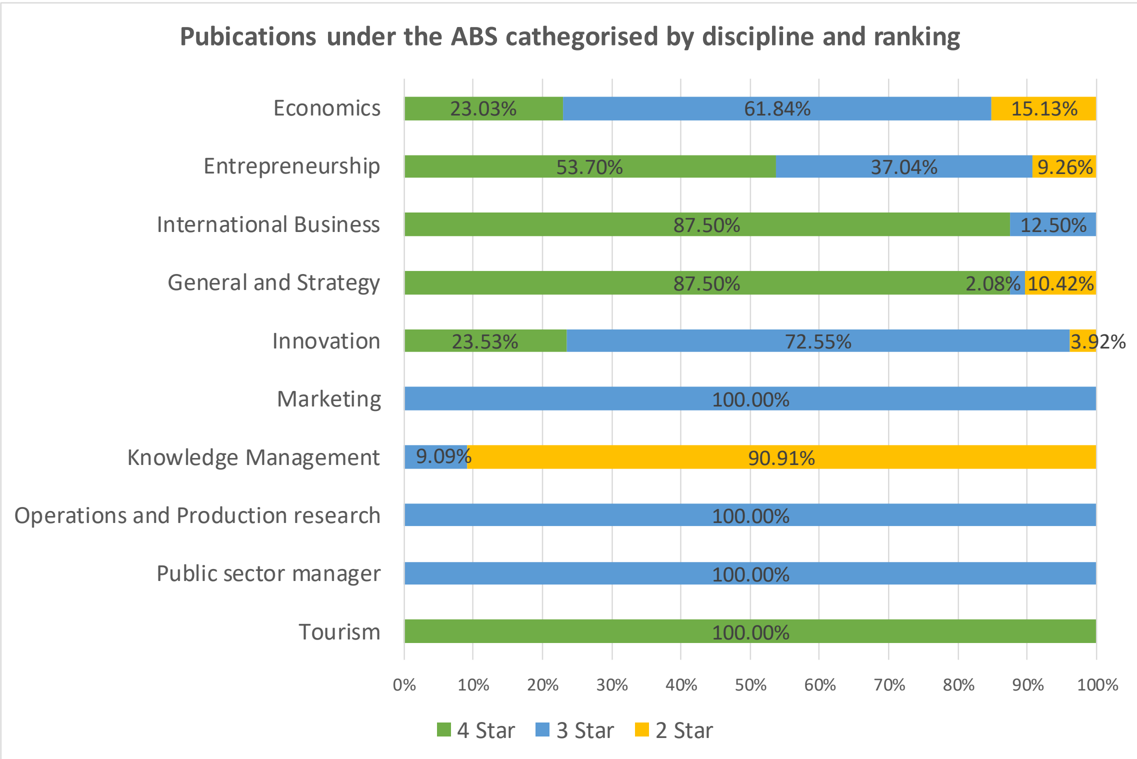


Figure A.10 - Publications categorised by discipline based on the ABS ranking

Table A.5 - Publications categorised by discipline based on the ABS ranking of journals

Discipline	4 Star	3 Star	2 Star	Total
Economics	35	94	23	152
Entrepreneurship	29	20	5	54
International Business	7	1		8
General and Strategy	42	1	5	48
Innovation	12	37	2	51
Marketing		19		19
Knowledge Management		1	10	11
Operations and Production research		13		13
Public sector manager		19		19
Tourism	1			1
TOTAL	126	205	45	
PERCENTAGE	33.51%	54.52%	11.97%	

From the 376 classified under the ABS ranking, 22.34% come from world-leading journals. The management journal and academic economic review academy have the highest reputation due to its h-index (See table A.5). However, these journals only had a total of seven articles that discuss the evaluation of knowledge. On the other hand, the strategic management journal and research policies present h-indexes above 200 with 36 papers worth 27.28 % of the 4* articles. However, the journals of Entrepreneurship Theory and Practice, Journal of Business Venturing, and Strategic Entrepreneurship present an essential source for the literature with 46 papers. All these journals assess companies strategies, influences by policies, and entrepreneurship. Furthermore, the Journal of Product Innovation provided insights on the internal processes that should e taken by companies when engaging in product innovation. The summary of the 4* papers is shown on table A.6.

Table A.6 - Summary of 4* journal articles based on the ABS ranking of journals.

Name of the journal	Number of articles	Percentage	h-index	SJR (2019)	Relevant discipline SCImago	Quartile	Discipline (ABS)	World Leading
Academy of Management Journal	4	3.13%	304	11.19	Management of Technology and Innova	Q1	Gen & Strat	Yes
American Economic Review	3	2.34%	277	13.773	Economics and Econometrics	Q1	Economics	Yes
Strategic Management Journal	11	8.59%	269	8.43	Strategy and Management	Q1	Gen & Strat	Yes
Academy of Management Review	3	2.34%	260	7.482	Strategy and Management	Q1	Gen & Strat	Yes
Research Policy	25	19.53%	224	3.246	Management of Technology and Innova	Q1	Economics	
Journal of Management	4	3.13%	208	6.982	Strategy and Management	Q1	Gen & Strat	Yes
Journal of International Business Studies	7	5.47%	184	4.994	Management of Technology and Innova	Q1	IB	Yes
Tourism Management	1	0.78%	179	3.068	Strategy and Management	Q1	Tourism	
Journal of Political Economy	3	2.34%	179	21.239	Economics and Econometrics	Q1	Economics	Yes
Journal of Management Studies	3	2.34%	172	4.608	Management of Technology and Innova	Q1	Gen & Strat	Yes
Journal of Business Venturing	9	7.03%	170	4.977	Management of Technology and Innova	Q1	Entrep	Yes
Entrepreneurship Theory and Practice	20	15.63%	140	3.566	Business and International Managemen	Q1	Entrep	Yes
Journal of Product Innovation Manageme	12	9.38%	135	3.128	Management of Technology and Innova	Q1	Innovation	
Economic Geography	4	3.13%	79	3.79	Geography, Planning and Development	Q1	Economics	
Journal of Economic Geography	2	1.56%	69	2.192	Economics and Econometrics	Q1	Economics	
Strategic Entrepreneurship Journal	17	13.28%	32	3.245	Strategy and Management	Q1	Gen & Strat	Yes
TOTAL	128							

The journals of Business Research, Small Business Economics, Regional Studies and Technovation are the most predominant with a cumulative percentage of papers of 63.41 %. The classification by discipline under the ABS fall in the category of entrepreneurship and economics. This form of evaluation is similar in articles published in the journal of Entrepreneurship and Regional Development. Papers in this area are focused on the evaluation of the KSTE at the regional level.

On the other hand, articles on innovation and marketing are more aligned to conducting case studies and structural equation modelling to evaluate companies directly. This approach to conducting data analysis is used in journals such as Technological Forecasting and Social Change, Business Management, IEEE Transactions on Engineering Management, and R&D Management, representing 8.29 % of all the 3* papers. All the mentioned journal are well regarded in their fields, with h indexes above 85 and SJR above one. The rest of the journal with less paper used falls either in entrepreneurship, operations, business management, or economics. The journal that does not fall directly in economics implicitly provides insights that supported the evaluation of knowledge spillovers on start-ups. The summary of the 3* papers is illustrated in table A.7.

Table A.7 - Summary of 3* journal articles based on the ABS ranking of journals.

Name of the journal	Number of articles	Percentage	h-index	SJR (2019)	Relevant discipline SCImago	Quartile	Discipline (ABS)
Expert Systems with Applications	1	0.49%	184	1.494	Engineering	Q1	MIS,KM
Journal of Business Research	12	5.85%	179	1.871	Marketing	Q1	Marketing
Urban studies	1	0.49%	138	1.618	Urban Studies	Q1	PSM
Industrial Marketing Management	7	3.41%	125	2.084	Marketing	Q1	Marketing
Technovation	23	11.22%	121	2.795	Management of Technology and Innovation	Q1	Innovation
Small Business Economics	77	37.56%	120	1.929	Business, Management and Accounting	Q1	Economics
Regional Studies	18	8.78%	111	1.543	Social Sciences	Q1	PSM
Industrial and Corporate Change	4	1.95%	104	1.12	Economics and Econometrics	Q1	Economics
Journal of Small Business Management	3	1.46%	103	1.561	Strategy and Management	Q1	Entrep
Technological Forecasting and Social Change	8	3.90%	103	1.815	Management of Technology and Innovation	Q1	Innovation
Journal of Urban Economics	6	2.93%	102	2.356	Urban Studies	Q1	Economics
R and D Management	6	2.93%	99	1.249	Management of Technology and Innovation	Q1	Innovation
IEEE Transactions on Engineering Management	9	4.39%	89	1.066	Strategy and Management	Q1	OR, MS, POM
Entrepreneurship & Regional Development	15	7.32%	83	1.368	Business and International Management	Q1	Entrep
International Journal of Industrial Organization	4	1.95%	80	1.105	Strategy and Management	Q1	OS/OB,HRM/R
International Small Business Journal	2	0.98%	78	1.848	Business and International Management	Q1	Entrep
Journal of Regional Science	1	0.49%	74	0.999	Development	Q1	Economics
Journal of International Management	1	0.49%	66	1.549	Business and International Management	Q1	IB
Scandinavian Journal of Economics	1	0.49%	63	1.044	Economics and Econometrics	Q2	Economics
Papers in Regional Science	5	2.44%	59	0.91	Geography, Planning and Development	Q1	Economics
Strategic organization	1	0.49%	51	2.987	Strategy and Management	Q1	Gen & Strat
TOTAL	205						

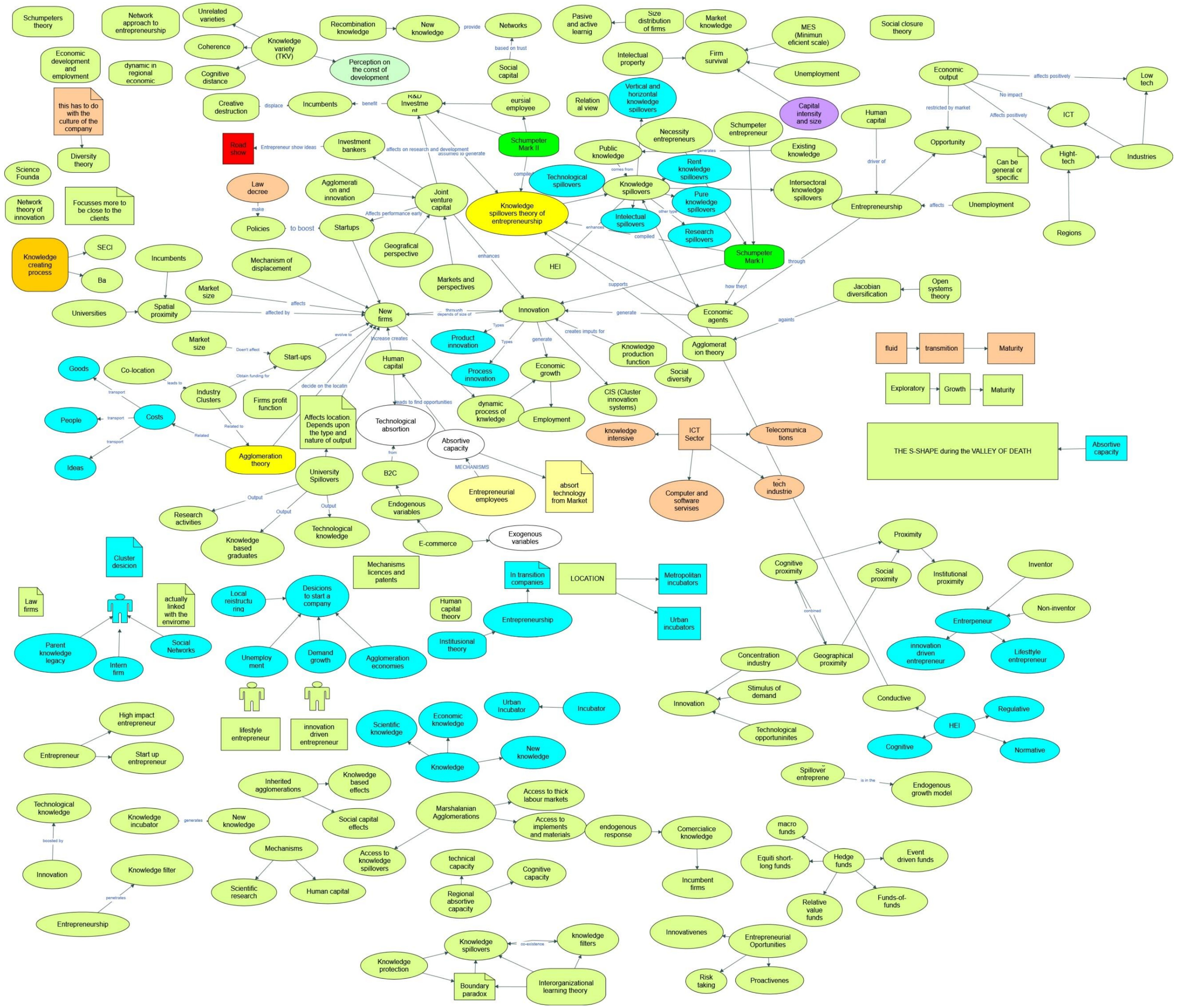
Finally, 2* journals such as Scientometrics, Oxford Review of Economic Policy, European Management Journal, and Journal of Knowledge Management present SJR above one. Out of these categories, the three leading journals used from this category represent 55.56% of articles used. Journals under the economics discipline are edited by the leading KSTE researchers, such as Acs and Audretsch. These sources provided to be useful as highlighted the main reports that supported on the categorisation of knowledge spillovers by source (Amoroso, Audretsch and Link, 2017).

On the other hand, articles published in the Journal of Knowledge Management included essential contributions to the knowledge spillovers evaluation. Some examples include assessing actors on the supply chain, assessment of industrial clusters, or analysis of the flow and transformation of knowledge (Montoro--Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Connell et al., 2014; Bandera, Bartolacci and Passerini, 2016). The summary of the 2* papers is shown on table A.8.

Table A.8 - Summary of 2* journal articles based on the ABS ranking of journals.

