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**Exploring knowledge and learning in new  
technology-based firms in an early-stage  
entrepreneurial ecosystem**

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**Doctor of Philosophy in Management**



**THE UNIVERSITY  
*of* EDINBURGH**

**2015**

## **Declaration**

This is to certify that that the work contained within has been composed by me and is entirely my own work. No part of this thesis has been submitted for any other degree or professional qualification.

Signed:

**Elizabeth Montoya Martínez**

## **Partial findings of this research and some models have been presented in conferences, workshops and doctoral consortiums:**

- *Doctoral Consortium*, BABSON College Entrepreneurship Research Conference. Ivey Business School, 2014.
- “Entrepreneurial Networks and New Technology-based Firms in Colombia: The role of Resources and Capabilities” in II International Entrepreneurship Workshop, 2014.
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## **Abstract**

This thesis investigates knowledge and learning in new technology-based firms (NTBFs) in an early-stage entrepreneurial ecosystem. Previous work on entrepreneurial learning suggests that experiential learning, vicarious learning and exploration are the learning types that entrepreneurs use to manage knowledge, and that this leads to the creation of entrepreneurial knowledge. While the majority of previous research involves entrepreneurial learning that is based on absorptive capacity (ACAP) to generate competitive advantage, this study examines how new venture teams (NVTs) manage new and prior knowledge when developing and commercialising software. The knowledge-based view (KBV) regards knowledge as the most important resource to allocate. This research adopts this approach in exploring how NVTs acquire, assimilate and use new knowledge. Based on a framework encompassing networks, prior knowledge and knowledge management the study explores, examines and analyses: i. Entrepreneurial networks; ii. Early-stage entrepreneurial ecosystems; iii. NVTs' prior knowledge; and iv. Knowledge integration activities.

The research adopts a qualitative approach and methodology comprising two stages. The first one captures the perceptions of multiple agents involved in the entrepreneurial networks in Colombia, from government, academia and support institutions (private and public). In the second stage eight NVTs from Medellín were asked to describe the resources and source of resources used when developing and commercialising the first innovative product while creating and establishing the NTBF; their answers were validated in a second interview using a mind map to illustrate key events and key sources of new knowledge.

Analysis of the data reveals that even in early-stage entrepreneurial ecosystems, NVTs acquire knowledge from external sources, such as mentors, intermediaries and customers. This finding echoes the importance of ACAP in NTBF creation and survival. Moreover, NVTs acquire knowledge from internal sources of knowledge, such as new members, experience and formal education. In general, regardless of how related, specific and complementary the prior knowledge of the NVT is, all cases use external and internal knowledge integration activities.

This study provides new insights into the nature of knowledge integration and has clarified distinctions between two key substantive capabilities in NTBFs: developing a technology and commercialising a new product. As regard to the KBV, the thesis also shows how entrepreneurial and innovative networks helped with the acquisition of new knowledge in an early-stage entrepreneurial ecosystem. This new knowledge can be market-related but also technical-related, and can also be acquired by outsourcing when the NVT's knowledge base is not specialised in the technology that the firm offers. NVTs manage prior and new knowledge when developing and commercialising new technologies while they create and establish the NTBF, for by doing so they also focus on sales to maintain cash flow. The study suggests that members of NVTs work together, make decisions together and are both reflective and selective when choosing their sources of new knowledge in NTBFs.

This study has important implications for policymakers and practitioners. While current policies and entrepreneurs recognise networks as the most important source of knowledge, findings of this research suggests that internal sources of knowledge are equally important, therefore NVTs must also develop internal knowledge integration abilities.

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## Abbreviations

ACAP	Absorptive Capacity
BPO	Business Process Outsourcing
Cap	Capital
CEDEZO	Centros de Desarrollo Zonal (Centers of local business development)
CEO	Chief Executive Officer
EL	Entrepreneurial Learning
GEM	Global Entrepreneurship Monitor
HIE	High Impact Entrepreneurship
ICT	Information and Communications Technology
IFC	Inter-Firm Cooperation
IO	Industrial Organisation
IP	Intellectual Protection
K	Knowledge
KBV	Knowledge-Based View
KI	Knowledge Integration
KI(1)	Internal Knowledge Integration
KI(2)	External Knowledge Integration
KM	Knowledge Management
MK	Market Knowledge
NP	New Product
NPD&C	New Product Development and Commercialisation
NPPD	New Products Development
NTBF	New Technology-Based Firm
NVT	New Venture Team
OL	Organisational Learning
PK	Prior Knowledge

R&D&I	Research, Development and Innovation
RBT	Resource-Based Theory
RBV	Resource-Based View
S&T	Science and Technology
SAS	Sociedad de Accion Simplificada (Simplified action society)
SLT	Situated Learning Theory
SMEs	Small and Medium Enterprises
TBF	Technology-Based Firms
TEA	Total Early-stage Entrepreneurial Activity
TEL	Type of Entrepreneurial Learning
TK	Technical Knowledge
TLC	Tratado de Libre Comercio (Free commerce agreement)
TMT	Top Management Team
TTO	Technology Transfer Offices
UIG	University Industry Government
VRIN	Valuable, Rare, Imperfectly imitable and not substitutable
WIPO	World Intellectual Property Organization

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## Chapter 1 INTRODUCTION

This PhD research proposes a knowledge-based view (KBV) of entrepreneurial learning in New Technology-based Firms (NTBFs). Given the fragmentation in the field of entrepreneurial learning and the need of theoretical and empirical studies in this field, this PhD research seeks to propose an integrated framework to understand how New Venture Teams (NVTs) manage knowledge when creating and establishing NTBFs in entrepreneurial ecosystems. This chapter is organised in five sections: they introduce the research background, framework, objectives and research questions, approach and structure.

### **1.1 Research background**

The creation of new ventures has always been a topic of common interest amongs academics, politicians and practitioners because the economy of regions is positively affected by new business creation. New firm creation has a positive impact on the creation of new employment, the development of new products and the improvement of welfare and the society (Schumpeter, 1934, Acs and Audretsch, 1988, Wennekers and Thurik, 1999, Baumol, 2002, Acs, Desai and Hessels, 2008).

Despite governmental efforts targeted at supporting new ventures, new firms suffer from “liabilities of newness” (Stinchcombe, 1965, Abatecola et al., 2012) because new firms lack learned experience. Entrepreneurs and their teams have to perform and create new roles, trust in strangers and develop stable links to new clients. New Venture Teams (NVTs) gain learning experience by acquiring, storing and using new knowledge.

NVTs need to learn how to manage their own knowledge and knowledge that can be drawn from networks. They have to bring together different types of knowledge and abilities; building upon pre-formation knowledge held by founders and developing the collective knowledge to be used by the new firm. They develop organisational capabilities to gain and



maintain competitive advantage. The KBV of the firm states that the ability to acquire and exploit new knowledge is key to gaining and maintaining competitive advantage (Grant, 1996b).

Existing literature relevant to an understanding of the role of knowledge and learning in new ventures has developed in two theoretical streams. Firstly, there is an understanding that new knowledge is transferred from external sources such as networks (See for example, Bourdieu, 1985, Zahra and George, 2002, Birley, 1986). Therefore, firms absorb new knowledge to gain and maintain competitive advantage. This stream has emphasised the importance of related knowledge to facilitate knowledge assimilation and has stressed the role of inter-organisational relationships. NVTs embedded in entrepreneurial ecosystems in which networks represent access to data, information and knowledge may benefit from the characteristics of these ecosystems. However, there are few studies looking at NTBF entrepreneurial ecosystems and how new firms develop in entrepreneurial ecosystems, particularly in countries in which entrepreneurial networks are in the early stage of development such as Colombia.

Secondly, new knowledge is created within the firm at the individual level (See for example, Fukujama, 1995, Grant, 1996b, Cope, 2011). Therefore, members of the NVT acquire new knowledge that is then exploited by the organisation. This stream emphasises the importance of specialised and complementary knowledge that is transformed into new knowledge by using it. While the first stream focuses on external conditions of the firm and knowledge processes such as transfer, sharing and acquisition, the second one focuses on internal conditions of the firm, and on entrepreneurs' behaviour and cognition. This suggests the fragmentation in the field.

Previous literature on NVTs has studied the impact of prior knowledge (PK) on firm performance and opportunity identification; however, it has limitations in explaining what knowledge process facilitates goal achievement in new ventures (Klotz et al, 2014) and the role of NVTs in processing new knowledge. To address these gaps, this PhD presents a KBV of entrepreneurial learning and proposes an integrated framework to explore how NVTs manage prior and new knowledge in NTBFs, created within the Colombian entrepreneurial ecosystem in which entrepreneurial networks are in early stage of development.