Name of the journal	Number of articles	Percentage	h-index	SJR (2019)	Relevant discipline SCImago	Quartile	Discipline (ABS)
Scientometrics	2	4.44%	106	1.21	Social Sciences	Q1	Innovation
Journal of Evolutionary Economics	5	11.11%	106	0.608	Business, Management and Accounting	Q1	Economics
Oxford Review of Economic Policy	1	2.22%	99	1.47	Management, Monitoring, Policy and Law	Q1	Economics
Annals of Regional Science	11	24.44%	80	0.75	Social Sciences	Q1	Economics
Review of Industrial Organization	2	4.44%	69	0.406	Management of Technology and Innovatio	Q2	Economics
Annals of Regional Science	1	2.22%	64	0.75	Social Sciences	Q1	Economics
World Economy	2	4.44%	60	0.592	Political Science	Q1	Economics
European Management Journal	3	6.67%	59	1.308	Strategy and Management	Q1	Gen & Strat
Economics of Innovation and New Techn	3	6.67%	59	0.923	Management of Technology and Innovatio	Q1	Entrep
Journal of Knowledge Management	9	20.00%	54	1.752	Management of Technology and Innovatio	Q1	MIS,KM
Journal of Information Science	1	2.22%	54	0.669	Library and Information Sciences	Q1	MIS,KM
Review of World Economics	1	2.22%	49	0.597	Economics, Econometrics and Finance	Q1	Economics
Scandinavian Journal of Management	1	2.22%	49	0.585	Strategy and Management	Q2	Gen & Strat
International Journal of	2	4.44%	39	0.217	Management of Technology and Innovatio	Q2	Entrep
European Business Review	1	2.22%	22	0.599	Business, Management and Accounting	Q1	Gen & Strat
TOTAL	45						

A.4- Mind Map of KSTE related concepts and theories



Appendix B Qualitative and Quantitative Research Desing

B.1: Mixed Methods Paradigms, Assumptions and Design

Design Type	Implementation	Priority	Stage of integration	Theoretical perspective
Sequential explanatory	Quantitative followed by qualitative	Usually quantitative; can be qualitative or equal	Interpretation phase	May be present
Sequential exploratory	Qualitative followed by quantitative	Usually qualitative; can be quantitative or equal	Interpretation phase	May be present
Sequential transformative	Either qualitative followed by quantitative	Quantitative, qualitative or equal	Interpretation phase	Present (conceptual framework)
Design Type	**Implementation**	**Priority**	**Stage of integration**	**Theoretical perspective**
Concurrent triangulation	Concurrent collection of quantitative and qualitative data	Preferably equal; can be qualitative or quantitative	Interpretation phase or analysis phase	May be present
Concurrent nested	Concurrent collection of qualitative and quantitative data	Qualitative or quantitative	Analysis phase	May be present
Concurrent transformative	Concurrent collection of quantitative and qualitative data	Qualitative or Quantitative	Usually analysis phase; can be used during the interpretation phase	Present (conceptual framework)

B.2: Description of incubators/accelerators and entrepreneurs

The level of analysis established the individuals, groups, or sample that is considered in the research. It allows setting at what level the results can be generalised and can be regarded as reliable (Strang, 2015). The analysis level can be individual, dyadic, groups; it can be extended to specific regions, countries or industries(Strang, 2015). In this particular case, the research considers the group of entrepreneurs that were part of an incubator or accelerator programme in Greater London. It is important to note that the level of analysis leads to the research's scope in the long term (Strang, 2015).

The initial selection of individuals' sample for the research is based on a theoretical sample (Burns, 2000). The characteristics that entrepreneurs have and the types of high-tech start-ups that decide to locate in urban areas (Burns, 2000). This approach supports and defines high-tech start-ups and entrepreneurs' types during the early stages as an explicit category (Burns, 2000). However, the types of entrepreneurs can differ from different facets (Welter et al., 2017). However, it can be discussed that the comparison of both parts has to lead to a substantial similarity on the definitions and agreements the types of entrepreneurs for the different perspectives illustrated in table B.1 (Welter et al., 2017). The opportunity and necessity-based approaches suggest that opportunity entrepreneurs would focus on obtaining capital, growing the company, and innovating. On the other hand, entrepreneurs based by necessity are more likely to imitate products, be informal and focus on their lifestyle.

Table B.1 - Dichotomy of entrepreneurs proposed by Welter et al., (2017).

Opportunity	**Necessity-based**
Venture Capital	Bootstrapped
Formal	Informal
Men-owned	Women-owned
innovator	replicator
promoter	trustee
Growth-oriented	lifestyle
entrepreneur	Small business owner/proprietor

Early start-ups seek to obtain resources at a low cost (Islam, Fremeth and Marcus, 2018). The difference of entrepreneurs with an SME is that start-ups are developing their internal methods to validate and commercialise products (Islam, Fremeth and Marcus, 2018). This process links to capturing knowledge spillovers and absorptive capacity from entrepreneurs by developing networks and enhancing relations with individuals and companies in the chain of value (Islam, Fremeth and Marcus, 2018). Recent studies on the KSTE have used the European Commission's surveys from the Advancing Knowledge-Intensive Entrepreneurship and Innovation for Growth and Social wellbeing in Europe (AEGIS) (Amoroso, Audretsch and Link, 2017). Thus, the characteristics of the founders of the companies in the high-tech sector consider the following:

- Experience in the industry
- Age of the entrepreneur
- Level of education

In addition to narrowing down the characteristics of entrepreneurs, it is necessary to highlight the differences that can expect from the types of incubators and accelerators. The KSTE has conducted most research on high-tech incubators in collaboration with universities. Studies have expanded on researching the sharing of knowledge and innovation level in STPs exposed to high-technology firms (Squicciarini, 2009; Montoro-Sánchez, Ortiz-de-Urbina-Criado and Mora-Valentín, 2011; Nicolopoulou et al., 2016). Other studies have focused on the level of innovation produced based on R&D, the number of patents created and the formation of entrepreneurship networks.

The classification of high-tech companies can be defined as early-stage start-ups. As a basis, high-tech companies invest more than five percent of resources towards R&D and hire educated human capital (O'Regan and Sims, 2008). The indicator of the types of companies fall in the category of high-tech companies is based on the Industrial Classification Index (SIC).

The research also needs to take into consideration the classification of incubators and accelerator programmes. The study proposes that incubators and accelerators would establish their programmes by considering if start-ups are connected to universities and Technology Transfer Offices (TTOs). Most incubators and accelerators do locate in urban areas with a high density of population and incumbents.

These programmes focus on accepting start-ups in their conceptual, seed or early stages of development (Zedtwitz, 2003). The taxonomy of incubators includes Business Information Centres (BICs), University Business Incubators (UBIs), independent Private Incubators (IPIs), and Corporate Private Incubators (CPIs) (Grimaldi and Grandi, 2005) (See figure B.1).

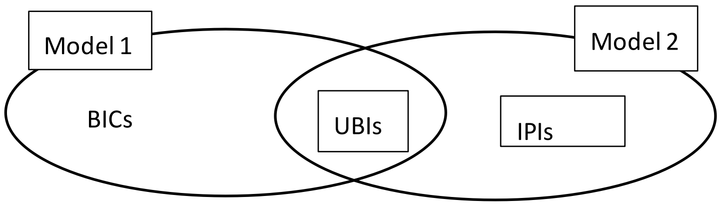


Figure B.1 - Two business incubators models, based on Grimaldi et al., (2016).

Incubators and accelerators can also be established at the regional level, habilitated through virtual environments and incumbents' support (Zedtwitz, 2003). Also, incubators can be classified as not for profit and for-profit. The scope of this research is to assess the transformation of tacit and explicit knowledge from the different souses (Nonaka, Toyama and Konno, 2000). For that matter, the entrepreneurs interviewed need to have to attend incubators for-profit or not for profit that has a physical location that can be *independent commercial* and from *universities* (Zedtwitz, 2003) (See figure C.2).

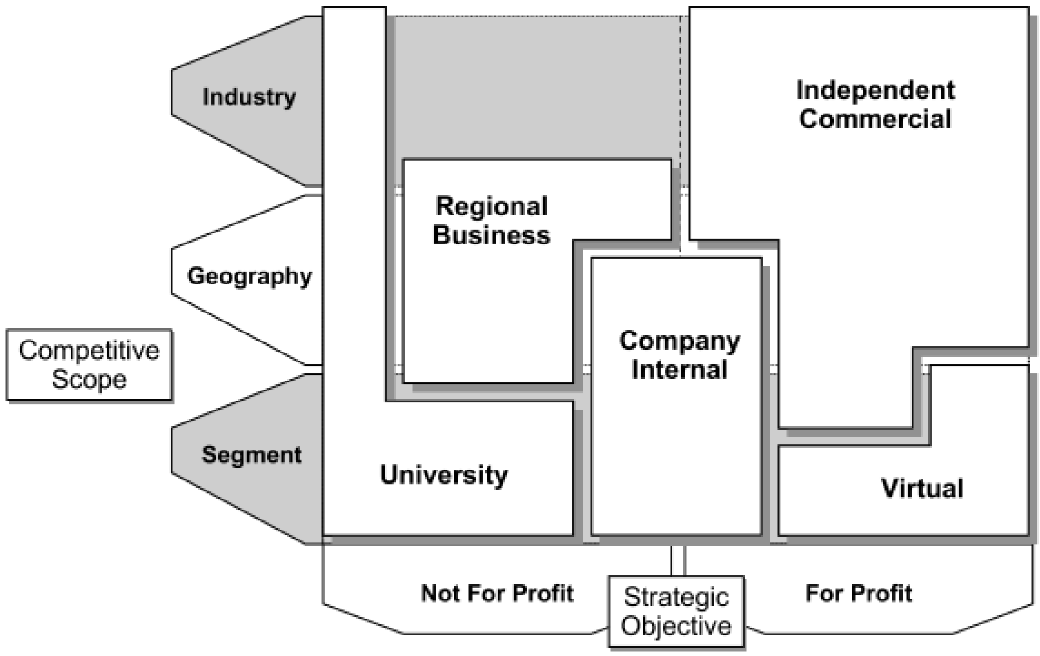


Figure B.2 - Classification of incubators, based on Zedtwitz (2003)

The KSTE focuses on transforming new knowledge into economic knowledge and depends on the level of absorptive capacity (Nieto and Quevedo, 2005). This considers investments and R&D competencies generated from the incubators' entrepreneurial opportunities (Zvi Griliches, 1992; Adams and Griliches, 1996; Markovitch, O'Connor and Harper, 2015).

B.3: Email sent to CEOs and Co-founders of conducting interviews

Dear <<First Name>>,

I am a doctoral researcher at the University of Westminster. I am currently researching high-tech start-ups and the effects of knowledge during an incubator programme being supervised by Dr. Richard Evans (https://goo.gl/8ZZflu), Dr. Maria Granados (https://goo.gl/BuF1xZ) and Prof. Alan Pilkington (https://goo.gl/srE1aP).

As part of my Project, I am researching the survival of entrepreneurs in incubators and accelerator programmes. The focus is to uncover how knowledge enables innovation and survival of start-ups and what are the most impactful mechanisms and awareness to implement knowledge towards innovation and obtain funding in high-growth cities such as London.

The aim is to create a statistical supported model that can explain the impact of relevant variables that affect start-ups during their first to seven years of operation.

I would like to know if you had a couple of minutes to discuss a possible interview meeting that I could have with you in accelerator or office for my research analysis. The incubator will provide a tea for the meeting.

I am open to having a brief called meeting via mobile or skype to discuss the requirements and about my research. You can contact me via email or on my mobile.

Assistance on the matter would be much appreciated.

Start-ups, incubators and accelerator programmes that collaborate on my research will have access to discuss the findings of my investigation. All information collected will remains anonymous.

I am looking forward to your response.

Kind Regards,

Marco Cuvero, Visiting Lecturer, Doctoral Researcher,University of Westminster.

cuverom@my.westminster.ac.uk

B.4- Qualitative data strategy and research question protocol

The qualitative data analysis of the material consists of integrating the data collected from the interviews transcribed with the start-ups (Creswell and Plano Clark, 2018). These materials were checked on accuracy and entered in the qualitative data analysis software NVivo 12 (Creswell and Plano Clark, 2018). The procedure utilized to elaborate in this chapter is defined in table B.2.

Table B.2 - Recommended qualitative data analysis procedures for qualitative data analysis. Based on Creswell et al.,(2018).

Persuasive Qualitative Data Analysis Procedures
• Organise documents and visual data • Transcribe text • Prepare the data analysis with a computer program
• Read through the data. • Write memos. • Develop qualitative codebook
• Code the data. • Assign labels to codes. • Group codes into themes (or categories). • Interrelate themes (or categories) or abstract to a smaller set of themes. • Use qualitative data analysis software programs.
• Represent findings in discussions of themes or categories. • Present visual models and tables.
• Assess how the research questions were answered. • Compare the findings with the literature. • Reflect on the personal meaning of the findings. • State new questions based on the findings.

The initial assessment of the research can be inductive or deductive. In a deductive approach, the focus is to structure initial research questions and proposed theoretical propositions that guide the research analysis (Saunders, Lewis and Thornhill, 2016). These concepts are defined through a developed conceptual map that guides the development of the interview guide. In the case studies, research guides are meant to collect the required data to start evaluating the research question (Yin, 2006, p74). The questionnaire has to include the names of the interviews, organizations, or observations to compare types of entrepreneurs and their background (Yin, 2006, p74).

An interview guide's quality assessment was conducted through pilot-tests using the interview guide (Maxwell, 2013). The questions asked in the case study adjusted to the company from a particular background, from a specific program set to be involved in a particular market (J A Maxwell, 2013). For instance, the analysis starts with broad grand tour questions that apply to all start-ups. Focused questions are aligned to expand on for particular issues. Probe questions extend the interviewees' answers to aim for a more specific set of details (Hadzilias, 2011, p20).

The interview guide First begins with broad questions about entrepreneurs' background, and demographics serve as a conduit to compare categories (Tashakkori and Teddlie, 2010). The integration of responses evaluated with queries using Nvivo 12 (Tashakkori and Teddlie, 2010).

Qualitative research's reliability can be obtained by covering replicability answers from the interviewees or using within or between-method triangulation to analyse multiple perspectives (Yin, 2003; Strang, 2015). This process seeks to reach theoretical and literal replication from the entrepreneurs' responses (Yin, 2003). These serve as a starting point and a requirement to establish the final interview guide, which requires initial data collection and analysis (Creswell, 2012). For that purpose, also, to cover the development of the research question with “what,” “why,” and “how” and “where.” The aim is to capture the entrepreneurs' thought process (Bryman and Bell, 2015; Strang, 2015).

The analysis section seeks to identify research issues and inferences through induction until saturation is reached (Hennink, Hutter and Bailey, 2011). The deductive method's adequate approach is to identify a pattern matching that enables to develop propositions, dependent, and independent variables (Saunders, Lewis and Thornhill, 2016). The collection of data will also consider the firm or organizational-level (Yin, 2003). (See figure B.3).

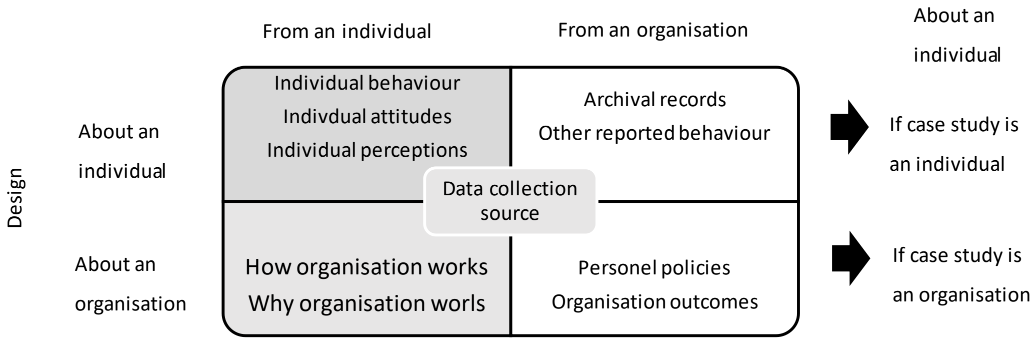


Figure B.3 - Design and data collection of multiple case studies. Based on Yin et al., (2003).

B 4.1. Identification of themes and concepts

The initial description of variables would be continuously be covered in the deductive conceptual cycle, where the literature and qualitative data collected is analysed according to the advance of the research. Identifying concepts and variables linked from the literature review are formulated into case study questions, where the selection of items that aim to uncover the perception of start-ups from different industries and uncover the differences between the multiple cases studied (Yin, 2003; J A Maxwell, 2013). The research guide's structure is to develop a set of questions that enables to establish the propositions of the model, which are the statements obtained based from the previous theories (J A Maxwell, 2013).