## 1.2 Research framework

Given the fact that knowledge has been identified as a key resource in NTBFs (Yi-Renko, Autio and Sapienza, 2001) and entrepreneurial ecosystems as a key source of knowledge for new firms, this research focuses on knowledge management in NTBFs in the Colombian entrepreneurial ecosystem. A NTBF is a firm “*whose strength and competitive edge derives from the engineering know-how of people who are integral to the firm, and upon the subsequent transformation of this know-how into products or services for a market*” (Klofsten, 1994:535). NTBF creation is one of the ways of transferring technology to society. Thus, NTBF creation represents one of the tangible outcomes of technological innovation<sup>1</sup> and entrepreneurship. NVTs aiming to create and establish NTBFs need to have the capability to create and utilise knowledge in such a way that the firm has the ability to innovate.

For the purpose of this research and following Klotz et al. (2014:227), an NVT is the “*group of individuals that is chiefly responsible for the strategic decision making and ongoing operations of a new venture*”. NVTs need to develop the ability to reconfigure their resources and routines when pursuing competitive advantage, but to do so, they need to know what resources and capabilities they have and what they need. They need to identify what new knowledge is required and what new knowledge is available within the team. This level of comprehension of what they lack when pursuing competitive advantage enables them to seek sources of information (knowledge) about where to find the resources they need to achieve their goals.

Knowledge represents the most critical resource in start-ups (Autio, Sapienza and Almeida, 2000, West and Noel, 2009, Brush, Greene and Hart, 2001, Nonaka, Toyama and Nagata 2000). The KBV suggests that new firms execute several processes to acquire, distribute, integrate and use the knowledge required to perform (Spender, 1996, Grant, 1996a, Cooner and Prahalad, 1996). Organisations have routines to combine and exploit prior and external knowledge (Huber, 1991), as Kogut and Zander (1992:391) state “creating new knowledge does not occur in abstraction from current abilities”. Knowledge is understood as knowledge, expertise, skills and information (Faulkner, 1994).

Several capabilities such as absorptive capacity (Cohen and Levinthal, 1990, Zhara and George, 2002) have been studied in the strategy literature. Knowledge transfer and sharing are

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<sup>1</sup> Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. Oslo Manual, 2005.

mostly studied in the networks literature (Inkpen and Tsang, 2005, Hansen, 1995, Hansen and Wortman, 1989, Hansen, 2002, Hansen, Mors and Løvås, 2005), while knowledge acquisition is mostly studied in internationalisation literature (Johanson and Vahlne, 1977), and knowledge exploration, assimilation, integration and exploitation are predominantly studied in the organisational learning (March, 1991) and the innovation literatures (Berggren et al, 2013).

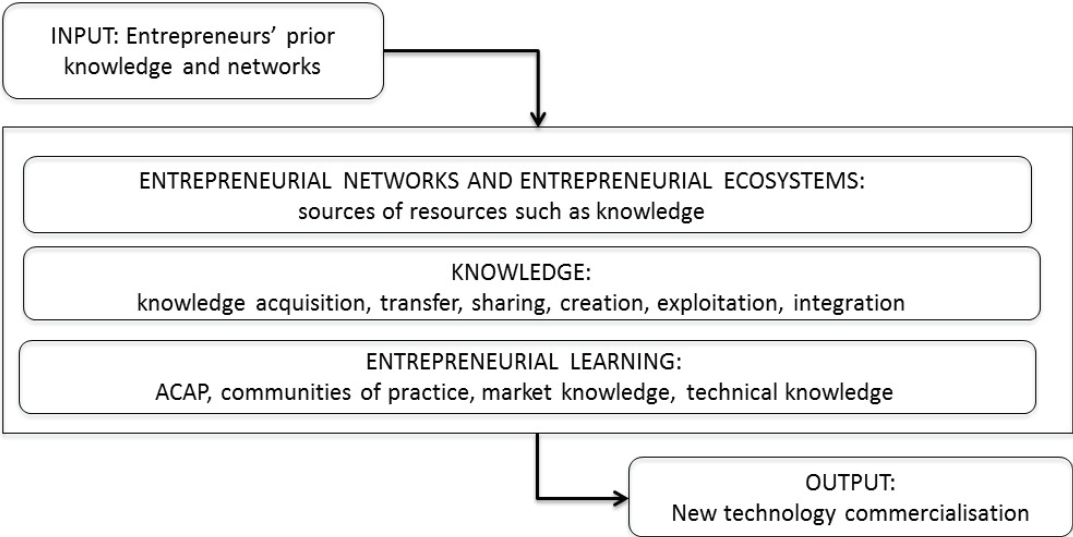
Regarding processing external knowledge for being competitive, the role of dynamic capabilities emerges, in particular, the role of absorptive capacity (ACAP) which has been much used and sometimes misunderstood (Eisenhardt and Martin, 2000, Zahra, Sapienza and Davidsson, 2006). A review of existent literature on entrepreneurial learning suggests that absorptive capacity (ACAP) is the theoretical framework that explains better how organisations learn when pursuing competitive advantage. Absorptive capacity has two main proponents. Cohen and Levinthal (1990) define it as the “ability to recognize the value of new information, assimilate it, and apply it to commercial ends” (p.128) while Zahra and George (2002) define as a “dynamic capability pertaining to knowledge creation and utilization that enhances a firm’s ability to gain and sustain a competitive advantage” (p.185).

Regarding processing internal knowledge in entrepreneurship, some of the literature on entrepreneurial learning makes reference to the role of learning by doing (experiential learning) and learning by critical events (Cope, 2005). Learning by doing refers to the process by which an individual or group increases its performance with experience in a task (Arrow, 1962). Learning by doing is required when the organisation needs to develop new solutions that are independent of the current state of knowledge (Sitkin, Sutcliffe and Schroeder, 1994). Through learning by doing, the organisation will take advantage of the resulting “high-fidelity experimental results” (Pisano, 1997: p. 45). In addition, learning by critical events has been explored in the context of solo entrepreneurs (Cope and Watts, 2000, 2005); however, most new firms are created by teams rather than by individuals (Harper, 2008).

Although Cope and Watts (2000) argue that learning is mostly a cognitive change that is difficult to observe or quantify, learning models in which it is difficult to determine the value of the learning task can suggest a tautological argument. New knowledge may represent value that will be capitalised by the entrepreneur later, in the identification or exploitation of any opportunity. The management of prior and new knowledge does not represent a valuable activity for the NTBFs if this process does not help the new firm to commercialise new technologies.

Several models of entrepreneurial learning make reference to outcomes such as entrepreneurial knowledge, opportunity recognition and opportunity exploitation (Minniti and Bygrave, 2001, Politis, 2005, Ravasi and Turati, 2005, Corbett, 2007, Holcomb et al., 2009). The assimilation and transformation of knowledge has to evolve into the exploitation of new knowledge for the development and commercialisation of new products because a new firm enters a market and begins to participate actively in the economic system once it commercialises products. In addition, several goals are pursued when creating a new firm such as the establishment of an NVT, the creation of organisational capabilities, the development of new products, securing financial resources and the development of networks. Figure 1.1 presents the constructs and concepts that compose the research framework to explore knowledge and learning in NTBFs.

**Figure 1.1 Research framework for exploring knowledge and learning in NTBFs**



Source: developed by author based on Hoang and Antoncic (2003), Collinson and Gregson (2003), Isenberg (2010), Autio et al. (2014), Cohen and Levinthal (1990), Zahra and George (2002), Huber (1991), Berggren et al. (2013), Holcomb et al. (2009), Rae (2006), Zahra, Sapienza and Davidsson (2006).

This PhD thesis extends the above literature by exploring how NVTs manage knowledge when creating and establishing an NTBF in an entrepreneurial ecosystem. By highlighting the links between prior knowledge, networks and knowledge integration in NTBFs, this PhD research provides a theoretical model in understanding how NVTs manage knowledge that is necessary for NTBFs success in Colombia. Colombia is a developing country in which

entrepreneurial networks may not be efficient, therefore, this thesis contribute into examining how entrepreneurs acquire, integrate and exploit knowledge in an early-stage entrepreneurial ecosystem.

Colombia is a developing country and one of the two all-rounder economies (World Bank, 2015a). An all-rounder economy is one with high rates of early stage, ambitious and innovative entrepreneurs. Colombia has 21.7% entrepreneurial activity, 18.8% growth ambition and 38.2% innovative entrepreneurs. Chile is the other all-rounder economy with 20.4% entrepreneurial activity, 12.1% growth ambition and 54.6% innovative entrepreneurs. Latin America's economy has improved over the past years; however, there is still a lag in productivity in comparison to advance and emerging economies (World Bank, 2015b).

In Medellín, during the past two decades there has been a constant effort to promote entrepreneurship and the local government has been supporting the promotion of an entrepreneurial culture for the past eight years. The actual entrepreneurial ecosystem of Medellín (Isenberg, D., 2010) is composed of actors belonging to the political, academic and industry sectors, the triple-helix model (Sábato & Botana, 1968) clearly represents the high dynamic entrepreneurial activity in the city. Cultural and governmental conditions have led Medellín to be identified in Latin America as a leader in the promotion of entrepreneurship.

### **1.3 Research objectives and research questions**

This PhD thesis aims to contribute to the understanding of entrepreneurial learning in entrepreneurial ecosystems by proposing a KBV of entrepreneurial learning in NTBFs. This thesis is a response to Campos and Hormiga's (2012) call to understand how entrepreneurs construct knowledge, to Wang and Chugh (2014:42) who call for "both theoretical and empirical development" in entrepreneurial learning, and to Klotz et al. (2014:238) regarding the need for a better understanding of action processes in NVTs.

The objective of the study is to understand how NVTs manage knowledge when creating and establishing NTBFs in an entrepreneurial ecosystem where entrepreneurial networks are in the early stage of development.

To address this objective, three main research questions are proposed and addressed:

- *To what extent is the Colombian entrepreneurial ecosystem promoting NTBFs?*

- *How do NVTs manage knowledge when creating NTBFs in the regional entrepreneurial ecosystem of Medellín?*
- *What is the nature of knowledge integration activities (KI) in NTBFs created in the regional entrepreneurial ecosystem of Medellín?*

## **1.4 Research approach**

In this thesis, a qualitative approach is used to explore the origin and evolution of the entrepreneurial ecosystem and entrepreneurs and their firms. This thesis examines how NVTs manage knowledge while creating and establishing NTBFs in a particular entrepreneurial ecosystem. It employs an interpretative paradigm in which it is assumed that the phenomenon to be researched is subjective (Easterby-Smith, Thorpe and Jackson, 2012). Therefore, this study is concerned with qualitative phenomena in which constructions are created by humans involved in the phenomenon and the researcher is a participant and a facilitator who seeks to accumulate different perspectives to develop a more elaborate construction by interpreting the multiple realities presented by the respondents.

A case study method is adopted to answer explorative, descriptive and explanatory questions about the phenomenon of interest (Yin, 2013). Although the main objective is exploratory, this methodological approach allows the researcher to use multiple units of analysis while exploring knowledge and learning in NTBFs under the same external knowledge constraints. A top-down theorising approach was used to engage in theory building (Shepherd and Sutcliffe, 2011). The research design is composed of two stages, the first one is related to the entrepreneurial ecosystem (the external source of knowledge) and the second one to the NVTs. Both stages used comparative cases, the first between different regional entrepreneurial ecosystems of Colombia and the second between eight NTBFs from Medellín, all of which have developed software, thus, they were part of ICT industry; a global industry in which it is necessary to make fast decisions to survive, and an industry that is characterised by its knowledge intensity, rapid technological advance, high growth and less extra cost to develop and deliver products (Saarendkto et al., 2008, Hyytinen and Pajarinen, 2005, Oakey and Cooper, 1991).

The creation of the entrepreneurial law (Law 1014 of 2006) in Colombia has provided a legal framework for the promotion of entrepreneurship; nevertheless there are still many drawbacks and challenges in several regions because regional constraints differ between cities: for instance, only a few local governments have strongly encouraged entrepreneurship. Data

collected evidenced that Medellín is a city of Colombia where the formal entrepreneurial network is evolving rapidly and where several layers of knowledge networks can be identified; in addition, a technological district is being created and supported.

By exploring the landscape within regional entrepreneurial ecosystems and comparing cases of NBTBs created in Medellín, the process of entrepreneurial learning is explored. Some of the conceptual underpinnings and assumptions of entrepreneurial learning are also highlighted, and suggest a theory for understanding how technical knowledge, market knowledge and knowledge integration generate technological commercialisation and substantive capabilities in NBTBs in an early stage entrepreneurial ecosystem. Analysis of the cases was undertaken using thematic analysis and both within-case and cross-case methods, as recommended by Miles, Huberman and Saldaña (2014).

## **1.5 Structure of the thesis**

Literature on entrepreneurial learning will benefit from a better understanding of how NVTs manage prior and new knowledge in entrepreneurial ecosystems. This thesis presents a KBV of entrepreneurial learning. To do so it explores, examines and analyses aspects of entrepreneurial networks, entrepreneurial ecosystems, and NVTs' PK and KI activities in NBTBs.

This thesis comprises eight chapters and is structured as follows:

Chapter One introduces the background of the research presenting the importance of new ventures, the research framework introducing the rationale of the overall thesis, the research objectives, approach and structure.

Chapter Two presents a review of the literature exploring entrepreneurial process, focusing on the models that have been presented to explain it, a review of NBTBs, networks and entrepreneurial ecosystems. This chapter sets the contexts in which this research is undertaken and identifies the need for developing the literature on new ventures in entrepreneurial ecosystems.

Chapter Three reviews the literature on the KBV, prior knowledge, knowledge-related process and entrepreneurial learning. It provides the theoretical background for the research, identifies

the research gaps, elicits the key theories and variables in the KBV of entrepreneurial learning in new ventures and provides a model of effective entrepreneurial learning in NTBFs.

Chapter Four discusses the research methodology and approach adopted for this research, with its limitations. The research adopts an interpretative paradigm, and applies a case study approach composed by two comparative case studies with different units of analysis. The research uses a qualitative approach. The rationale behind case selection in each stage and data collection methods is addressed in order to justify the choice of data collection methods. The data analysis follows within case and cross-case methods with use of the mind map technique in the second stage.

Chapter Five presents the findings of the first stage of data collection. This chapter is organised in two sections. The first describes the Colombian entrepreneurial ecosystem. The second is the within case analysis, which presents four regional systems of entrepreneurship from the four biggest cities of Colombia: Bogota, Medellín, Cali and Barranquilla. This analysis allowed identification of key factors influencing NTBFs in Colombia.

Chapter Six presents the findings of the second stage of data collection. The within-case analysis is presented with narratives developed around two core themes: the new venture team and products-services. This chapter is summarised in three sections. The first one presents the characteristics of the regional ecosystem selected as the founding environment. The second one presents the key events identified in the value chain of entrepreneurship and the stage of the firms. The third one presents how similar and how different the eight selected cases are. Doing so, it describes the level of the knowledge base of the entrepreneurs when each firm was legally created and when data were collected (in 2013).

Chapter Seven presents the cross-case analysis and discusses the findings of this research with entrepreneurial learning literature. It presents the several sources of new knowledge that NVTs used when creating and establishing the NTBFs. Seven integration activities were identified and categorised in external and internal knowledge integration and four different forms of knowledge integration. It was found that regardless of the knowledge base of the NVTs, all firms use internal and external knowledge integration when developing and commercialising the new technologies. While some of the identified knowledge integration activities provide social and human capital, one of the external activities of knowledge integration provides intellectual capital (outsourcing). Two key substantive capabilities (market and technical knowledge) were developed as a consequence of the reflective and selective behaviour of the members of the NVTs when choosing sources of new knowledge in an early stage



entrepreneurial ecosystem. This chapter also explains other key findings and proposes a theory of entrepreneurial learning in NTBFs that explains how NVT manage knowledge in NTBFs in early stage entrepreneurial ecosystems.

Chapter Eight synthesise the key findings of the research in relation to the aim and research questions of the study. It discusses and explains the contributions to the fields of entrepreneurial learning, NTBFs and entrepreneurial ecosystems. It also explains the methodological contribution for studying knowledge management in NTBFs. Finally, the chapter identifies the implications of the research and the key areas for further research.

## Chapter 2 **ENTREPRENEURSHIP AND ENTREPRENEURIAL ECOSYSTEMS**

In the knowledge society, entrepreneurship is a key economic driver. The creation of a new business and/or new products represents the generation of actions that inject dynamism into the economic system. The individual, the process and the system feed off each other (Morrison, Pietrobelli and Rabellotti, 2008, Timmons and Spinelli, 1999); therefore, a study of entrepreneurship must consider not only the process and the entrepreneurs, but also the networks and system which support entrepreneurship.