For that purpose, the collection of data through interviews has to be realised, bearing in mind that the inquiry line is focused on identifying knowledge spillovers effects while remaining unbiased (Yin, 2003). Qualitative research is recommended to have two central questions and a subset of five to seven sub-questions for each one of the sections (Creswell, 2014). In the case of studies, the focus is to explore a process that falls in this category as the absorption, transformation, and implementation of knowledge spillovers. The following illustration presents the position of case study methods (Strang, 2015). This research started with the planned pragmatic cases from Eisenhardt, as shown in figure B.4.

The information classification will fall under categories previously identified through patent matching and organised quotes (Yin, 2003). This approach enables to put the qualitative data in categories established in a set chronology tabulated (Yin, 2003). The end possible outcome from using a highly deductive positivistic approach, which transitions on a more inductive creation of a model, was the formation of propositions and plausible hypotheses narrowed down between interactions on analysed case studies (Strang, 2015).

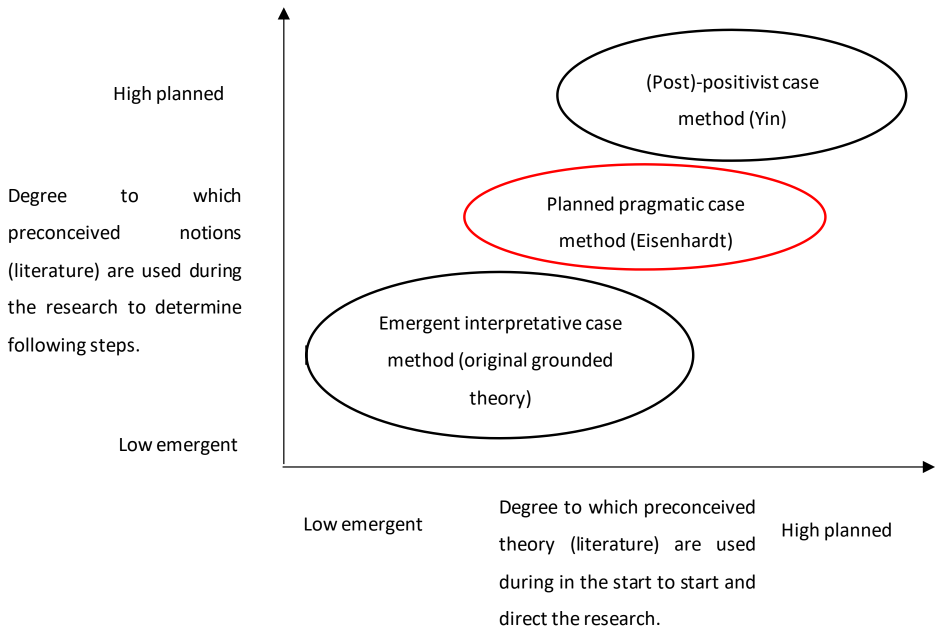


Figure B.4 -Case studies, based on Kenneth et al., (2015).

The area of entrepreneurship and knowledge spillovers is well renowned for understanding the effects at the regional levels or research conducted on the United States and Europe (Renski, 2014; Kontolaimou, Giotopoulos and Tsakanikas, 2016). The collection of multiple case studies would allow the collection of understanding the phenomenon of knowledge spillovers and entrepreneurial ecosystems (Audretsch and Belitski, 2017).

The research considers entrepreneurs who have founded high-tech companies and have experience in incubators and accelerator programmes (Denzin and Lincoln, 2018). The structure of the interview guide has to cover aspects of (1) questions that uncover the meaning of knowledge spillover events with organisations and individuals involved on the case, (2) The influence of the incubator or accelerator programmes that provide a context of physical proximity with other companies and other sources of knowledge in Greater London, and (3) assessment of the processes and mechanism to absorb and implement knowledge (J A Maxwell, 2013). The types of question used in the research are stated in table B.3.

Table B.3 - Description of types of research questions established by levels. Based on Yin (2003).

Level of question	Types of research questions
Level 1	Questions that are asked to specific types of entrepreneurs by industry
Level 2	Questions asked of the individual case, which needs to be assessed by the researcher
Level 3	Questions required to identify patterns across the multiple cases
Level 4	Questions that market to identify the relation of the KSTE with other relevant theories, models and conceptual frameworks
Level 5	Normative questions about possible policy recommendations and other topics that go beyond the scope of the research

Levels develop this type of research questions formulated for the interview guide is linked to the initial theories and models. For instance, the classification of research questions is realised by main topics or sets of questions to maintain coherence on the questionnaire structure (Hennink, Hutter and Bailey, 2011). Every set of questions is linked to developing hypotheses and propositions that remain tested (Creswell, 2012).

The construction of the interview guide is classified first by the standard structure of the interview guide which is first to set the structure which is: (1) introduction to the research, were the researcher brings a brief description of the types of research questions to be tested in the research, (2), opening questions, which are used to cover the broad set of questions and to build rapport with the interviewee, (3) key questions, which are focused on identifying knowledge spillovers events and theories developed during the creation of the new company, and (4) closing questions, which are used to determine the plans of the company, which may lead to a process of creative destruction or creative construction (Hennink, Hutter and Bailey, 2011). Questions can also include probes, closed questions, and comparison questions to identify the data required to understand the knowledge spillovers phenomenon (Hennink, Hutter and Bailey, 2011; Collis and Hussey, 2014; Saunders, Lewis and Thornhill, 2016). The types of research questions in the interview guide defined in Table B.4.

Table B.4 - Types of research questions defined by use and implementation. Based on Hennik et al., (2011).

Types of questions	Useful for	Not useful for	Section used and direction
Open questions	Opening to explore and gather broad information	Responses can be affected if the participant is talkative	Introduction and opening questions
Closed questions	Getting more factual information on knowledge spillover type and source	Obtaining a broad perspective of knowledge spillovers phenomenon	Identify knowledge spillovers and mechanisms and tools used to transform knowledge
Multiple questions	Not useful	Not useful	Not used
Probes	Gather information on the sequence of the events during the analysis	Exploring sensitive events	Identify the flow of knowledge spillovers
Hypothetical questions	Encourage the interviewee to engage in broad thinking	Explore broad thinking propositions beyond the scope of the research	Test to expand on the possible mechanisms used beyond geographical proximity
Comparison questions	Explore the needs to capture knowledge spillovers	Not to set unrealistic alternatives	Seeks to identify types of knowledge spillovers captured and transformed by entrepreneurs
Summary questions	Validation of the data realised and used to identify patterns	Frequent use and to start the question	Set a summary of answers provided by the interviewees

The formation of the types of questions is to set an initial illustration of a conceptual framework that can seek replicability of previously conducted studies (Yin, 2003). Probe questions used to extend the initially proposed framework to identify variables and hypotheses that support the quantitative phase (Yin, 2003; Strang, 2015). The selection of semi-structured interviews enables to cover case summaries to support and contrast the effects of knowledge spillovers from the most relevant authors and articles and recent publications that extend the established theory (Burns, 2000).

B.5: Interview Guide

Questions	Supporting literature	Type of Question
Opening Questions		
1. What is the name of your company and what industry do you operate?	Fritsch et al., (2017); Audretsch et al., (2015); Nieto et al., (year), Tsvetkova et al., (2014), Figueiredo et al., (2012); Helmers et al., (2010); Narula et al., (2009).	Open, Level 1
2. What encouraged you to start a new company and product?	Hervas-Oliver et al., (2017); Collombelli et al., (2016); Montoro-Sanchez et al., (2011); Fritsch et al., (2017); Figueiredo et al., (2013);	Open, Level 2
2.1. What enabled you to set an estimated value for your company's idea and product?	Nieto et al., (2005), Markovitch et al., (2015); Glaeser et al., (year), O'Gorman (2008)	Open, Probe
3. How were the initial ideas for your company identified?	Nieto et al., (2005), Montoro-Sancez et al., (2011); Ries et al., (2011); Glaeser et al., (year); O'Gorman (2008); Wennberg et al., (2011).	Key Question, Level 3
4. What is your opinion on starting a business in an urban city such as London?	Tsvetkova et al., (2014); Colombelli et al., (2016); Nieto et al., (2005); Kenney et al., (2005); Fritsch et al., (2017),	Open, Level 1
4.1. Why did you choose this location for the programme?	Kenney et al., (2005); Henri et al., (2008).	Open, Probe
5. What is your opinion on the importance of the team in your organisation?	Fritsch et al., (2017); Qian et al., (2017); Audretch et al., (2015); Tsvetkova et al., (2014), Nielsen et al., (2014); Stam (2013); Audtretsch et al., (2010); Beugelsdijk (2007);	Open, Level 1
5.1. How does the business hold collaboration with other start-ups?	Bouncken et al., (2017); Ellison et al., (2010).	Open, Level 2
Background of the Entrepreneurs		
6. Can you tell me about your academic and professional experience?	Audretsch et al., (2015); Lasch et al., (2013); Oort et al., (2004);	Open, Level 1
7. What can you tell me about your experiences about innovations in product or improvement of operations?	Nicolopoulou et al., (2017); Audretsch et al., (2012); Huang et al., (2012); Montoro-Sanchez et al., (2011); Woodward et al., (2006). Audretsch et al., (2005).	Open, Level 2
7.1. Where professional, academic, entrepreneurial, which one exactly?	Stam (2013); Rothaermel et al., (2004).	Probe, Level 3
8. What interactions have you had with entrepreneurs that come from a different country?	Markovitch et al., (2015); Audretsch et al., (2010); Rodriguez-Pose et al., (2014), Lasch et al., (2013); Stuetzer et al., (2017)	Key Question, Level 3
9. What interactions have you had with entrepreneurs professionals that come from a different background?	Markovitch et al., (2015); Colombelli (2016); Rodriguez-Pose et al., (2014); Stuetzer et al., (2017); Bouncken et al., (2013).	Open, Level 1
10. What is your perception of the interactions with entrepreneurs?	Bouncker et al., (2013); Schmidt (2015); Petruzzelli et al., (2007); Shu-Chun et al., (2011)	Open, Level 1
11. How has the performance of a company been changed during the programme?	Nicolopoulou et al., (2015); Clarysee et al., (2005); Qian et al., (2017); Vanderstraeten et al., (2010); Hausberg et al., (2017)	Open, Level 1

Questions	Supporting literature	Type of Question
Incubators, Accelerator Programmes and Networking		
12. How has networking events and other gatherings expanded your network?	Hervas-Oliver et al., (2017); Cantu (2017); Hayter (2013); Montoro-Sanchez et al., (2011); Kenney et al., (2005).	Key Question, Level 3
12.1. Organisations, entrepreneurs, academics?	Hervas-Oliver et al., (2017); Cantu (2017).	The probe, Level 1
13. What about the knowledge you could collect from these new connections and events attended?	Cantu et al., (2017); Connell et al., (2014); Narula et al., (2007); Wong et al., (2007);	Open, Level 1
13.1. About the characteristics of products or processes? Where these expanded in the incubator or accelerator programme?	Cantu et al., (2017); Wong et al., (2007).	The probe, Level 2
14. What type of knowledge or information have you been able to collect from these sources?	Cantu et al., (2017); Connell et al., (2014); Wong et al., (2007).	Open, Level 1
14.1. Technical knowledge? Marketing knowledge? International knowledge?	Cantu et al., (2017); Wong et al., (2007).	The probe, Level 2
15. What kind of recourses have you being able to collect from these connections	Cantu (2017); Lockett et al., (2015); Fritsch et al., (2015); Hayter (2015)	Open, Level 1
15.1. Products? New locations? Human capital?	Cantu (2017); Lockett et al., (2015); Fritsch et al., (2015); Hayter (2015)	The probe, Level 2
16. Where you able to recognise new knowledge that might apply to your company?	Audretsch et al., (2017); Wong et al., (2007).	Open, Level 1
16.1. From entrepreneurs? Companies? Universities? Incubators? Accelerators? Other sources?	Cantu et al., (2017); Wong et al., (2007).	The probe, Level 1
17. What type of knowledge have you been able to gather from the incubator/accelerator inadvertently?	Antu et al., (2017); Narula et al., (2007).	Open, Level 2
17.1. Was it a face to face interaction or virtual exchange of knowledge?	Connell et al., (2014); Petruzzelli et al., (2007)	Probe, Level 2
18. What is your perception about the potential competition on the programme?	Bouncker et al., (2013); Wong et al., (2007); Shu et al., (2013); Hayter (2013).	Open, Level 1
Knowledge Spillovers and Innovation		
19. What is your understanding of the term spillover regarding the sharing of knowledge?	Cantu (2017); Amoroso et al., (2017); Lasch et al., (2013) Montoro-Sanchez et al., (2011); Shu-Chun et al., (2011); Nieto et al., (2004); Verspagen (1997).	Key Question, Level 1
19.1. Would you give an example?	Cantu (2017); Amoroso et al., (2017); Lasch et al., (2013) Montoro-Sanchez et al., (2011); Shu-Chun et al., (2011); Nieto et al., (2004); Verspagen (1997).	Key Question, Level 3
20. What is your opinion about additional investment in Research and Development?	Nieto et al., (2005); Beugelsdjk (2007).	Open, Level 1
20.1. For exploring technological knowledge, for exploring the market?	Cantu et al., (2017).	Open, Level 1

Questions	Supporting literature	Type of Question
Knowledge Spillovers and Innovation (Cont)		
21. What is your opinion on the formation of new alliances and knowledge sharing?	Montoro-Sanchez et al., (2011)	Open, Level 1
22. What type of knowledge or information have you been able to collect from these sources?	Amoroso et al., (2017);; Markovitch et al., (2015); Montoro-Sanchez et al., (2011); Stam (2013) Kirchhoff et al., (2007)	Open, Level 1
22.1. Inside or outside the accelerator?	Markovitch et al., (2015)	Probe, Level 2
23. What type of channels or tools or methodologies have you used for gathering free knowledge?	Schmidt (2017); Kirchhoff et al., (2007); Oort et al., (2004).	Open, Level 1
23.1. What about the internet, e-commerce, ICTs?	Larsch et al., (2013); Oort et al., (2004).	Probe. Level 2
24. How is research and development conducted in your company?	Beugelsjk (2007); Fritsch et al., (2007)	Open, Level 2
24.1. Is in enabled through high-skilled employees, through investment?	Fritsch et al., (2017); Beugelsjk (2007), Nieto et al., (2005); Stam (2013).	Probe, Level 2
25. What have been the effects on your company of sharing knowledge and collaborating with other enterprises or entrepreneurs?	Montoro-Sanchez et al., (2011)	Open, Level 1
26. What unintended knowledge have you collected in your companies chain of value?	Cantu (2017); Amoroso et al., (2017); Lasch et al., (2013) Montoro-Sanchez et al., (2011); Shu-Chun et al., (2011); Nieto et al., (2004); Verspagen (1997);	Open, Level 1
26.1. What kind of knowledge was it? Was it free and unintentional? How about information from competitors?	Cantu (2017); Amoroso et al., (2017); Lasch et al., (2013) Montoro-Sanchez et al., (2011); Shu-Chun et al., (2011); Nieto et al., (2004); Verspagen (1997);	Probe, Level 2
27. What are your perceptions towards information identifiable from the transportation of products or materials?	Schmidt (2017); Montoro-Sanchez (2011).	Open, Level 1
28. What is your opinion about recruiting and letting members go from your company	Nieto et al., (2005); Beulesdjk (2007); Qian et al., (2017); Stam (2013)	Open, Level 1
29. What is your perception about the level of technical skills and background of your employees required in your company?	Audretsch et al., (2007); Fritsch et al., (2017); Qian et al., (2017); Stam (2013) ;Nieto et al., (2005); Beugelsdjk (2007)	Open, Level 1
29.1. What about their cultural diversity?		Probe, Level 2
30. How is the new knowledge evaluated and implemented in your company?	Schmidt (2017); Cantu (2017); Audretsch et al., (2005);	Open, Level 1

Questions	Supporting literature	Type of Question
Proximity and Location		
31. What do you think about the geographical location and population surrounding the incubator/accelerator in which you operate?	Cantu (2017); Amoroso et al., (2017); Lasch et al., (2013) Montoro-Sanchez et al., (2011); Shu-Chun et al., (2011); Nieto et al., (2004); Verspagen (1997);	Key Question, Level 1
31.1. What about the interactions with universities, companies, STPs?	Cantu (2017); Amoroso et al., (2017); Lasch et al., (2013) Montoro-Sanchez et al., (2011); Shu-Chun et al., (2011); Nieto et al., (2004); Verspagen (1997);	Key Question, Level 3
32. What is your opinion about additional investment in Research and Development?	Nieto et al., (2005); Beugelsdjk (2007).	Open, Level 1
32.1. For exploring technological knowledge, for exploring the market?	Cantu et al., (2017).	Key Question, Level 3
33. What do you think about access to Science and Technology Parks and universities?	Montoro-Sanchez et al., (2011)	Open, Level 1
34. What is your perception about developing your company in London?	Markovitch et al., (2015)	Probe, Level 2
Closing Questions		
35. What are your objectives at the end of the programme and for the following years?	Schmidt (2017); Kirchhoff et al., (2007); Oort et al., (2004).	Closing question, Level 1
36. What do you think about the market size and competition in your company's industry?	Larsch et al., (2013); Oort et al., (2004).	Closing question. Level 1
36.1. What about your company's survival and chances to enter the market?	Beugelsjk (2007); Fritsch et al., (2007)	Probe, Level 2
37. What are your thoughts on the programme and knowledge received?	Fritsch et al., (2017); Beugelsjk (2007), Nieto et al., (2005); Stam (2013).	Closing question, Level 1
38. What do you think about opening an initial public offering or patenting relevant knowledge	Montoro-Sanchez et al., (2011)	Closing question, Level 1

B.6: Email template sent to the entrepreneurs during the quantitative phase

Dear <<First Name>>,

My name is Marco Cuvero, and I am writing to introduce myself as a PhD Researcher at the University of Westminster. I am currently studying high-tech start-ups and the effects that knowledge can have during incubator programmes; my research is being supervised by Dr Maria Granados (https://goo.gl/BuF1xZ), Prof. Alan Pilkington (https://goo.gl/srE1aP) and Dr Richard Evans (https://goo.gl/8ZZfIu).

As part of my study, I am examining the survival rate for entrepreneurs in incubator and accelerator programmes. The focus of my work is to uncover how human and organisational knowledge enables innovation and survival of start-ups; also, what are the most significant mechanisms for utilising captured knowledge to encourage innovation and obtain investment in high-growth cities, such as London.

The aim is to create a statistically-supported model that can explain the impact of relevant variables that affect start-ups during the first years of operation.

To this end, I would like to invite you to be part of the research by completing the following survey, which should take approximately **5-10 minutes** to complete.

https://westminster.onlinesurveys.ac.uk/ks-survey

Please, could you aim to complete the survey by **Friday 19th April 2019**.

All data collected will be used for this research only and will not be shared with anyone outside of the research team at the University of Westminster. Names and information of the companies **will remain anonymous**. The findings of the research with statistical support will be provided to all companies which are part of this research.

I thank you in anticipation for completing the survey.

Should you have any queries, please feel free to contact me at M.cuverocalero@westminster.ac.uk.

Yours sincerely,

Marco Cuvero

PhD Candidate & Visiting Lecturer

University of Westminster

M: +447985786601

B.7: Survey Sent to Entrepreneurs

#	Dimension	Item	Literature	Scale
1	**Exploratory Innovation**	EXI1: We invent and develop new products and services.	Limaj et al. (2019), Zhongfeng et al. (2018), Enkel et al. (2017), Jansen et al. (2006).	(1-7 Likert scale: 1 = strongly disagree; 7 = Strongly Agree)
2		EXI2: We experiment with new products and prototypes that challenge existing ideas in the industry.	Limaj et al. (2019), Zhongfeng et al. (2018), Enkel et al. (2017), Jansen et al. (2006).	
3		EXI3: We developed new products and prototypes that are completely **new to our company**.	Limaj et al. (2019), Zhongfeng et al. (2018), Enkel et al. (2017), Jansen et al. (2006).	
4		EXI4: We explore new opportunities in new markets.	Limaj et al. (2019), Zhongfeng et al. (2018), Enkel et al. (2017), Jansen et al. (2006).	
5		EXI5: Our company use new distribution channels.	Limaj et al. (2019), Zhongfeng et al. (2018), Jansen et al. (2006).	
6	**Exploitative Innovation**	EPI1: We continuously extend the offerings of existing products and services.	Limaj et al. (2018), Enkel et al. (2017), Jansen et al. (2006)	(1-7 Likert scale: 1 = strongly disagree; 7 = Strongly Agree)
7		EPI2: We implement small adaptations to existing products and services	Limaj et al. (2018), Enkel et al. (2017), Jansen et al. (2006)	
8		EPI3: We continuously launch improved characteristics of existing products and services to the market	Limaj et al. (2018), Enkel et al. (2017), Jansen et al. (2006)	
9		EPI4: We improve our efficiency in the delivery of products and services	Limaj et al. (2018), Enkel et al. (2017), Jansen et al. (2006)	
10		EPI5: Our success is based on our capability to optimize existing technologies	Limaj et al. (2018), Enkel et al. (2017), Jansen et al. (2006)	
11	**Potential Absorptive Capacity**	PAC1-AQS1: We search for external information for new technologies.	Tzokas et al. (2015), Limaj (2016)	(1-7 Likert scale: 1 = strongly disagree; 7 = Strongly Agree)
12		PAC-AQS2: Our employees visit other branches or companies.	Flor et al. (2018), Tzokas et al. (2015), Ferreras-Mendez et al. (2016)	
13		PAC-AQS3: We encourage our employees to identify and use external information sources.	Ferreras-Mendez et al. (2016), Lo et al. (2015), Tzokas et al. (2015),	
14		PAC-AQS4: We periodically have frequent meetings with customers or third parties to acquire new technological knowledge	Jansen et al. (2005). Ferreras-Mendez et al. (2016)	
15		PAC-AQS5: We collect business and technological knowledge through informal means (e.g. lunch with industry friends, talks with trade partners).	Ferreras-Mendez (2016), Lo et al. (2015), Jaspers. (2002)	
16		PAC-ASM1: We regularly organise and conduct internal meetings in the company to discuss new findings.	Limaj et al. (2019)	
17		PAC-ASM2: We work together across the company to interpret and understand external information.	Limaj et al. (2019), Jansen et al. (2005), Enkel et al. (2017)	
18		PAC-ASM3: External information is shared between employees.	Limaj et al. (2019). Enkel et al. (2017)	
19	**Realised Absorptive Capacity**	RAC-TRM1: We are proficient at recording and storing relevant information for future reference	Limaj et al. (2019), Ferreras-Mendez et al. (2016),	(1-7 Likert scale: 1 = strongly disagree; 7 = Strongly Agree)
20		RAC-TRM2: We quickly analyse and interpret changing demands for our product development	Ferreras-Mendes et al. (2016), Tzokas et al. (2015)	
21		RAC-TRM3: New opportunities to provide our customers with existing technologies are quickly understood.	Flor et al. (2018), Ferreras-Mendez et al. (2015), Tzokas et al. (2015),	
22		RAC-TRM4: We quickly recognize the usefulness of new external knowledge to existing knowledge.	Flor et al. (2018), Ferreas-Mendes et al. (2016), Tzokas et al. (2015), Flatten et al., (2011), Jaspen et al. (2005)	
23		RAC-EXP1: We quickly recognise new technologies in new product prototypes and ideas.	Limaj et al. (2019), Tzokas et al. (2015), Ferreras-Mendes et al. (2016), Flatten et al., (2011)	
24		RAC-EXP2: We constantly consider how to exploit knowledge better.	Ferreras-Mendez et al. (2016), Tzokas et al. (2015), Limaj et al. (2019), Lau et al. (2015), Flatten et al. (2011)	
		We combine external and internal resources into novel configurations	Ferreras-Mendez et al. (2016), Tzokas et al. (2015)	
25		RAX-EXP3-Employees share a common language to refer to our products and services.	Flor et al. (2018), Lau et al. (2015),	
26	**Network Spillovers**	In your perception in your company's industry, your start-up can easily expand their knowledge by NKS1: Reading and following white papers.	Amoroso et al. (2017), Foss et al. (2013), Sisodiya et al. (2013), Faria et al. (2010), Cassiman et al. (2002)	(1-7 likert scale: 1 = "not at all"; 7 = "to a large extend")
27		NKS2: Participating in and attending conferences, presentations, trade fairs, or exhibitions.	Amoroso et al. (2017), Foss et al. (2013), Sisodiya et al. (2013), Faria et al. (2010), Cassiman et al. (2002)	
28		NKS3: Subscribing to scientific journals or trade/technical publications or patents.	Amoroso et al. (2017), Foss et al. (2013), Sisodiya et al. (2013), Faria et al. (2010), Cassiman et al. (2002)	
29		NKS4: Interacting with other companies or associations within the industry.	Amoroso et al. (2017), Foss et al. (2013), Sisodiya et al. (2013), Faria et al. (2010), Cassiman et al. (2002)	
30		NKS5: Accessing Online Communities	Amoroso et al. (2017), Foss et al. (2013), Faria et al. (2010), Cassiman et al. (2002)	

	Dimensions	Items	Literature
		Please evaluate the importance to access the mentioned sources of knowledge for exploring new business opportunities.	
31	Incoming Knowledge Spillovers	INK1: Other companies or start-ups	Hájek et al. (2018), Amoroso et al. (2017), Ferreras-Mendez et al. (2016), Lau et al. (2015), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)
32		INK2: Suppliers of equipment, materials, components or software	Ferreras-Mendez et al. (2016), Hájek et al. (2018), Amoroso et al. (2017), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)
33		INK3: Clients or customers	Ferreras-Mendez et al. (2016), Hájek et al. (2018), Amoroso et al. (2017), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)
34		INK4: Competitors and other companies from the same industry	Ferreras-Mendez et al. (2016), Hájek et al. (2018), Amoroso et al. (2017), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)
35		INK5: Universities or research institutions.	Ferreras-Mendez et al. (2016), Hájek et al. (2018), Amoroso et al. (2017), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)
36		INK6: Consultants	Ferreras-Mendez et al. (2016), Hájek et al. (2018), Amoroso et al. (2017), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)
37		INK7: Government or private non-profit research institutes	Ferreras-Mendez et al. (2016), Hájek et al. (2018), Amoroso et al. (2017), Chen et al. (2011), Montoro-Sanchez et al. (2011), Belderbos et al. (2004), Kaiser (2002)

	Control variables	Item	Literature
38	Firm size	Log number of full-time employees (1-9, 10-49, >50)	Ferreras-Méndez et al. (2016), Alnuaimi et al. (2016), Jong et al. (2015), Kostopoulos et al. (2011)
39	Firms age	Log number of years since founding (1-3, 4-6, 7-8, 9-10)	Jin et al. (2018), Santoro et al. (2018), Alnuaimi et al. (2016), Kostopoulos et al. (2011)
40	Attended an incubator/accelerator programme	Dummy variable	Rothaermel et al. (2004)
41	Industry	High-Tech: NACE 244 (pharmaceuticals), 30 (Office Machinery and Computing), 32 (Radio, TV and Communication equipment), 33 (Medical, Precision, and Optical Instruments, 353 (Aircraft and spacecraft);	Zhongfeng et al. (2018), Faria et a. (2010), Doloeux et al. (2007)
42		Information technology, electronics, electric equipment, pharmaceuticals, software development).	Jin et al. (2018)
43		TKIBS (Dummy): NACE 61 (Telecommunications), 62 (Computer programming, consultancy and related activities), 64 (Financial service activities, except insurance and pension funding), 65 (Insurance, reinsurance and pension funding, except compulsory social security), 66 (Activities auxiliary to financial services and insurance activities), 67 72 (Scientific research and development), 73 (Advertising and market research), 74 (Another professional, scientific and technical activities).	
44	Market type	(1 = local, regional market, 2 = operating in market in neighbour country, 3 = operating in national marker, 4 = operating in international market)	Kostopoulos et al. (2011)
45	Ownership	UK owned firm (1 = if the company is in a UK local firm; 2 = if the company is a foreign firm)	Abdullahi et al. (2017), Su et al. (2014)
46	Incubator/Accelerator	IN/AC: Have you attended an incubator or accelerator programme in the United Kingdom? (1= Yes, 2 = No)	
47	Diversification	17. Is the company diversified (Example: has multiple businesses with coherent product/market combinations) (1 = yes; 0 = no)	Zobel et al. (2016)
48	Startup experience	Did you have experience with start-ups before starting to work in the company? (1=Yes, 2=No)	Song et al. (2017)
49	Work experience in the same industry	Did you have experience with start-ups before starting to work in the company? (1=Yes, 2=No)	Song et al. (2017)

B.8: Quantitative Analysis of Statistical Methods

B.8.1. Exploratory Factor Analysis

B.8.1.1. Extraction of factors

The first test to conduct while developing the EFA is to evaluate the **Kaiser-Meyer-Olkin (KMO)** measure of adequacy, which has to be between 0.5 and 1 (A Field, 2018). KMO values above 0.8 are considered to be very good to support the development of an accurate model. This indicator evaluates if the sample size is sufficient and adequate to conduct a factor analysis (Malhotra, 2020). **Bartlett's sphericity statistics tests** need to be significant by showing a value that has to be less than 0.5 (A Field, 2018). This test is appropriate to identify if the model would hold problematic variables in the model early on. Next, the analysis requires to evaluate the **eigenvalues** assessing the reduced correlation matrix (Brown, 2015). These indicators, alongside the eigenvectors, enable summarising the variations of the variance-correlation matrix (Brown, 2015). This analysis extracts the model's factors and assesses the ratio of correlation between each group and between the groups using the sum of squares (Ullman and Bentler, 2003; Masaki M., 2011; Malhotra, 2020). The variables' eigen values have to be equal to or larger than zero (Benitez et al., 2020).

The SPSS output of total variance explained also indicates the cumulative percentage of all the factors identified (A Field, 2018). All the factors extracted from the analysis have eigen values above one. The EFA also calculates the **communalities** in the model, explaining the proportion of existing variances in every variable (A Field, 2018). This effect is also dependant on the factors with strong commonalities that present better determinacy (Brown, 2015). For an adequate model, all the variables need to have values bellow 0.5 (A Field, 2018).

The EFA also conducts the extraction of factors through principal components (Masaki M., 2011). In this extraction, all the components' variances are considered and are used to identify the required minimum factors that determine the model's maximum variance (Malhotra, 2020). On the other hand, principal axis factoring is used when the objective is to identify the underlining dimensions or constructs with common variance among the items (Malhotra, 2020). The communalities are located among the correlation matrix diagonal and align latent factors (Masaki M., 2011; Malhotra, 2020).

Although most research aligns to principal components for its alignment with conducting CFA on SPSS-AMOS, it is recommended to try both extraction methods until factors are identified with no common variables among factors (Costello and Osborne, 2005). The extraction of factors suppressed coefficients with values bellow 0.3 (A Field, 2018). The pattern matrix also enables to identify which variables load to each one of the factors, and adjuncts when the division shows cross-loadings (A Field, 2018).