The purpose of this chapter is to present the key themes considered in this PhD research. This chapter is organised in four sections to examine the multifaceted nature of entrepreneurship. It discusses the theories of entrepreneurship and then, in the second section, the entrepreneurial process in new firms. The third section presents a review of the literature of NTBFs, examines definition, the entrepreneurial process, teams and entrepreneurial characteristics. Section four explores the dimensions of entrepreneurial networks and the role of knowledge networks in knowledge transfer and sharing in new venture creation. Finally, the last section examines the macro context in which networks coexist; the role of the entrepreneurial ecosystem and the need for further exploration of this concept.

### **2.1 Defining entrepreneurship**

There is no one commonly agreed theory of entrepreneurship. Researchers have approached the topic from several theoretical perspectives, including the behavioural school, ecological school and dynamic capability school (Baron, 2007, Aldrich, 1990, Zahra, Sapienza and Davidsson, 2006). Moreover entrepreneurship has been studied through focusing on two different moments in time of the firm: when it is being created and when it is established.

Many authors have pointed to the lack of a unified definition of entrepreneurship (Gartner, 1990, Gartner, 1988, Aldrich and Martinez, 2007, Stevenson and Jarillo, 1990). Veciana (2007) establishes that definitions add meaning to concepts by representing their important

characteristics. However, due to the complexities of entrepreneurship, it is difficult to define one attribute as more important than another (Gartner, 1990). The interdisciplinary nature of entrepreneurship (economics, psychology, anthropology, management, sociology, and finance) makes it challenging to propose one 'complete and robust' theory (Amit et al., 1993, Ucbasaran et al., 2001).

There are four major theories in entrepreneurship which are mainly focused on entrepreneur behaviour and capabilities: (1) the French tradition proposed by Cantillon which identifies the entrepreneur as a manager, (2) the Modern Austrian tradition, proposed by Kirzner, which affirms that everyone can be an entrepreneur and opportunities emerge as a result of the entrepreneur's knowledge, (3) the Schumpeterian theory, also known as the German-Austrian tradition, which is the conception of the innovative entrepreneur, a person who creates new things or new ways to do things, and (4) the Chicago tradition, proposed by Knight, which shows the entrepreneur as a person who manages uncertainty, is prepared to take risks and face decisions, and deals with the consequences (Bruyat and Julien, 2001, Stevenson, 1983, Bhide and Stevenson, 1992, Stevenson, 2000, Shane, 2003, Cuevas, 1994, Ucbasaran et al., 2001).

The entrepreneur is an innovator, and although his/her role as a manager, seeker of opportunities, and risk-taker is also important, there is no entrepreneur if there is not a 'good enough' (creative) idea that can form the basis of a business. It is the creation of new products based on innovative ideas that helps to create a competitive advantage. Innovation is a determinant characteristic that promotes entrepreneurship because the core of entrepreneurship is to offer a product or service as a result of creating something new or finding new ways to do things (Schumpeter, 1934).

Schumpeter affirms that 'Innovation is the true essence of entrepreneurship' (Cuevas, 1994:81) and that any person can perform all the roles required to be an entrepreneur (manager, seeker of opportunities and risk-taker), except for the innovator which is primarily achieved by chance. However, it has been suggested that even creativity is a skill that can be developed (Amabile, 1983, Amabile et al., 1996, Basadur, 2004). An entrepreneur is mainly an innovator and a manager who identifies the opportunity and in order to exploit it, seeks resources in society in order to generate value.

The entrepreneur's resources vary from personal skills, behaviours and attitudes to financial and social capital acquired from networks offered by the environment (Jarillo, 1989). Stevenson (2000:1) defines entrepreneurship as "the pursuit of opportunity beyond the

resources you currently control". Entrepreneurs have the ability to see an opportunity in the market and lead the process of transforming or developing the detected business idea into a stable business. This definition of entrepreneurship and entrepreneurs is adopted in this research.

Several studies focus on the factors influencing the creation of new business: some of them focus on specific factors related to the entrepreneur (Zhao and Seibert, 2006, Thompson, 2004, Gatewood et al., 1995, Cooper and Artz, 1995, Lee and Peterson, 2001, Bruyat and Julien, 2001); others, such as those by Parker (2009) and Landstrom (2007), present specific factors grouped by dimension. These two authors propose two levels of research in entrepreneurship: macro and micro. The macro level makes reference to the environment, entrepreneurship's role in society, and the dynamic development of regions and industries. The micro level focuses on the individual. Gartner (1985) proposes four perspectives for describing entrepreneurship: (1) characteristics of the individuals who start the venture, (2) the organisation which they create, (3) the environment surrounding the new venture, and (4) the process by which the new venture is started.

Given the fact that entrepreneurship cannot be explained either by environmental forces or by individual characteristics in the absence of the others (Shane, 2003), and given that both dimensions coexist over time in the entrepreneurial process, describing entrepreneurship must include all dimensions and the relations between them. Describing entrepreneurship by taking into account the individual, environment, organisation, entrepreneurial process, and the relations between them will capture the multifaceted reality of entrepreneurship.

The next section describes the entrepreneurial process and includes a critical comparison of several models presented in the literature.

## **2.2 The entrepreneurial process**

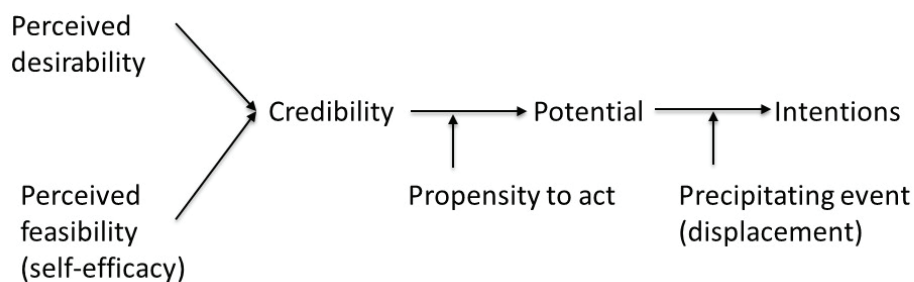
As defined earlier, an entrepreneur is mainly an innovator and manager who identifies an opportunity and seeks resources to exploit it in order to generate value. This section presents a review of literature focused on the entrepreneurial process; it includes the pre-entrepreneurial process and a comparative analysis of several models of the entrepreneurial process. This critical review has implications for the focal theory which is developed in this research and, therefore, on its research design.

Entrepreneurship emerges as a result of an opportunity identified by a potential entrepreneur with initiative. “Potential entrepreneurs need not have any salient intentions toward starting a business; their potential is latent and is causally and temporally prior to intentions” (Krueger and Brazeal, 1994:91). A potential entrepreneur is a person who has the ability, attitude and behaviour required to decide to set up a business; this can be understood as a prior stage before becoming a nascent entrepreneur, once a trigger event encourages him/her to make the decision to start a new firm (Krueger and Brazeal, 1994).

Shapero and Sokol (1982) and Bird and Jelinek (1988) have developed two models to explain the process and characteristics needed during the preliminary start-up stage. Both models have been used to design entrepreneurial educational programmes (Peterman and Kennedy, 2003, Lucas and Cooper, 2005, Fallone et al., 2006). Although there is another model (Ajzen's theory of planned behaviour, 1988, 1991), these models are the most used and recognised due to their attention to detail in explaining the pre-entrepreneurial process (Krueger, Reilly and Carsrud, 2000).

Krueger and Brazeal (1994) attest that Shapero’s model of the entrepreneurial event is based on the affirmation that relative credibility and some propensity to act are the characteristics of a potential entrepreneur and that credibility emerges as the presence of perceived desirability and perceived feasibility (Figure 2.1).

**Figure 2.1 Model of entrepreneurial potential (simplified)**



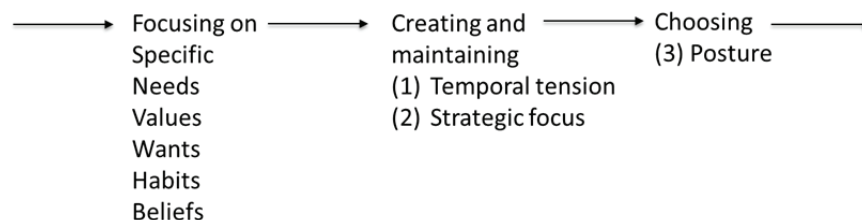
Source: Krueger and Brazeal (1994:95)

There are two notions of intention: (1) intention serves to predict entrepreneurial behaviour and, therefore, can help decision makers to know where to focus, and (2) intention is perception-based and, thus, can be learned, and can change depending on individuals and

situations (Krueger and Brazeal, 1994). Founding a business starts with the expression of intention (Bird and Jelinek, 1988, Bird, 1988, Hansen and Wortman, 1989, Katz and Gartner, 1988), then there is an implication of action (Gartner, 1985, Boyd and Vozikis, 1994, Bird, 1988, Learned, 1992) and, therefore, a commitment to a specific goal.