B.8.1.2. Rotations

The analysis also requires to rotate the extracted factors to clarify its interpretation (Brown, 2015). The orthogonal rotation or Varimax enables the researcher to easily assess the correlations within factors and show simple correlations (Brown, 2015). In this scheme, the axes maintained at ninety degrees (Hair et al., 2012). Varimax focuses on maximising the loadings dispersions within and across a model's factors (A Field, 2018). This initial assessment is good, to begin with, but can cause problems when factors are related to each other, common in management studies (Masaki M., 2011).

The factors' assessment can also conduct an oblique rotation, where the factor matrix is separated into a pattern and structure matrix (A Field, 2018). This method enables to maintain a consistent analysis when implementing a CFA (Masaki M., 2011). These rotations allow the factors to intercorrelate with rotations bellow ninety degrees (Brown, 2015). This method can cause to inflate the variation between factors, causing to illustrate a real representation of the variables assessed between constructs evaluating similar activities in start-ups (Brown, 2015).

The EFA in this research was conducted with a Promax rotation, which enables to gather the varimax solution and raise the loadings of the factors to a power kappa (Masaki M., 2011). Also, Promax rotations are appropriate when the study uses a large dataset (A Field, 2018). The researcher processed to evaluate the variables to make sure that all variables are loaded only on one factor in the pattern matrix. The extraction and rotations used to identify the most appropriate selection of variables for the model KTS-CNCM developed in Chapter V.

The evaluation of the factors is conducted by evaluating the correlation matrix, and making sure that the factors do not exceed the value of 0.7 (Costello and Osborne, 2005; Brown, 2015; A Field, 2018). It is also feasible to conduct an individual EFA on the first and second-order factors and to remove the variables that affect the overall Cronbach's Alpha factor of the construct (Lowry and Gaskin, 2014). This indicator enables to evaluate the scale of reliability of each factor (Landstrom, Harirchi and Astrom, 2012; Brown, 2015). Cobranch's Alpha values for each construct should be between 0.7 and 0.9 (Hair et al., 2016; A Field, 2018). The Harman's single factor test used to evaluate if a single factor obtained from the factor analysis and its accountability for the covariance among variables (Podsakoff et al., 2003).

B.8.2. Partial Least Squares Structural Equation Modelling

B.8.2.1. Evaluation of reflective-formative models

The first step is to evaluate the composite reliability and validity of the model. Like the CFA, the model produces **Cronbach's Alpha** values for the reflective constructs, which is a measure of composite reliability when the with acceptable values of 0.6 to 0.7 when conducting exploratory research (Hair et al., 2016). However, it is recommended to obtain values allocated between 0.7 and 0.9 (Hair et al., 2017). Similarly, the convergent validity of the reflective constructs by evaluating outer loadings is assessed through the average variance extracted (AVE). The explained variance of the factors should explain a minimum of 0.5 to be statistically significant (Hair et al., 2016). The composite indicators assess the consistency of reflective constructs evaluated between 0 and 1 and are evaluated similarly to Cronbach's alpha (Hair et al., 2016).

The model's formative constructs were evaluated through the **Variance Inflation Factor** (VIF) (O'Brien, 2007). This statistic assesses multicollinearity with other independent variables. The evaluation considers if the remaining variables explain the construct's invariance (Hair et al., 2017). For this test, the maximum threshold for the formative construct variables should not exceed a value of 10 (Lowry and Gaskin, 2014). The construct's assessment could be even more rigorous by making sure that the values do not exceed 3.3 (Lowry and Gaskin, 2014). The analysis proceeds by evaluating the variables' outer weights to assess its contribution to the model (Hair et al., 2016). The paths are evaluated through a generated p-value for every variable, which has to be below 0.05 to be statistically significant.

The statistical software used the PLS-SEM algorithm estimates all the established PLS path model elements using what is known from the data (Hair, 2018). The analysis determines an allocated score for the constructs and conducts partial regressions (Hair, 2018). The procedure enables determining the loadings and path coefficients (Henseler, Ringle and Sarstedt, 2016). The analysis follows up by conducting bootstrapping with 5000 samples and a ninety-five percent interval (Hair, 2018; Benitez et al., 2020). The calculated paths are statistically significant when the p values are below 0.05. Also, the analysis produces a t statistic between paths that evaluate the regression coefficients statistically significant in contrast to the null hypothesis (O'Brien, 2007). Significant t statistics should have a t value equal to or above 1.96 (Hair et al., 2017).

B.8.2.2. Multiple Group Analysis

The research took into consideration the characteristics of the start-ups and background of the entrepreneurs. For that matter, the study considers that it may have different effects between groups (Becker et al., 2013). Observed heterogeneity between groups can be assessed based on the entrepreneur's education, gender, type of industry and diversification (Limaj and Bernroider, 2017; Zobel, 2017; Shafique and Kalyar, 2018). Thus, the research conducts a multiple group analysis and compares statistical significance differences between groups (Hair, 2018). The study between two groups can also conduct a parametric test by evaluating the differences between samples. Statistical significance is determined when the difference of variances produces a p-value bellow 0.05, or a t statistic above 1.96 (Hair, 2018).

Appendix C Data Preparation

C.1: Outliers identified from Mahalanobis test

ID	Mahalanobis distance	Probability
90	170.55389	0
557	115.09457	0
104	114.69161	0
293	110.21424	0
265	109.72066	0
581	106.78343	0
114	103.46181	0
537	101.4621	0
368	99.44056	0
15	98.04345	0
92	95.31681	0.00001
384	94.38583	0.00001
240	94.25069	0.00001
213	93.22058	0.00001
395	91.44626	0.00002
192	90.04742	0.00002
348	89.63254	0.00003
207	89.42085	0.00003
290	89.00842	0.00003
38	88.90986	0.00003
549	87.28946	0.00005
343	83.70838	0.00014
157	83.09871	0.00016
98	79.66008	0.0004
556	79.1093	0.00046
115	77.80658	0.00065
325	77.31964	0.00073
19	76.22229	0.00097

C.2: Skewness and kurtosis for the data

Variables	N Valid	N Missing	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
EXI1	556	0	-2.976	0.104	9.687	0.207
EXI2	556	0	-2.273	0.104	5.119	0.207
EXI3	556	0	-1.650	0.104	2.098	0.207
EXI4	556	0	-1.453	0.104	1.649	0.207
EXI5	556	0	-0.277	0.104	-0.937	0.207
EPI1	556	0	-1.232	0.104	1.184	0.207
EPI2	556	0	-1.178	0.104	0.401	0.207
EPI3	556	0	-0.990	0.104	0.139	0.207
EPI4	556	0	-1.133	0.104	0.960	0.207
EPI5	556	0	-0.588	0.104	-0.570	0.207
NKS1	556	0	-0.111	0.104	-1.018	0.207
NKS2	556	0	-0.551	0.104	-0.545	0.207
NKS3	556	0	-0.222	0.104	-1.005	0.207
NKS4	556	0	-0.813	0.104	0.331	0.207
NKS5	556	0	-0.408	0.104	-0.466	0.207
INKS1	556	0	-0.618	0.104	-0.272	0.207
INKS2	556	0	-0.282	0.104	-0.672	0.207
INKS3	556	0	-1.610	0.104	2.487	0.207
INKS4	556	0	-0.779	0.104	0.289	0.207
INKS5	556	0	-0.134	0.104	-1.114	0.207
INKS6	556	0	0.231	0.104	-0.925	0.207
INKS7	556	0	0.217	0.104	-1.071	0.207
PAC_AQS1	556	0	-1.068	0.104	0.868	0.207
PAC_AQS2	556	0	-0.129	0.104	-1.002	0.207
PAC_AQS3	556	0	-1.141	0.104	0.984	0.207
PAC_AQS4	556	0	-0.942	0.104	0.302	0.207
PAC_AQS5	556	0	-1.025	0.104	1.014	0.207
PAC_ASM1	556	0	-0.931	0.104	0.126	0.207
PAC_ASM2	556	0	-1.254	0.104	1.604	0.207
PAC_ASM3	556	0	-1.231	0.104	1.791	0.207
RAC_TRM1	556	0	-0.442	0.104	-0.414	0.207
RAC_TRM2	556	0	-0.967	0.104	1.139	0.207
RAC_TRM3	556	0	-0.930	0.104	0.587	0.207
RAC_TRM4	556	0	-0.998	0.104	1.122	0.207
RAC_EXP1	556	0	-1.152	0.104	1.359	0.207
RAC_EXP2	556	0	-0.837	0.104	0.345	0.207
RAC_EXP3	556	0	-1.008	0.104	0.955	0.207
RAC_EXP4	556	0	-1.129	0.104	1.559	0.207
TUR1	556	0	-1.124	0.104	0.914	0.207
TUR2	556	0	-0.414	0.104	-0.705	0.207
TUR3	556	0	-0.930	0.104	0.020	0.207
TUR4	556	0	0.016	0.104	-0.719	0.207
Respondents_age	552	4	-0.165	0.104	-0.300	0.208
Respondents_age_replaced	556	0	-0.166	0.104	-0.280	0.207
Respondents_age_I	556	0	-0.861	0.104	-0.274	0.207
Firm_size	556	0	3.315	0.104	14.162	0.207
Firm_size_Interval	556	0	0.510	0.104	-0.344	0.207
Firm_age	556	0	2.005	0.104	5.725	0.207
Firm_age_Interval	556	0	0.436	0.104	-1.114	0.207
Respondents_role	556	0	-2.259	0.104	3.609	0.207
gender	556	0	2.391	0.104	3.730	0.207
Startup_experience	556	0	-0.678	0.104	-1.546	0.207
Industry_experience	556	0	-0.619	0.104	-1.623	0.207
Education_I_MBA	556	0	-0.100	0.104	-0.820	0.207
Education_I	556	0	-0.614	0.104	-0.424	0.207
Industry	556	0	0.700	0.104	-0.695	0.207
Market_type	556	0	1.112	0.104	-0.421	0.207
Diversification	556	0	0.883	0.104	-1.225	0.207
Ownership	556	0	-8.178	0.104	65.109	0.207
IN_AC	556	0	-0.405	0.104	-1.843	0.207

Appendix D – Quantitative Analysis

D.1: Keiser-Meyer-Olkin (KMO) measure and communalities

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.893
Bartlett's Test of Sphericity	Approx. Chi-Square	5442.146
	df	190
	Sig.	0.000

Communalities

	Initial	Extraction
EXI1	1.000	0.745
EXI2	1.000	0.765
EXI3	1.000	0.704
EPI1	1.000	0.637
EPI2	1.000	0.756
EPI3	1.000	0.797
EPI4	1.000	0.565
RAC_TRM1	1.000	0.512
RAC_TRM2	1.000	0.691
RAC_TRM3	1.000	0.674
RAC_TRM4	1.000	0.683
PAC_ASM1	1.000	0.721
PAC_ASM2	1.000	0.830
PAC_ASM3	1.000	0.745
PAC_AQS2	1.000	0.726
PAC_AQS3	1.000	0.596
PAC_AQS5	1.000	0.547
RAC_EXP1	1.000	0.643
RAC_EXP2	1.000	0.603
RAC_EXP3	1.000	0.591

Extraction Method: Principal Component Analysis.

D.2: Total Variance Explained in the model

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.271	31.614	31.614	7.271	31.614	31.614	6.231
2	2.395	10.413	42.027	2.395	10.413	42.027	3.317
3	1.920	8.347	50.375	1.920	8.347	50.375	4.003
4	1.643	7.144	57.518	1.643	7.144	57.518	4.842
5	1.481	6.440	63.958	1.481	6.440	63.958	2.603
6	0.922	4.011	67.969	0.922	4.011	67.969	3.023
7	0.732	3.181	71.151				
8	0.709	3.082	74.232				
9	0.601	2.613	76.845				
10	0.579	2.519	79.364				
11	0.532	2.315	81.679				
12	0.501	2.179	83.858				
13	0.451	1.962	85.820				
14	0.448	1.949	87.769				
15	0.409	1.780	89.549				
16	0.392	1.706	91.255				
17	0.368	1.600	92.855				
18	0.339	1.473	94.328				
19	0.313	1.361	95.689				
20	0.292	1.272	96.960				
21	0.272	1.182	98.142				
22	0.235	1.020	99.161				
23	0.193	0.839	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

D.3: Pattern Matrix

Pattern Matrix

	Component					
	1	2	3	4	5	6
EXI1			.839			
EXI2			.910			
EXI3			.864			
EPI1		.770				
EPI2		.895				
EPI3		.891				
EPI4		.676				
RAC_TRM1	.760					
RAC_TRM2	.881					
RAC_TRM3	.901					
RAC_TRM4	.803					
PAC_ASM1				.920		
PAC_ASM2				.897		
PAC_ASM3				.721		
PAC_AQS2						.925
PAC_AQS3						.534
PAC_AQS5						.708
RAC_EXP1	.726					
RAC_EXP2	.678					
RAC_EXP3	.550					
TUR1					.848	
TUR2					.832	
TUR3					.786	

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

D.4: Reliability analysis of the Components

Exploratory Innovation

Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
EXI	0.823	0.831	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
EXI1	12.27	6.275	0.702	0.503	0.747
EXI2	12.48	5.576	0.702	0.507	0.731
EXI3	12.74	4.945	0.658	0.433	0.794

Exploitative Innovation

Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
EPI	0.840	0.839	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
EPI1	16.57	17.470	0.637	0.408	0.813
EPI2	16.69	14.767	0.721	0.559	0.777
EPI3	16.84	14.568	0.771	0.609	0.751
EPI4	16.53	18.596	0.580	0.347	0.836

Potential Absorptive Capacity - Assimilation

Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
PAC-ASM	0.836	0.845	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PAC_ASM1	11.58	5.469	0.630	0.415	0.860
PAC_ASM2	11.29	5.578	0.788	0.653	0.684
PAC_ASM3	11.14	6.587	0.708	0.582	0.776

Potential Absorptive Capacity - Acquisition

Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
PAC - AQS	0.639	0.651	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PAC_AQS2	11.17	5.018	0.453	0.209	0.565
PAC_AQS3	9.45	6.601	0.490	0.241	0.497
PAC_AQS5	9.67	6.990	0.434	0.195	0.568

Realised Absorptive Capacity

Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
RAC	0.885	0.887	7

Technological Turbulence

Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
TUR	0.752	0.759	3

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
RAC_TRM1	34.01	33.787	0.563	0.345	0.884
RAC_TRM2	33.36	33.507	0.730	0.571	0.862
RAC_TRM3	33.31	33.891	0.669	0.527	0.869
RAC_TRM4	33.30	33.064	0.744	0.565	0.860
RAC_EXP1	33.19	33.238	0.692	0.494	0.866
RAC_EXP2	33.34	33.078	0.693	0.505	0.866
RAC_EXP3	33.36	33.351	0.652	0.463	0.871

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
TUR1	10.33	6.841	0.676	0.464	0.575
TUR2	11.20	6.663	0.511	0.284	0.754
TUR3	10.62	6.491	0.571	0.383	0.680

D.5: Complete Parametric tests and bootstrapping results of incubation/accelerator attendance

Direct Paths	Path Coefficients-diff (| No attendance IN/AC - Attendance IN/AC |)	t-Value(No attendance IN/AC vs Attendance IN/AC)	p-Value(No attendance IN/AC vs Attendance IN/AC)	Path Coefficients Mean (No attendance IN/AC)	STDEV (Attendance IN/AC)	STDEV (No attendance IN/AC)	t-Values (Attendance IN/AC)	t-Values (No attendance IN/AC)	p-Values (Attendance IN/AC)	p-Values (No attendance IN/AC)
INKS -> EPI	0.024	0.13	0.897	0.94	0.007	0.01	133.618	98.626	0	0
INKS -> EXI	0.027	0.216	0.829	0.913	0.01	0.011	89.645	81.808	0	0
INKS -> PAC	0.203	2.295	0.022	0.908	0.01	0.016	91.11	55.256	0	0
INKS -> RAC	0.008	0.079	0.937	0.827	0.024	0.027	33.864	30.952	0	0
NKS -> EPI	0.088	0.565	0.572	0.506	0.048	0.069	12.62	7.544	0	0
NKS -> EXI	0.072	0.673	0.501	0.418	0.07	0.097	3.764	4.368	0	0
NKS -> PAC	0.168	1.873	0.062	0.37	0.052	0.072	3.891	5.123	0	0
NKS -> RAC	0.095	0.972	0.331	0.317	0.078	0.095	2.26	3.375	0.024	0.001
PAC -> AQS	0	0.01	0.992	0.149	0.054	0.072	2.294	2.009	0.022	0.045
PAC -> ASM	0.006	0.342	0.732	0.189	0.052	0.071	6.674	2.023	0	0.043
PAC -> EPI	0.016	0.127	0.899	0.122	0.045	0.064	3.309	1.95	0.001	0.051
PAC -> EXI	0.155	1.229	0.22	0.105	0.102	0.169	1.442	0.723	0.149	0.47
PAC -> RAC	0.084	1.008	0.314	0.102	0.067	0.113	2.184	1.056	0.029	0.291
RAC -> EPI	0.145	1.138	0.256	0.119	0.079	0.097	1.296	1.222	0.195	0.222
RAC -> EXI	0.158	1.318	0.188	0.115	0.053	0.078	1.594	1.429	0.111	0.153
RAC -> EXP	0.013	0.704	0.482	0.101	0.053	0.065	2.504	1.546	0.012	0.122
RAC -> TRM	0.005	0.398	0.691	0.096	0.058	0.089	1.111	0.814	0.266	0.416
TUR -> EPI	0.026	0.286	0.775	0.019	0.08	0.082	2.271	0.328	0.023	0.743
TUR -> EXI	0.021	0.231	0.817	0.025	0.054	0.086	1.558	0.118	0.119	0.906
TUR -> PAC	0.033	0.375	0.708	-0.14	0.063	0.086	1.539	1.965	0.124	0.049
TUR -> RAC	0.023	0.294	0.769	-0.158	0.098	0.105	0.966	1.739	0.334	0.082

Legend

Statistical diference

Close to the statistical difference

D.6: Complete Parametric tests for product diversification

Direct Paths	Path Coefficients-diff (| Diversified - Not diversified |)	t-Value(Diversified vs Not diversified)	p-Value(Diversified vs Not diversified)
INKS -> EPI	0.145	0.67	0.503
INKS -> EXI	0.097	0.782	0.434
INKS -> PAC	0.057	0.583	0.56
INKS -> RAC	0.266	2.786	0.006
NKS -> EPI	0.241	1.41	0.159
NKS -> EXI	0.02	0.19	0.85
NKS -> PAC	0.017	0.168	0.867
NKS -> RAC	0.088	0.911	0.363
PAC -> AQS	0.001	0.026	0.979
PAC -> ASM	0.005	0.313	0.754
PAC -> EPI	0.189	1.434	0.152
PAC -> EXI	0.289	2.335	0.02
PAC -> RAC	0.162	1.963	0.05
RAC -> EPI	0.054	0.41	0.682
RAC -> EXI	0.129	1.033	0.302
RAC -> EXP	0.004	0.18	0.857
RAC -> TRM	0.011	0.823	0.411
TUR -> EPI	0.045	0.461	0.645
TUR -> EXI	0.001	0.014	0.989
TUR -> PAC	0.085	0.874	0.382
TUR -> RAC	0.048	0.465	0.642

Statistical diference

Evidence of a reduced statistical effect

D.7: Bootstrapping results for product diversification

Direct Paths	Path Coefficients Mean (Diversified)	Path Coefficients Mean (Not diversified)	STDEV (Diversified)	STDEV (Not diversified)	t-Values (Diversified)	t-Values (Not diversified)	p-Values (Diversified)	p-Values (Not diversified)
INKS -> EPI	0.233	0.069	0.112	0.133	2.109	0.678	0.035	0.498
INKS -> EXI	0.08	0.172	0.117	0.064	0.704	2.809	0.481	0.005
INKS -> PAC	0.346	0.283	0.08	0.054	4.119	5.071	0	0
INKS -> RAC	0.24	-0.006	0.075	0.054	3.326	0.319	0.001	0.749
NKS -> EPI	0.057	-0.157	0.183	0.08	0.362	2.181	0.717	0.029
NKS -> EXI	-0.082	-0.109	0.08	0.062	1.243	1.938	0.214	0.053
NKS -> PAC	0.222	0.252	0.107	0.05	2.116	4.898	0.034	0
NKS -> RAC	-0.074	-0.025	0.085	0.051	1.427	0.658	0.154	0.511
PAC -> AQS	0.825	0.824	0.035	0.022	23.307	37.731	0	0
PAC -> ASM	0.922	0.916	0.016	0.009	57.84	105.311	0	0
PAC -> EPI	-0.018	0.174	0.107	0.073	0.192	2.306	0.848	0.021
PAC -> EXI	0.29	0.015	0.09	0.071	3.365	0.195	0.001	0.845
PAC -> RAC	0.445	0.622	0.083	0.041	5.612	15.493	0	0
RAC -> EPI	0.224	0.176	0.112	0.072	2.084	2.489	0.037	0.013
RAC -> EXI	0.24	0.367	0.105	0.068	2.32	5.447	0.02	0
RAC -> EXP	0.918	0.915	0.017	0.011	54.889	86.173	0	0
RAC -> TRM	0.949	0.939	0.011	0.007	85.149	136.35	0	0
TUR -> EPI	0.109	0.067	0.085	0.054	1.326	1.245	0.185	0.213
TUR -> EXI	0.118	0.13	0.091	0.051	1.434	2.6	0.152	0.009
TUR -> PAC	0.063	0.14	0.084	0.053	0.692	2.719	0.489	0.007
TUR -> RAC	0.161	0.135	0.118	0.045	1.561	3.054	0.119	0.002

D.8. Complete Parametric tests and bootstrapping results for gender

Direct Paths	Path Coefficients-diff (| Female - Male |)	t-Value(Female vs Male)	p-Value(Female vs Male)
INKS -> EPI	0.02	0.104	0.918
INKS -> EXI	0.166	0.837	0.406
INKS -> PAC	0.11	0.775	0.441
INKS -> RAC	0.17	1.273	0.207
NKS -> EPI	0.007	0.047	0.962
NKS -> EXI	0.029	0.219	0.827
NKS -> PAC	0.004	0.028	0.978
NKS -> RAC	0.074	0.573	0.568
PAC -> AQS	0.009	0.169	0.866
PAC -> ASM	0.021	1.256	0.213
PAC -> EPI	0.157	1.003	0.319
PAC -> EXI	0.079	0.467	0.642
PAC -> RAC	0.037	0.322	0.748
RAC -> EPI	0.291	1.675	0.098
RAC -> EXI	0.234	1.344	0.183
RAC -> EXP	0.032	1.526	0.131
RAC -> TRM	0.028	2.39	0.019
TUR -> EPI	0.025	0.214	0.831
TUR -> EXI	0.099	0.792	0.431
TUR -> PAC	0.079	0.629	0.532
TUR -> RAC	0.043	0.427	0.67

Statistical difference

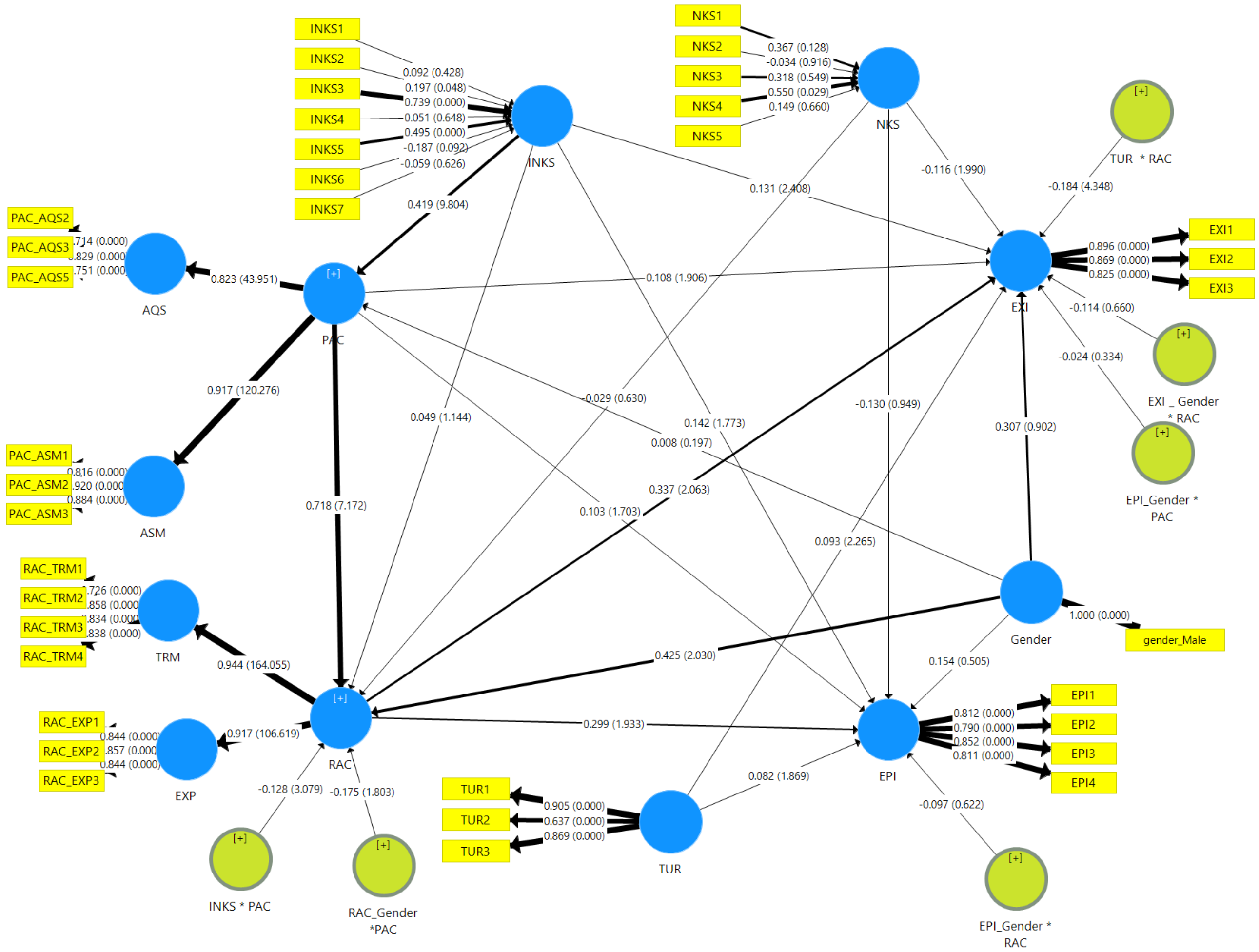
Close to reduced statistical evidence

Direct Paths	Path Coefficients Original (Female)	Path Coefficients Original (Male)	Path Coefficients Mean (Female)	Path Coefficients Mean (Male)	STDEV (Female)	STDEV (Male)	t-Values (Female)	t-Values (Male)	p-Values (Female)	p-Values (Male)
INKS -> EPI	0.148	0.168	0.189	0.152	0.156	0.109	0.948	1.537	0.343	0.124
INKS -> EXI	0.296	0.13	0.288	0.13	0.192	0.058	1.545	2.234	0.122	0.026
INKS -> PAC	0.391	0.281	0.414	0.291	0.135	0.048	2.892	5.896	0.004	0
INKS -> RAC	0.227	0.057	0.261	0.059	0.124	0.052	1.831	1.098	0.067	0.272
NKS -> EPI	-0.139	-0.146	-0.115	-0.127	0.125	0.081	1.111	1.795	0.267	0.073
NKS -> EXI	-0.136	-0.108	-0.095	-0.1	0.122	0.052	1.122	2.056	0.262	0.04
NKS -> PAC	0.259	0.263	0.273	0.265	0.122	0.046	2.121	5.66	0.034	0
NKS -> RAC	0.009	-0.065	0.036	-0.054	0.121	0.047	0.07	1.395	0.944	0.163
PAC -> AQS	0.818	0.827	0.822	0.827	0.052	0.019	15.8	42.992	0	0
PAC -> ASM	0.933	0.912	0.936	0.913	0.014	0.009	64.652	101.374	0	0
PAC -> EPI	0.244	0.087	0.219	0.088	0.144	0.063	1.691	1.379	0.091	0.168
PAC -> EXI	0.059	0.138	0.039	0.134	0.158	0.064	0.375	2.146	0.708	0.032
PAC -> RAC	0.543	0.58	0.505	0.574	0.107	0.043	5.073	13.63	0	0
RAC -> EPI	0.456	0.166	0.433	0.166	0.164	0.06	2.782	2.739	0.005	0.006
RAC -> EXI	0.494	0.261	0.477	0.26	0.164	0.06	3.005	4.365	0.003	0
RAC -> EXP	0.944	0.912	0.942	0.911	0.019	0.01	49.532	95.621	0	0
RAC -> TRM	0.966	0.938	0.966	0.938	0.01	0.007	99.149	141.989	0	0
TUR -> EPI	0.048	0.073	0.047	0.072	0.107	0.047	0.45	1.552	0.653	0.121
TUR -> EXI	0.022	0.121	0.028	0.12	0.118	0.044	0.183	2.726	0.855	0.006
TUR -> PAC	0.166	0.087	0.154	0.087	0.118	0.046	1.403	1.875	0.161	0.061
TUR -> RAC	0.159	0.116	0.15	0.117	0.094	0.041	1.701	2.846	0.089	0.004