After a precipitating event occurs, if the potential entrepreneur has an intention to create a new venture, he/she assumes the nascent entrepreneur role and the start-up stage begins. Bird and Jelinek (1988) propose a model of intention (Figure 2.2) that suggests that the entrepreneurial process begins with the entrepreneur's personal needs, values, habits, and beliefs, which have their own precursors. Three more steps follow: (1) creating and maintaining temporal tension, (2) creating and maintaining strategic focus, and (3) choosing a posture.

**Figure 2.2 Model of Intention**



Source: Bird and Jelinek (1988:445).

The intention model emphasises the role of the entrepreneur and his/her behavioural characteristics. However, the precipitating event can be associated with external factors such as an economic crisis, a new law or programme, or a familiar situation (Krueger et al., 2000). A potential entrepreneur looks for an opportunity to seize or faces a particular precipitating event. An entrepreneurial event triggers the start of a new business, the pre-entrepreneurial process finishes, and the entrepreneurial process begins.

“The moment in time when an entrepreneur starts exploiting a perceived opportunity can be defined as the entrepreneurial event of any venture” (Kollmann and Kuckertz, 2006:30). That happens when an opportunity is identified and resources are allocated (individual and external factors have influence); the entrepreneurial event is when people decide to exploit a business opportunity. Start-ups are also referred to as new firms and new ventures; they are also

considered micro-firms when they have fewer than ten employees (which may grow later) and a turnover of less than two million euros (Lim, Platts and Minshall, 2012).

The start-up process includes the identification of an opportunity, the entrepreneurial event, and the survival/development phase (part of the implementation phase). Many authors describe the entrepreneurial process (Table 2.1). Some present it as the initial phases of the lifecycle of a business, and, therefore, theories of growth are used. In these cases the entrepreneurial process can be compared with the S-curves of new product creation, and, therefore, the lifecycle of a firm can be described as the succession of several entrepreneurial processes. In comparison with the entrepreneurial process, the lifecycle of a firm includes two more phases: maturity/expansion and decline/innovation.

The survival/development phase is characterised by the commercialisation of products or services for which prototypes were formulated and validated. First sales are made and sales volume increases. In some cases business plans are created and applied. During the post-start-up stage, the main sub-phases are characterised by substantial increases in sales and turnover. To succeed, the new venture starts exchanges with the market and operations involving the improvement of “production” processes. Growth and expansion require a bundle of resources which the entrepreneur, as the leader of the entrepreneurial team, is responsible for assembling and managing according to the surrounding context and the capabilities of the team (Koryak et al., 2015).

The lifecycle metaphor is used to describe the entrepreneurial process and the new venture creation process, including the start-up stage (Ayres, 2004). The stage approach assumes a linear sequence, like an evolutionary process, rather than a random series of events (Kamm, 1993). However, there is no consensus on whether a single sequence of events (linear model) can characterise the entrepreneurial process or whether it consists of simultaneously operating sub-processes (Bhave, 1994).

Table 2.1 presents a comparison of 14 approaches that have been used to characterise the entrepreneurial process. It can be seen that most of the models present the entrepreneurial process as part of the lifecycle, but only three of them include the entrepreneurial event. In addition, Table 2.1 also presents a categorisation (random or linear model) of the approaches; random models do not consider a sequence of stages while linear models describe the entrepreneurial process as a sequence of stages. This table, organised from the oldest to the newest approach, shows that there has not been a historical transition in the literature to either of these two types of models, although models after 2000 are linear. It suggests that a different

perspective could be more appropriate to explain the entrepreneurial process, and it also helps to identify how complex this process is and what different elements have been considered to describe it.

**Table 2.1 Models and approaches used to conceptualise and describe the entrepreneurial process (Part 1)**

Author(s)	Description – Factors/Components (Type of business)	Considering:			
		As part of the Lifecycle	Random model	Linear model	The Entrepr. Event
Greiner's model of organisation development (1972)	Suggests that organisations grow through five evolutionary stages, separated by brief periods of 'revolution', or dramatic organisational change. At each phase, major changes in the organisation need to take place for the firm to be successful in the succeeding period.	X		X	?
Wilken (1979)	Postulates three stages of the entrepreneurial process: the first corresponds to developing the idea and searching for social support, the second stage is planning the business (in practice, boundaries within these two stages are not clear), and third stage begins when the business starts.		X		X
Shapero and Sokol (1982:78)	Characteristics: (1) initiative-taking: an individual or group takes the initiative, (2) consolidation of resources: an organisation is formed or restructured to accomplish some objective, (3) management of organisations by those who took the initiative, (4) relative autonomy: resources are disposed of and distributed with relative freedom, (5) risk-taking: the organisation's success or failure is shared by the initiators.	?	X		X
Quinn and Cameron (1983)	Present a model integrating nine models and composed of four stages: entrepreneurial, collectivity, formalisation and control.	X		X	X
Kazanjian (1988)	Recognises four stages in NTBFs: (1) conception and development, (2) commercialisation, (3) growth, (4) stability. In this model every stage has a dominant problem and thus a specific outcome.			X	X
Bygrave (1989)	Includes personal, sociological, and environmental factors that give birth to a new enterprise. A person gets an idea for a new business either through a deliberate search or a chance encounter. Whether or not he decides to pursue that idea depends on factors such as his alternative career prospects, family, friends, role models, the state of the economy, and the availability of resources. There is almost always a triggering event that gives birth to a new organisation.	X	X		X
Larson and Starr (1993)	Network model: Organisation formation results from the crystallisation of stable, committed, exchange relations. The model describes this transition from pre-organisation to new organisation. It includes three stages: focusing on essential dyads, converting dyadic ties to socio-economic exchanges, and layering the exchanges.	X	X		?

Source: Developed by author



**Table 2.1.** Models and approaches used to conceptualise and describe the entrepreneurial process (Part 2)

Author(s)	Description – Factors/Components (Type of business)	Considering:			
		As part of the Lifecycle	Random model	Linear model	The Entrepr. Event
Naffziger et al. (1994:32)	Motivational model: “Integrates the start-up decision with issues of strategy formulation and implementation and sustained entrepreneurial behaviour. The process described in the model identifies how a new firm takes shape, how it is managed, and what leads the owner to sustain entrepreneurship”.	X	X		X
Bhave (1994)	Divides into three stages: the first is the opportunity stage which includes motivation, opportunity detection and opportunity access; the second stage is technology and organisational creation, which includes most organisational routines and practices, and therefore covers a myriad of activities like team formation, capital accumulation and employee recruitment; and the final stage is the exchange of resources with suppliers, customers, and others.	X		X	X
Busenitz and Lau (1996)	Cognitive model: Integrates social context, cultural values, and personal variables as factors influencing cognition (cognitive structure schema and cognitive process-heuristics).	X	X		X
Ndonzuau et al. (2002)	Proposes four stages relevant in explaining the transformation of academic research results into economic value. Each stage has a specific function in the global spin-off process: the first stage generates and assesses ideas with regard to possible commercialisation; the second stage considers these ideas and translates the most promising into genuine entrepreneurial projects; the third stage realises the best projects by creating new spin-off firms; and the fourth stage consolidates and strengthens the economic value created by these new firms.	X		X	X
Vohora et al. (2004)	One juncture is overcome in each stage. The four junctures are: opportunity recognition, entrepreneurial commitment, credibility and sustainable returns.	X		X	X
Gelderen et al. (2004)	Propose a four stage model: (1) The development of an intention to start an enterprise, (2) an entrepreneurial opportunity is recognised and a business concept is developed, (3) resources are assembled and the organisation is created, (4) the organisation starts to exchange with the market.			X	X
Baron and Shane (2007)	Explain that the entrepreneurial process unfolds over time and moves through a number of different phases. These phases are namely: (1) the idea for new product or service and/or opportunity recognition, (2) initial decision to proceed, (3) assembling the required resources (information, finance, and people), (4) actual launch of the new venture, and (5) building a successful business and harvesting the rewards.	X		X	

Source: Developed by author.

Moroz and Hindle (2012) present a harmonising multiple perspective view of the entrepreneurship as a process. They identify 32 models that can be categorised into stage, static, process dynamics, quantification sequences and others. Four representative models are identified: (1) Gartner's (1985) is static, (2) Bruyat and Juliet's (2001) considers the issue of temporality and value creation, (3) Sarasvathy's (2006) is a dynamic model of effectuation, and (4) Shane's (2003) involves opportunities and individuals. They conclude that no model in the literature is both generic and distinct, covers the broad complexity of entrepreneurship, or focuses on the exclusive activities of entrepreneurship.

As the literature does not suggest one universal model of the entrepreneurial process (Carter, Gartner and Reynolds, 1996), the selection of a model that captures the elements of entrepreneurship needs to take into consideration more variables than the individual and the environment. A model of the entrepreneurial process must also consider the issue of temporality, the driver of the entrepreneur (such as research, opportunity and need), specific characteristics of the firm (such as the type of entrepreneurship, for instance, NTBFs have particular characteristics) and the nature of the particular problem of interest.

The entrepreneurial process comprises two main stages. The first stage corresponds with the intention model, the willingness and opportunity to create a firm; and the second stage corresponds with the creation and establishment of the new firm. The main difference between both stages is that in the second stage a higher level of commitment moderates entrepreneurial action because entrepreneurs have already passed the entrepreneurial event; they have decided to engage in the creation the firm. In this stage entrepreneurs have already set a goal to make the new organisation survive and therefore they are committed to achieving their goal despite the uncertainty and risk associated with the creation of a new firm.

In both stages, individual and environmental factors play key roles. Entrepreneurs engage in pursuing and exploiting an opportunity or developing an idea, thus their behaviour and cognition defines their entrepreneurial action. The environment provides support and information to transform ideas and opportunities that can be exploited by creating a new firm; industrial, social, institutional, spatial and temporal conditions have an impact on entrepreneurs' action. Moreover, particular organisational conditions of the new firm also impact entrepreneurs' actions, for instance, employees' competences and types of product to be developed and commercialised impact how entrepreneurs allocate people into specific tasks.

Individual, organisational and environmental conditions must be considered when understanding how new firms are created and established. The entrepreneurial process can be

better described as a synchronised system in which the entrepreneur interacts with the organisational and surrounding conditions to create or identify opportunities and exploit them.

The problem of interest in the current research is the management of the knowledge needed and available when pursuing the opportunity to create a new firm. Therefore, since knowledge is the most important resource in NTBFs (Yli-Renko, Autio and Sapienza 2001), and networks are the most important source of knowledge for new firms, the next two sections present a brief literature review of NTBFs and networks. Section 2.3.2 will present the entrepreneurial process in NTBFs.

## **2.3 New Technology-based Firms**

*“Technology is the social pool of knowledge of the industrial arts”. Schmookler (1966:1)*

NTBF creation is one of the principal ways of transferring technology to society. NTBF creation represents one of the tangible outcomes of technological innovation<sup>2</sup> and entrepreneurship. Given that the focus of this research is on entrepreneurial learning and that knowledge has been identified as the main resource in NTBF (Yli-Renko, Autio and Sapienza, 2001), this section presents the definition of NTBFs, the entrepreneurial process in NTBFs and the importance of the team in the establishment of NTBFs.

### **2.3.1 Definition**

Following Autio (1994:260) this research “takes the view that NTBFs are essentially concentrations of technology, and that NTBFs may develop technology internally and/or acquire it from external sources. NTBFs refine technology to achieve the best possible fit with customer needs. NTBFs deliver, or transfer, technology to customers through various interactions.” NTBF is a firm “whose strength and competitive edge derives from the engineering know-how of people who are integral to the firm, and upon the subsequent transformation of this know-how into products or services for a market” (Klofsten, 1994:535).

The use of Klofsten’s definition allows having a broad group of firms that includes corporate spin-offs, university spin-offs and spin-outs. University spin-offs are one of the categories of NTBF and their particular characteristic is the relationship with the university where (1) the

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<sup>2</sup> Innovation is the implementation of a new or significantly improved product (goods or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. (Oslo Manual, 2005)

business idea was formulated and thus it might have some implications for the IP rights, or (2) the NTBF was incubated and thus it might have some implications for the ownership. Several researchers focus on academic entrepreneurship (Shane, 2004, Van Burg et al., 2008), and new firms created from academy are a type of NTBF.

Bathelt, Kogler and Munro (2010) propose a typology of spin-offs and start-ups according to university sponsorship and involvement in the firm formation processes. They present six different categories: four of them represent centralised idea development from the university, where sponsorship and exclusivity are determinants for describing the type of start-up; the other two categories present new firms with some ties with the university but different sources of sponsorship (see Table 2.2). All these categories are included in the presented definition of NTBF.

New technology-based firms (NTBFs) are not only expected to improve standards of living and quality of life but also to have a positive impact on the economic system. New products, services and processes, which have been developed from knowledge-related activities, are transferred to the market and have a more significant impact on the economy (Shane, 2005, Vendrell-Herrero, González-Pernía and Peña-Legazkue, 2011, Audretsch and Keilbach, 2004) because they add value to the value chain of its industry (Porter, 2008).

**Table 2.2 Typology of spin-offs and start-ups according to university sponsorship and involvement in firm formation process**

University sponsorship	University involvement in spin-off and start-up processes		
	University spin-offs		University related start-ups
	University research	University-industry joint ventures	Decentralised idea development
Sponsored spin-offs	<i>IP development at the university</i>	<i>University and industry formal agreement</i>	<i>By former graduates or undergraduate students</i>
Un-sponsored spin-offs	<i>Idea developed at the university, then the inventor leaves the university to develop it</i>	<i>Unsolicited innovation brought forward by someone in the research group and developed into a product</i>	<i>Completely self-developed firms, with social ties with the university</i>

Source: Adapted from Bathelt et al. (2010)

Attempts to create a technology-based firm draw heavily on resources such as financial resources, personal skills, patented technology, and social as well as professional networks

(Sarasvathy, 2001, Shane, 2004). For the purpose of this study, it is assumed that knowledge is the key resource, thus PK of the NVT and its capabilities are the key resources to manage. As Cooner and Prahalad (1996) state, when more valuable knowledge is generated by an employment contract than by a market contract, a firm is created. The next section explores some models of the entrepreneurial process in NTBFs.

### **2.3.2 The entrepreneurial process in NTBFs**

From Table 2.1, three models of the entrepreneurial process in NTBF can be identified: Kazanjian's model (1988), Bhavé's model (1989) and Ndonzuau et al. (2002). These three models can be summarised in four main linear stages: (i) the motivation stage when there is an idea and the entrepreneur works on its development, (ii) the commercialisation stage in which an idea is transformed into a marketable product and a business, (iii) the establishment stage and (iv) the growth stage. This general view is similar to Wilken's model (1979); however, Wilken states that boundaries between the first two stages are not clear in practice and that the two other stages (establishment and growth) is the third stage that happens when the business starts.

Business opportunities are acknowledged to arise from: alertness (Kirzner, 1997), improvisation (Baker, Miner and Eesley., 2003, Moorman and Miner, 1998), experience (Shane, 2003), and emergence (Sarasvathy, 2001). A technological innovation can have its origin in a new technology that needs to find a market to be sold (technological push) or in a market that needs a technology to supply a need (market pull) (concepts introduced by Schon, 1967).

There are different mechanisms for protecting IP depending on the category of the technology. The World Intellectual Property Organization (WIPO) affirms that an idea can be protected by formal rights such as trademarks, industrial design, copyright and patents. New ventures are more likely to exploit technologies that are patentable, particularly those that can be protected by a portfolio of broad scope patents (Shane, 2004). Although protection of intellectual property rights is not a guarantee for protecting the idea (Lang, 2002), a country must have developed a legal framework for protecting intellectual property (IP), because these policies give technological entrepreneurs a secure base for developing commercial relations within a country.

When developing a technology for commercialisation, there is a need for understanding better the product development process. There are a series of new product process activities (Cooper and Kleinschmidt, 1986) that can be organised into two groups: the ones required for developing the product (initial screening, preliminary market assessment, preliminary technical assessment, detailed market study/market research, business/financial analysis, a prototype or sample product development) and the ones required for market launch (in-house product testing, customer tests of products, test market/trial sales, trial production, pre-commercialisation business analysis, production start-up and launch of the product).

Shane (2004) establishes a model for university technology development, in which the first stage is the use of funded research, which includes the conception and development; the second stage is the creation and disclosure of the invention; the third stage is the decision to seek IP protection; and the fourth stage is marketing the technology and the final one is the licensing decision. Shane also establishes more stages that are subsequent to the creation of a spin-off: proof of principle, prototype development, the product development process and developing a market for the new technology.