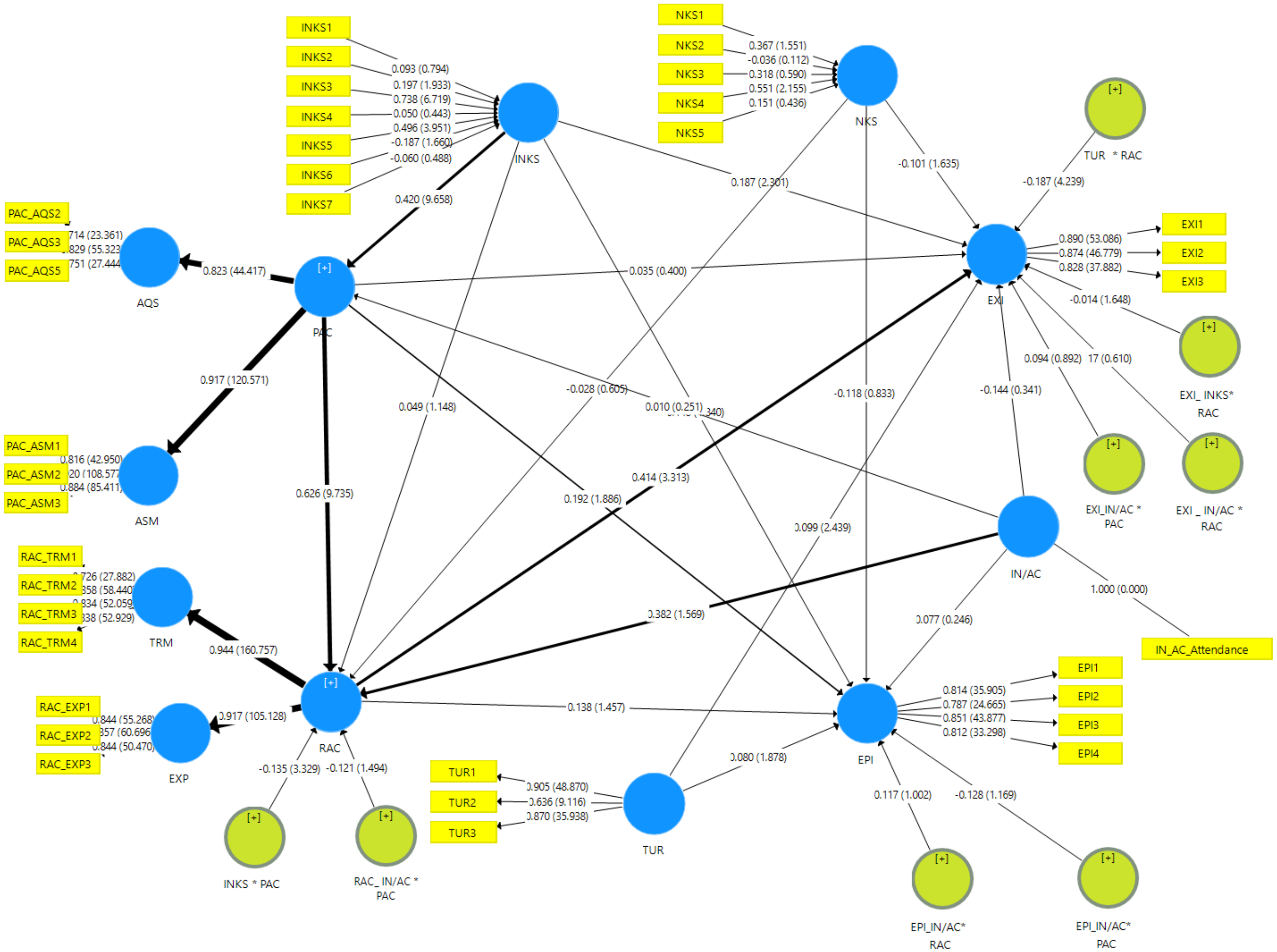
Statistical diference

Close to statistical difference

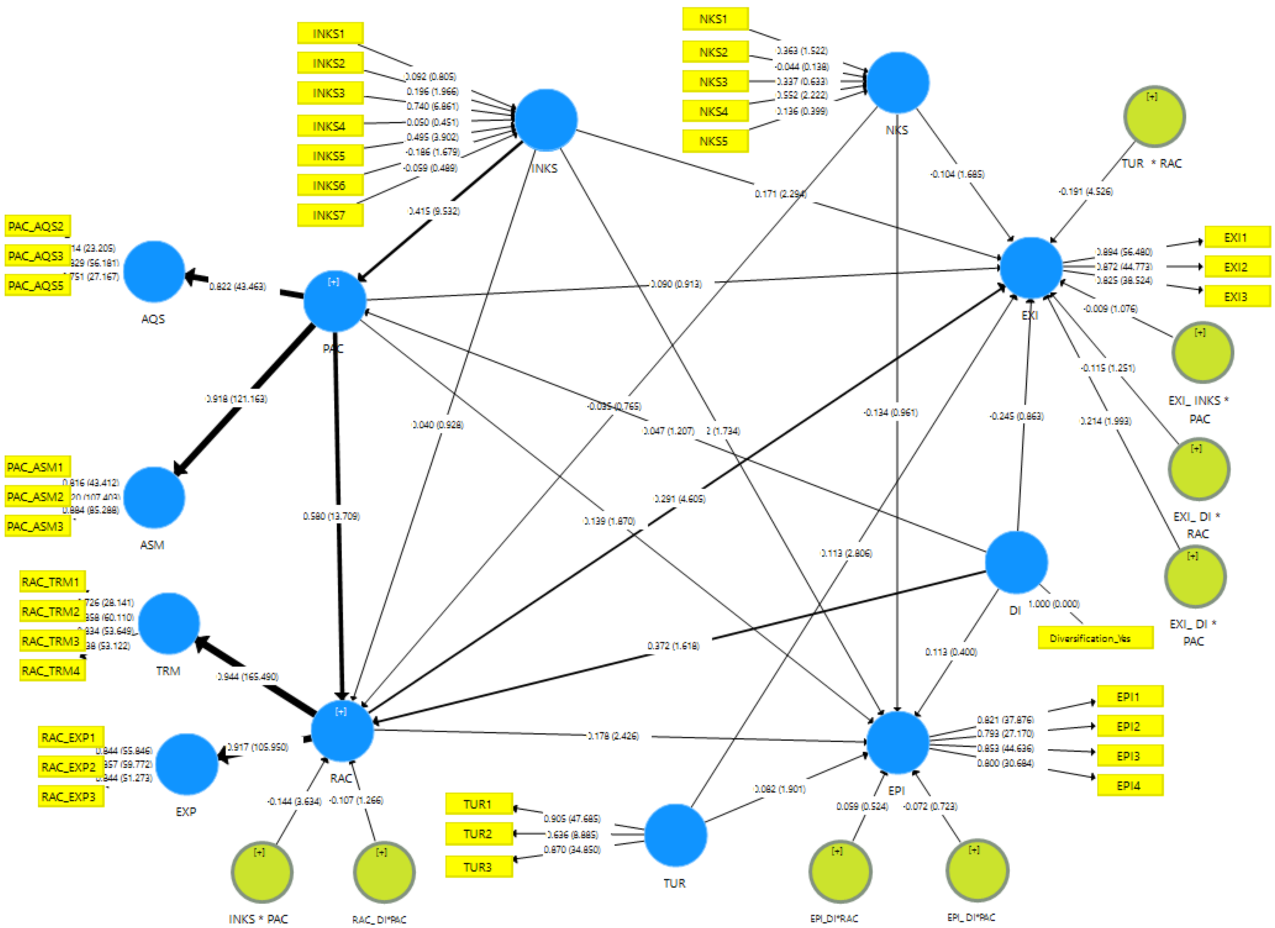
D.9: Model 1c with moderating effects of gender



D.10: Model 1c with moderating effects of Incubator/accelerator attendance



D.11: Model 1c with moderating effects of diversification and bootstrapping

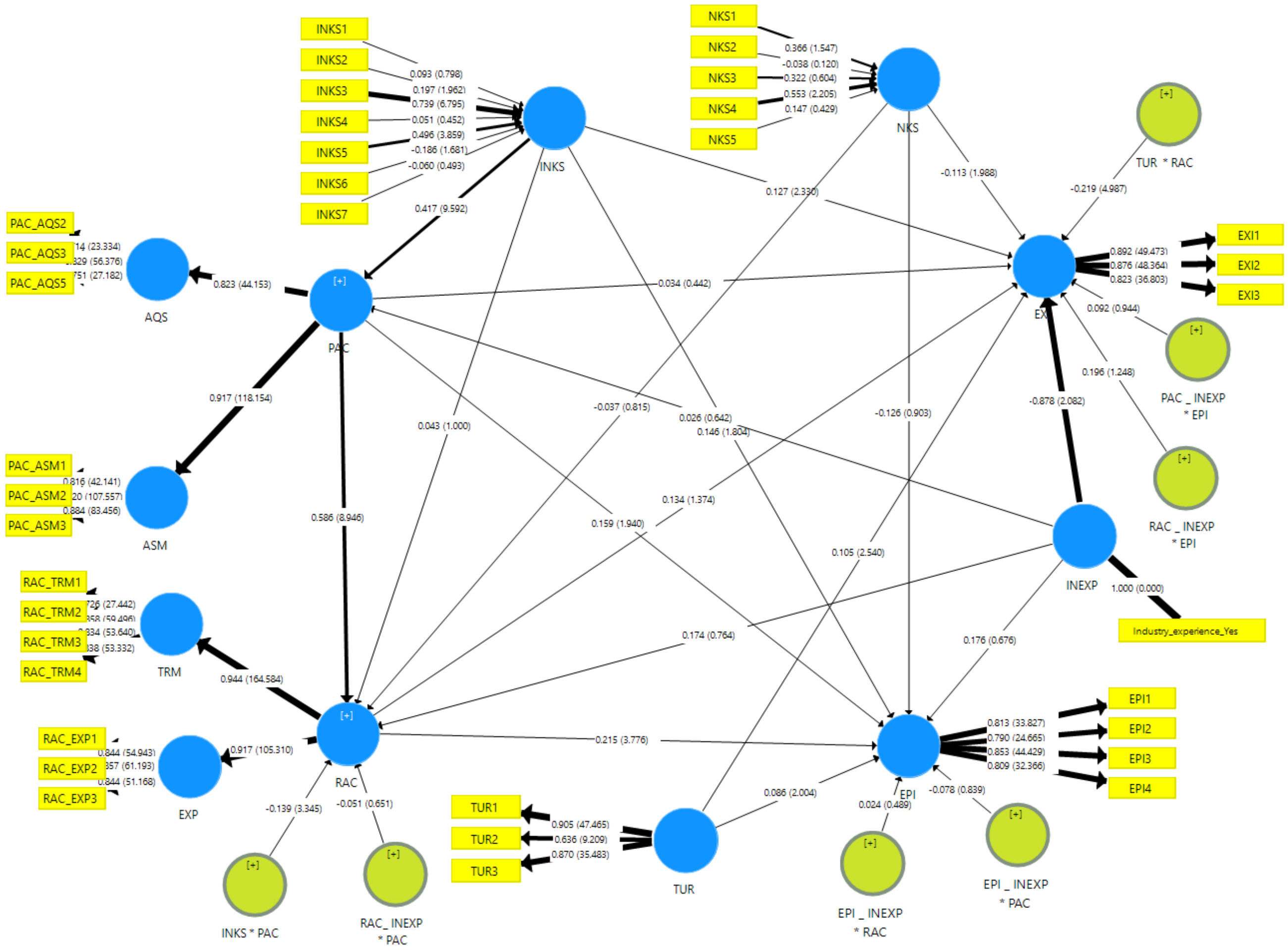


D.11: (Continuation). Model 1c with moderating effects of diversification and bootstrapping

Direct Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
DI -> EPI	0.113	0.121	0.282	0.4	0.689
DI -> EXI	-0.245	-0.273	0.284	0.863	0.388
DI -> PAC	0.047	0.047	0.039	1.207	0.228
DI -> RAC	0.372	0.361	0.23	1.618	0.106
EPI_ DI*PAC -> EPI	-0.072	-0.076	0.1	0.723	0.47
EPI_DI*RAC -> EPI	0.059	0.059	0.113	0.524	0.601
EXI_ DI * PAC -> EXI	0.214	0.211	0.107	1.993	0.046
EXI_ DI * RAC -> EXI	-0.115	-0.102	0.092	1.251	0.211
EXI_ INKS * PAC -> EXI	-0.009	-0.01	0.009	1.076	0.282
INKS -> EPI	0.142	0.112	0.082	1.734	0.083
INKS -> EXI	0.171	0.164	0.074	2.294	0.022
INKS -> PAC	0.415	0.423	0.044	9.532	0
INKS -> RAC	0.04	0.036	0.044	0.928	0.353
INKS * PAC -> RAC	-0.144	-0.158	0.04	3.634	0
NKS -> EPI	-0.134	-0.084	0.139	0.961	0.337
NKS -> EXI	-0.104	-0.07	0.062	1.685	0.092
NKS -> RAC	-0.035	-0.002	0.045	0.765	0.444
PAC -> AQS	0.822	0.822	0.019	43.463	0
PAC -> ASM	0.918	0.918	0.008	121.163	0
PAC -> EPI	0.139	0.127	0.074	1.87	0.062
PAC -> EXI	0.09	0.084	0.098	0.913	0.361
PAC -> RAC	0.58	0.561	0.042	13.709	0
RAC -> EPI	0.178	0.185	0.073	2.426	0.015
RAC -> EXI	0.291	0.286	0.063	4.605	0
RAC -> EXP	0.917	0.917	0.009	105.95	0
RAC -> TRM	0.944	0.943	0.006	165.49	0
RAC_ DI*PAC -> RAC	-0.107	-0.103	0.084	1.266	0.205
TUR -> EPI	0.082	0.072	0.043	1.901	0.057
TUR -> EXI	0.113	0.109	0.04	2.806	0.005
TUR * RAC -> EXI	-0.191	-0.192	0.042	4.526	0

Statistically significant

D.12: Model 1c with moderating effects of industrial experience and bootstrapping

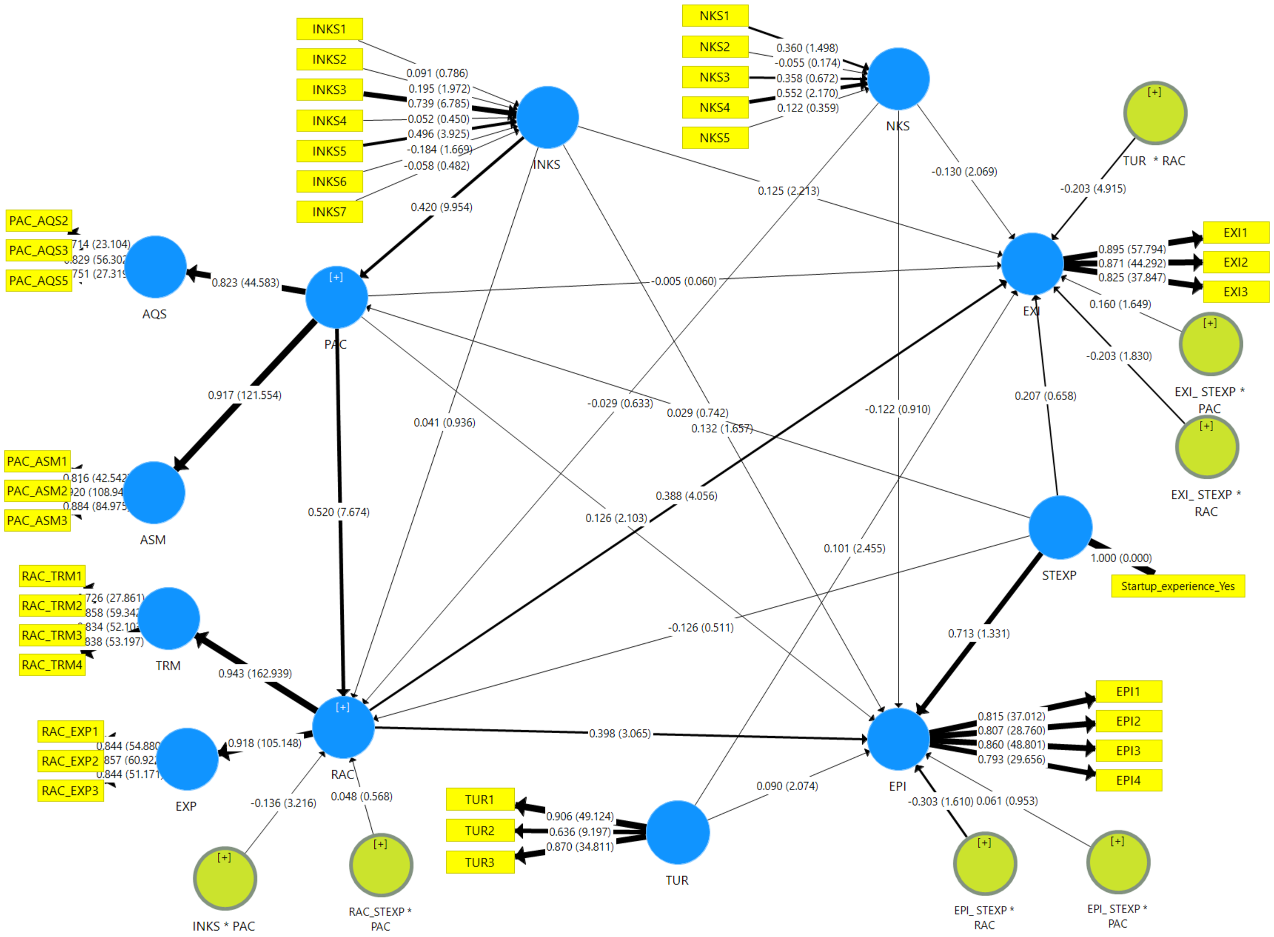


D.12: (Continuation). Model 1c with moderating effects of diversification and bootstrapping