It can be seen that both models of technology development presented consider the market, preliminary assessments and prototype development. To clarify how a new product represents a competitive advantage, there are some tools (SWOT, PESTEL, Porter 5-forces, Eco-business driver, new business road test) that help to identify industry and market activities, future challenges and ways to solve them, resources needed and feasibility of the idea development (WIPO, 2004). Some entrepreneurs write business plans to assess and communicate the feasibility of a business idea based on the perceived opportunity to develop and commercialise a new product or service (Honig and Karlsson, 2004).

NTBFs require that a new idea emerges from the opportunity of commercialising knowledge assets. The development of a new technology that can be commercialised is a stage of the entrepreneurial process characterised by assessing the feasibility of the commercialisation of the new technology. The NTBF needs to identify its markets and commercialise a new technology to become part of an industry and pass the business idea development stage to become a business.

Autio (1994) developed a framework for classifying the technology transfer effects of NTBFs. He identified three phases: initial technology transfer, development of technology, and commercialisation of technology. The first is when the emerging firm develops and acquires its initial pool of technological knowledge. The second is between the establishment of the

company and the first sales of the product/service, this stage can be long, short or it can happen before the first stage. The third follows the technology development, although “in reality, a company may start to sell services while still developing its main product” (262).

To summarise, NTBFs are one form to transfer technologies in the economic system. Not all new technologies have the potential to become the basis of a new business, and different types of organisations can generate NTBFs. Regardless of the origin of the business idea, all NTBFs develop and commercialise new technologies. The transformation of an idea into a business implies management of resources, however the most important resource in NTBFs is knowledge.

### **2.3.3 Entrepreneurial characteristics in NTBFs**

An entrepreneur can be a person of any demographic group with particular skills and behavioural attributes that make him/her able to identify opportunities and exploit them. Bhide (2000) identified two groups of abilities: one group of them is necessary to start up a new business and the other is necessary to make it grow. It suggests that an entrepreneurial team starts up a new business but another entrepreneurial team makes it grow.

Several researchers have focused their studies on the entrepreneur’s personality, skills, demographic and background; it has been found that, in general, demographics aspects, such as age, civil status and gender (Fischer, Reuber and Dyke, 1993, GEM, 2011) are not significant to differentiate who an entrepreneur is, nor to characterise behaviours within populations with different socio-economic patterns. Table 2.3 presents the most common characteristics explored in the literature, however, other authors have stated that a set of characteristics describe in a more relevant way who nascent entrepreneurs are (Gatewood et al., 1995, Zhao and Seibert, 2006, Ravasi and Turati, 2005, Heinonen and Poikkijiki, 2006, Heinonen, 2007).

As can be seen (Table 2.3), it is complex to identify a specific set of characteristics to define an entrepreneur but it is clear that an entrepreneur is a manager, a risk taker and a creative person with problem-solving skills. An entrepreneur is a manager because an entrepreneur has to lead an organisation and, to do so, he/she has to manage it. She/he is a risk taker because, once a triggering event occurs, the entrepreneur has to identify an opportunity and, under all types of uncertainty, invest his/her time, capital and effort into making it a reality. An entrepreneur is a creative person because there is no new business if there is not an idea with a

distinctive competitive advantage, and having competitive advantage implies offering something different; something creative that has not been proposed before.

**Table 2.3 Characteristics studied in the nascent entrepreneur**

<b>Aspect</b>	<b>Authors</b>
<i>Skills – abilities</i>	
Creativity	Thompson, 2004, Basadur, 2004
Teamwork	Baron and Markman, 2000
Managerial skills	Henry, Hill and Leitch, 2005a, Henry Hill and Leitch, 2005b, Lazear, 2004, Jovanovic, 1994, Kets de Vries, 1985
<i>Attitudes</i>	
Risk attitude	Stewart Jr and Roth, 2001, Parker, 1997, Palich and Bagby, 1995, Norton Jr and Moore, 2006, Kan and Tsai, 2006, Cramer et al., 2002
<i>Others</i>	
Role models	Krueger et al., 2000
Education	Johannisson, 1991, Jo and Lee, 1996
Experience	Parker, 2004, Cooper, Folta and Woo, 1995, Johannisson, 1991, Stuart and Abetti, 1990, Reuber and Fischer, 1994, Jo and Lee, 1996
Access to start-up capital	Blanchflower, Oswald and Stutzer, 2001

Source: Compiled by author.

Coleman and Cohn (2000) found some evidence of education being positively related to external loans. Experience and education level obtained may provide signals of better human capital. Consequentially, access to debt capital should be greater for these firms in which entrepreneurs have higher levels of human capital (Bates, 1997).

It is difficult to find an individual with all the skills to create a new business and make it grow because the abilities needed to start up a business and make it grow are different. Moreover, both groups of abilities are broad and difficult to find in only the entrepreneur. This is why it can be stated that entrepreneurs build teams that meet the abilities needed, and synergy among its members helps make the new business successful while mastering knowledge in the entrepreneurial process.

The human capital provided by founder's abilities is an important contributor to the success of the firm (Cooper, Gimeno-Gascon and Woo, 1994). Skills and abilities that founders bring to the business constitute important resources (Chandler and Jansen, 1992). Social skills, which help entrepreneurs interact effectively, are also identified as important in the new venture creation process (Baron and Markman, 2003) because networks are considered the most important source of knowledge.

Before moving to discussing networks, it can be concluded that the entrepreneurial process in NTBFs is mostly executed by a multi-skilled team that commercialises technologies and by



doing so, interacts with the ecosystem and develops an organisation in which knowledge is created and applied. This process requires the acquisition of new knowledge that is processed by the team to achieve the goal of creating and establishing a new firm.

“Knowledge is particularly important for technology-based firms: generating and exploiting knowledge in high-technology sectors demands that knowledge be continually replenished. Because the acquisition and exploitation of knowledge are predominantly social process, social capital may be critical for the long term success of technology-based firms” (Yli-Renko, Autio and Sapienza, 2001:587). The next section presents the challenge of building teams in NTBFs.

#### **2.3.4 Entrepreneurial teams in NTBFs**

Theories of entrepreneurship make reference to a single person as the one that executes the entrepreneurial function. This focus is mainly supported by the stance that individuals make strategic decisions (Casson, 1982). However, NTBFs are mostly created by teams, some of which know that to make appropriate decisions there is some information that is uncertain and unknowable (Knight, 2012), or simply undiscovered (Kirzner, 1997).

For Kamm et al. (1990:7) an entrepreneurial team is “two or more individuals who jointly establish a business in which they have an equity (financial) interest [and who] ... are present during the pre-start-up phase of the firm”. For Harper (2008:617) an entrepreneurial team is “a group of entrepreneurs with a common goal that can only be achieved by appropriate combinations of individual entrepreneurial actions”. In contrast with Kamm et al., for Harper entrepreneurial teams can be found also inside or within existing organisations.

Despite the definition used for entrepreneurial teams, several authors (Cooper and Bruno, 1977, Bird, 1989, Roberts, 1991, Eisenhardt and Schoonhoven, 1990, Harper, 2008) affirm that survival and fast growth are more likely to happen when firms are founded by teams rather than by individuals. As Cooper and Daily (1997:144) state “Entrepreneurial teams are at the heart of any new venture”. Forming effective and efficient teams is a challenge; researchers have identified that establishing a well-balanced skilled team (functional expertise, management skills, decision-making styles, and experience) is a usual problem in new venture creation (MacMillan, Siegel and Narisimha, 1986, Timmons, 1989). Entrepreneurial teams aiming to create new firms need to have the capability to create and utilise knowledge in such a way that the new firm has the ability to apply it to commercial ends, and gain and sustain a

competitive advantage (Cohen and Levinthal, 1990, Zahra and George, 2002).

Ucbasaran, Westhead and Wright (2001) affirm that balancing human resource and developing knowledge base are perhaps the most important challenges facing science-based entrepreneurial firms. In technology-based start-ups, entrepreneurial teams in the early stage tend to be formed by founders with homogeneous profiles because founders (e.g. academic entrepreneurs) select their partners considering their networks ties, forgetting the importance of a balance of skills (Ensley and Hmieleski, 2005, Franklin, Wright and Lockett, 2001).

The wide group of skills and knowledge required to create a technology-based business suggests that groups permit a more balanced management team, one less likely to have major areas of weakness. In fact, team-based entrepreneurship is the typical technology start-up mode as around only one in four technology firms is established by a lone entrepreneur (Cooper, 2006). NTBFs require entrepreneurs who are skilled at collaborating affectively with scientists and engineers as well as with financial managers and venture capitalists.

As it is unlikely to find many individuals whose profile includes all the entrepreneurial skills needed to develop a technology, create a business and make it survive, a collection of skills, teamwork and a leader are needed to establish an effective and efficient team and, therefore, a successful new business. Members' skills have to be sufficient for success or new members must be incorporated to supply skills. Entrepreneurial teams tend to be dynamic units where members change in order to establish a team.