Direct Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
EPI _ INEXP * PAC -> EPI	-0.078	-0.03	0.093	0.839	0.402
EPI _ INEXP * RAC -> EPI	0.024	0.011	0.049	0.489	0.625
INEXP -> EPI	0.176	0.039	0.26	0.676	0.499
INEXP -> EXI	-0.878	-0.664	0.422	2.082	0.037
INEXP -> PAC	0.026	0.025	0.04	0.642	0.521
INEXP -> RAC	0.174	0.135	0.228	0.764	0.445
INKS -> EPI	0.146	0.119	0.081	1.804	0.071
INKS -> EXI	0.127	0.109	0.054	2.33	0.02
INKS -> PAC	0.417	0.425	0.043	9.592	0
INKS -> RAC	0.043	0.039	0.043	1	0.317
INKS * PAC -> RAC	-0.139	-0.155	0.042	3.345	0.001
NKS -> EPI	-0.126	-0.079	0.14	0.903	0.366
NKS -> EXI	-0.113	-0.074	0.057	1.988	0.047
NKS -> RAC	-0.037	-0.002	0.045	0.815	0.415
PAC -> AQS	0.823	0.823	0.019	44.153	0
PAC -> ASM	0.917	0.918	0.008	118.154	0
PAC -> EPI	0.159	0.112	0.082	1.94	0.052
PAC -> EXI	0.034	0.022	0.077	0.442	0.659
PAC -> RAC	0.586	0.557	0.065	8.946	0
PAC _ INEXP * EPI -> EXI	0.092	0.087	0.097	0.944	0.345
RAC -> EPI	0.215	0.22	0.057	3.776	0
RAC -> EXI	0.134	0.183	0.098	1.374	0.169
RAC -> EXP	0.917	0.917	0.009	105.31	0
RAC -> TRM	0.944	0.943	0.006	164.584	0
RAC _ INEXP * EPI -> EXI	0.196	0.122	0.157	1.248	0.212
RAC_ INEXP * PAC -> RAC	-0.051	-0.038	0.078	0.651	0.515
TUR -> EPI	0.086	0.077	0.043	2.004	0.045
TUR -> EXI	0.105	0.097	0.041	2.54	0.011
TUR * RAC -> EXI	-0.219	-0.215	0.044	4.987	0

Statistically significant

D.13: Model 1c with moderating effects of entrepreneurial experience



D.14: Bootstrapping of Model 2 with types of industries and moderating effects

Path Coefficients	Path Coefficients Original (Industry_High-tech)	Path Coefficients Original (Industry_KIBS and Other)	Path Coefficients Mean (Industry_High-tech)	Path Coefficients Mean (Industry_KIBS and Other)	STDEV (Industry_High-tech)	STDEV (Industry_KIBS and Other)	t-Values (Industry_High-tech)	t-Values (Industry_KIBS and Other)	p-Values (Industry_High-tech)	p-Values (Industry_KIBS and Other)
Age company -> EPI	0.067	0.011	0.064	0.014	0.047	0.073	1.442	0.151	0.149	0.88
Age company -> EXI	-0.046	0.016	-0.048	0.021	0.055	0.052	0.83	0.302	0.407	0.763
Age entrepreneur -> EPI	-0.121	-0.066	-0.119	-0.071	0.046	0.077	2.644	0.859	0.008	0.391
Age entrepreneur -> EXI	-0.022	0.008	-0.023	0.009	0.048	0.071	0.455	0.109	0.649	0.913
Firm size -> EPI	0.011	0.176	0.012	0.179	0.053	0.047	0.2	3.785	0.842	0
Firm size -> EXI	0.047	0.058	0.05	0.061	0.046	0.053	1.025	1.09	0.305	0.276
INKS -> EPI	0.255	0.032	0.214	0.034	0.142	0.111	1.794	0.289	0.073	0.772
INKS -> EXI	0.088	0.1	0.083	0.104	0.079	0.104	1.114	0.962	0.265	0.336
INKS -> PAC	0.267	0.384	0.282	0.396	0.066	0.07	4.028	5.528	0	0
INKS -> RAC	0.096	0.243	0.103	0.238	0.074	0.119	1.293	2.046	0.196	0.041
INKS * PAC -> RAC	-0.017	-0.009	-0.017	-0.008	0.008	0.012	2.023	0.774	0.043	0.439
NKS -> EPI	-0.22	0.005	-0.186	0.017	0.088	0.093	2.497	0.048	0.013	0.961
NKS -> EXI	-0.093	-0.133	-0.085	-0.112	0.062	0.08	1.514	1.659	0.13	0.097
NKS -> PAC	0.282	0.264	0.282	0.274	0.058	0.069	4.867	3.847	0	0
NKS -> RAC	0.013	-0.034	0.021	-0.018	0.054	0.083	0.242	0.415	0.809	0.679
PAC -> AQS	0.833	0.803	0.833	0.802	0.02	0.043	41.949	18.746	0	0
PAC -> ASM	0.916	0.916	0.917	0.917	0.009	0.013	100.291	67.895	0	0
PAC -> EPI	0.076	0.077	0.086	0.07	0.067	0.114	1.133	0.676	0.257	0.499
PAC -> EXI	0.101	0.114	0.095	0.102	0.075	0.102	1.343	1.118	0.179	0.264
PAC -> RAC	0.74	0.587	0.731	0.564	0.072	0.101	10.219	5.836	0	0
RAC -> EPI	0.224	0.687	0.181	0.58	0.135	0.28	1.662	2.456	0.097	0.014
RAC -> EXI	0.221	0.296	0.216	0.295	0.061	0.083	3.638	3.549	0	0
RAC -> EXP	0.903	0.94	0.903	0.939	0.012	0.012	78.4	77.781	0	0
RAC -> TRM	0.931	0.961	0.931	0.961	0.008	0.007	112.815	138.485	0	0
TUR -> EPI	0.072	0.826	0.015	0.693	0.174	0.321	0.412	2.573	0.68	0.01
TUR -> EXI	0.131	0.04	0.132	0.042	0.055	0.063	2.371	0.643	0.018	0.52
TUR * RAC -> EXI	-0.158	-0.3	-0.168	-0.298	0.073	0.063	2.17	4.743	0.03	0
TUR * RAC -> EPI	-0.005	-0.077	0.002	-0.06	0.02	0.039	0.253	1.987	0.8	0.047

Statistically significant

Evidence of reduced statistical effect

D.15: Bootstrapping of Model 3 with the assessment of academic qualifications and moderating effects

Direct Paths	Path Coefficients Original (Education_Bachelor's degree)	Path Coefficients Original (Education_MA/MSc)	Path Coefficients Original (Education_Other and no qualifications)	Path Coefficients Original (Education_PhD)
Age company -> EPI	0.051	0.051	-0.04	0.233
Age company -> EXI	-0.059	-0.059	-0.111	0.087
Age entrepreneur -> EPI	-0.032	-0.032	-0.049	-0.217
Age entrepreneur -> EXI	0.063	0.063	-0.081	-0.043
Firm size -> EPI	0.04	0.04	0.163	0.067
Firm size -> EXI	0.143	0.143	0.014	-0.103
INKS -> EPI	0.169	0.169	-0.24	0.173
INKS -> EXI	0.316	0.316	0.114	0.036
INKS -> PAC	0.228	0.228	0.28	0.478
INKS -> RAC	0.019	0.019	-0.091	0.209
INKS * PAC -> RAC	0.008	0.008	0.017	-0.026
NKS -> EPI	-0.056	-0.056	0.093	0.156
NKS -> EXI	-0.188	-0.188	-0.131	0.019
NKS -> PAC	0.312	0.312	0.304	0.271
NKS -> RAC	-0.065	-0.065	-0.129	0.087
PAC -> AQS	0.822	0.822	0.763	0.896
PAC -> ASM	0.926	0.926	0.91	0.938
PAC -> EPI	0.163	0.163	0.068	-0.084
PAC -> EXI	0.011	0.011	0.159	0.009
PAC -> RAC	0.583	0.583	0.402	0.854
RAC -> EPI	0.555	0.555	0.561	0.107
RAC -> EXI	0.243	0.243	0.141	0.334
RAC -> EXP	0.918	0.918	0.898	0.937
RAC -> TRM	0.954	0.954	0.924	0.953
TUR -> EPI	0.553	0.553	0.772	0.155
TUR -> EXI	0.1	0.1	0.285	-0.01
TUR * RAC -> EXI	-0.16	-0.16	-0.286	-0.41
TUR * RAC -> EPI	-0.052	-0.052	-0.093	0.002

D.15: (Continuation). Bootstrapping of Model 3 with the assessment of academic qualifications and moderating effects

Direct Paths	Path Coefficients Mean (Education_Bachelor's degree)	Path Coefficients Mean (Education_MA/MSc)	Path Coefficients Mean (Education_Other and no qualifications)	Path Coefficients Mean (Education_PhD)
Age company -> EPI	0.043	0.043	-0.05	0.237
Age company -> EXI	-0.062	-0.06	-0.084	0.084
Age entrepreneur -> EPI	-0.031	-0.029	-0.092	-0.224
Age entrepreneur -> EXI	0.066	0.066	-0.067	-0.046
Firm size -> EPI	0.036	0.036	0.141	0.051
Firm size -> EXI	0.128	0.127	0.014	-0.096
INKS -> EPI	0.157	0.156	-0.166	0.174
INKS -> EXI	0.267	0.268	0.108	0.045
INKS -> PAC	0.263	0.264	0.292	0.496
INKS -> RAC	0.043	0.045	-0.016	0.207
INKS * PAC -> RAC	0.007	0.007	0.012	-0.023
NKS -> EPI	-0.023	-0.023	-0.028	0.152
NKS -> EXI	-0.141	-0.142	-0.089	0.025
NKS -> PAC	0.313	0.314	0.322	0.267
NKS -> RAC	-0.052	-0.05	-0.087	0.094
PAC -> AQS	0.822	0.822	0.753	0.895
PAC -> ASM	0.927	0.928	0.917	0.937
PAC -> EPI	0.155	0.154	0.036	-0.07
PAC -> EXI	0.007	0.007	0.146	-0.001
PAC -> RAC	0.584	0.58	0.416	0.814
RAC -> EPI	0.493	0.495	0.281	0.01
RAC -> EXI	0.235	0.238	0.13	0.329
RAC -> EXP	0.918	0.918	0.899	0.935
RAC -> TRM	0.955	0.955	0.925	0.952
TUR -> EPI	0.47	0.468	0.236	0.042
TUR -> EXI	0.095	0.094	0.252	-0.008
TUR * RAC -> EXI	-0.177	-0.176	-0.053	-0.404
TUR * RAC -> EPI	-0.041	-0.041	-0.032	0.017

D.15: (Continuation). Bootstrapping of Model 3 with the assessment of academic qualifications and moderating effects

Direct Paths	STDEV (Education_Bachelor's degree)	STDEV (Education_MA/MSc)	STDEV (Education_Other and no qualifications)	STDEV (Education_PhD)
Age company -> EPI	0.063	0.063	0.094	0.094
Age company -> EXI	0.077	0.078	0.098	0.067
Age entrepreneur -> EPI	0.065	0.065	0.129	0.082
Age entrepreneur -> EXI	0.07	0.069	0.083	0.067
Firm size -> EPI	0.074	0.074	0.121	0.094
Firm size -> EXI	0.057	0.058	0.073	0.104
INKS -> EPI	0.12	0.119	0.262	0.166
INKS -> EXI	0.109	0.11	0.187	0.097
INKS -> PAC	0.088	0.088	0.119	0.088
INKS -> RAC	0.107	0.107	0.183	0.13
INKS * PAC -> RAC	0.011	0.011	0.02	0.014
NKS -> EPI	0.113	0.112	0.241	0.138
NKS -> EXI	0.112	0.11	0.129	0.09
NKS -> PAC	0.088	0.084	0.106	0.088
NKS -> RAC	0.081	0.08	0.169	0.094
PAC -> AQS	0.038	0.037	0.078	0.023
PAC -> ASM	0.012	0.012	0.02	0.015
PAC -> EPI	0.094	0.095	0.145	0.164
PAC -> EXI	0.1	0.103	0.149	0.109
PAC -> RAC	0.098	0.099	0.19	0.102
RAC -> EPI	0.242	0.241	0.272	0.296
RAC -> EXI	0.085	0.085	0.106	0.107
RAC -> EXP	0.016	0.016	0.022	0.017
RAC -> TRM	0.008	0.008	0.018	0.013
TUR -> EPI	0.276	0.275	0.457	0.34
TUR -> EXI	0.083	0.08	0.113	0.063
TUR * RAC -> EXI	0.123	0.122	0.3	0.067
TUR * RAC -> EPI	0.034	0.034	0.058	0.041

D.15: (Continuation). Bootstrapping of Model 3 with the assessment of academic qualifications and moderating effects

Direct Paths	p-Values (Education_Bachelor's degree)	p-Values (Education_MA/MSc)	p-Values (Education_Other and no qualifications)	p-Values (Education_PhD)
Age company -> EPI	0.422	0.424	0.667	0.013
Age company -> EXI	0.442	0.446	0.26	0.194
Age entrepreneur -> EPI	0.621	0.617	0.703	0.008
Age entrepreneur -> EXI	0.371	0.366	0.334	0.523
Firm size -> EPI	0.589	0.588	0.179	0.471
Firm size -> EXI	0.012	0.013	0.85	0.324
INKS -> EPI	0.16	0.155	0.361	0.298
INKS -> EXI	0.004	0.004	0.542	0.714
INKS -> PAC	0.01	0.01	0.019	0
INKS -> RAC	0.856	0.857	0.621	0.11
INKS * PAC -> RAC	0.458	0.462	0.396	0.063
NKS -> EPI	0.622	0.619	0.699	0.259
NKS -> EXI	0.093	0.089	0.312	0.832
NKS -> PAC	0	0	0.004	0.002
NKS -> RAC	0.426	0.418	0.445	0.355
PAC -> AQS	0	0	0	0
PAC -> ASM	0	0	0	0
PAC -> EPI	0.081	0.087	0.64	0.608
PAC -> EXI	0.915	0.917	0.285	0.932
PAC -> RAC	0	0	0.034	0
RAC -> EPI	0.022	0.021	0.039	0.717
RAC -> EXI	0.004	0.004	0.184	0.002
RAC -> EXP	0	0	0	0
RAC -> TRM	0	0	0	0
TUR -> EPI	0.045	0.045	0.091	0.648
TUR -> EXI	0.227	0.213	0.012	0.873
TUR * RAC -> EXI	0.191	0.189	0.341	0
TUR * RAC -> EPI	0.131	0.128	0.107	0.968