There have been several studies to identify success factors in entrepreneurial teams. It has been claimed that human capital and the individual are important in new business performance (Thakur, 1999, Herron and Robinson Jr, 1993, Cooper and Kleinschmidt, 1995, Sandberg and Hofer, 1988, Learned, 1992). Pitman (2001) affirms that the effectiveness and the efficiency of the team are due to three group process issues: group decision-making, conflict management and group cohesion (trust, collective motivation, and commitment to group goals).

Literature identifies the importance of leadership in teams. Chorev and Anderson (2006) found that leaders from technology-based businesses should consider: excellent and motivated staff; to prioritise opportunities and to focus in terms of strategy, products and markets; to leverage strengths because of the lack of resources, for example integrating partnership agreements; to raise funds when possible and not wait until they are urgently needed; to strive to overcome local weaknesses; to open eyes to new markets and opportunities; that the external

environment has a relatively low effect on success and should not be a barrier for entrepreneurial high-tech start-up activity.

## **2.4 Networks**

Networks have been identified as the most important source of resources in new firms, particularly entrepreneurs have stated that networks can provide information and knowledge needed (Jenssen, 2001, Aldrich and Zimmer, 1986). Networks are key resources to manage in order to overcome the liabilities of newness (Stinchcombe, 1965, Abatecola et al., 2012). “Networks can be defined as a specific set of linkages between a defined set of actors with the characteristic that the linkages as a whole may be used to interpret the social behaviour of the actors involved” (Lechner, Dowling and Welppe, 2006:516).

Successful entrepreneurs recognise the importance of networks in the process of starting a new firm (Tidd et al., 2011) and networks as a source of resources for the success and growth of the new business (Bessant and Tidd, 2007, Hansen, 1995). Research demonstrates that social capital can be acquired through efficient networks “in which no matter when the entrepreneur enters the network, his needs are diagnosed and he is passed round the system until he gathers the necessary information and advice” (Birley, 1986:116).

Through relationships people can acquire knowledge, skills and capabilities to act differently (develop human capital) and increase that intellectual capital (Nahapiet and Ghoshal, 1998), the “knowledge and knowing capability of social collectiveness” for instance in an organisation (Nahapiet and Ghoshal, 1998:245).

Network relationships contain tangible resources such as financial capital, and intangible resources such as emotional support for risk-taking, business information and advice. Linkages between potential entrepreneurs, resources and opportunities can promote or limit entrepreneurship. For instance, relationships can have reputational and signalling content where entrepreneurs seek information to measure the potential of their ideas; in these cases, legitimacy helps to reduce uncertainty by having approval from experts or recognised organisations.

As stated in this section, networks are an important source of resources such as knowledge in NTBFs. A better understanding of networking, its dimensions and some typologies such as knowledge networks, will help to understand to what extent networks can help entrepreneurs

obtain the knowledge needed to create and establish an NTBF. Moreover, in countries like Colombia in which formal entrepreneurial networks are evolving, it is necessary to understand its evolution and its stage to have a clear perspective of the external conditions supporting NTBFs.

### **2.4.1 Dimensions of networks**

Research distinguishes three dimensions of networks or components of social capital: structural, cognitive and relational (Hoang and Antoncic, 2003, Nahapiet and Ghoshal, 1998, Inkpen and Tsang, 2005). These three factors are used to understand the role of networks in firm creation, establishment and performance. Each dimension will be discussed below.

#### ***2.4.1.1 The structural dimension***

The structural dimension corresponds to the dynamics of the linkages of the network; these linkages are considered the social structure of the network. Aldrich and Zimmer (1986) studied the role of structures within entrepreneurial networks and suggested that linkages between potential entrepreneurs, resources and opportunities can promote or limit entrepreneurship.

Greve and Salaff (2003) and Greve (1995) found that time spent by entrepreneurs on developing ties increases through the entrepreneurial process, meaning that time spent developing the idea during the development stage is less than during the establishment stage. Entrepreneurs spend more time maintaining ties and organising the foundations of the firm than on the development of the idea. Further findings indicate that density<sup>3</sup> does not change significantly through the entrepreneurial process, however a slight increase was found in the establishment stage. In general, contacts in the network are tightly connected (higher densities where previous relationships exist: the members to a large extent may share information and there may be a high tendency towards redundancy of information).

Martinez and Aldrich (2011) studied cohesion and diversity in network relations. They found that while strong social relations among the network members (cohesion) decreases through the entrepreneurial process, substantial variation in social characteristics among members (diversity) increases. At the beginning of the entrepreneurial process, networks are mostly informal, and family members represent a significant source of confidence. When

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<sup>3</sup> “Density refers to how tightly connected the persons in a network are to each other”. (Greve, 1995:6)

entrepreneurship moves to the following stages, formal networks are needed to acquire more specialised resources.

The way entrepreneurs spend their time in networking is different when they are developing the idea, organising the founding team and running the new firm (Aldrich and Zimmer, 1986, Greve and Salaff, 2003, Martinez and Aldrich, 2011, Greve, 1995). Nevertheless, it has also been stated that information flows better in weak ties under particular circumstances when weak ties act as a bridge between network components (Granovetter, 1983).

#### ***2.4.1.2 The relational dimension***

The relational dimension of social capital and governance represents the personal relationships people have developed with each other through a history of interactions. Governance is defined by the reliance upon “implicit and open-ended contracts” supported by power and influence, or by trust as the critical mechanism that enhances the quality of the resource flows (Hoang and Antoncic, 2003).

Governance mechanisms are critical for creating cost advantages; trust in networks is vital for allowing resources to flow through actors to obtain the greatest advantage of ties by sharing information (Barney and Hansen, 1994). Some researchers have stated that trust has a positive influence in internal knowledge sharing.

The relational dimension has three components: trust, norms and identification. Trust is the dimension that has been explored most frequently in the literature because this enables an open interchange of information and knowledge, “trust plays a key role in the willingness of network actors to share knowledge” (Inkpen and Tsang, 2005). Moreover, Inkpen and Tsang state that in institutional networks there is a set of norms that institutionalises the interchange of knowledge, and in particular types of networks, such as industrial districts. Interpersonal trust enables the transformation of individual social capital into organisational social capital.

Moreover, it is important to notice that resource acquisition and transfer within organisations depend not only on the network components (Hoang and Antoncic, 2003) but also the type of network (Inkpen and Tsang, 2005). The structural, cognitive and relational dimensions of a network differ depending on the type of network, for instance a franchise has a structured governance while an industrial district has an unstructured governance.

#### ***2.4.1.3 The cognitive dimension***

Shared representations, interpretations, and systems of meaning among the parties, represent the cognitive dimension of social capital and belong to the content component of networks. Gibb (1997) proposes a classification of the relationships that an entrepreneur manages –

under some degree of uncertainty – to help the firm survive: the network of customers, suppliers, bankers, accountants, solicitors, agents (peers), marketing channels (other service producers such as transport), regulatory authorities such as Chamber of Commerce, staff (employees), associations, and more intimate acquaintances (family and friends). This classification of relationships represents the cognitive dimension of social capital because it provides information about what content of information can be managed with each of these contacts; for instance, legal information is discussed with solicitors. New Venture Teams (NVTs) whose PK is not related to legal issues will search for people that can advise and support them in this field.

Entrepreneurs use informal networks and formal networks during the entrepreneurial process: formal contacts such as bank, accountant, local government, Chamber of Commerce, and informal contacts such as family, personal friends, business contacts and other contacts provide support (Birley, 1986). Cooper and Artz (1995) argue that cognitive schema in familiar and unfamiliar domains of entrepreneurs could be studied, in particular the role of seeking knowledge in changing those schemas and particularly how entrepreneurs gather and use information when needed.

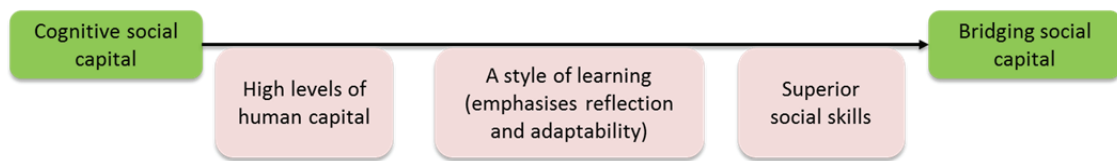
Cognitive social capital is the resource that provides shared representations, interpretations, and systems of meaning among parties; shared goals, culture, language and codes (Nahapiet and Ghoshal, 1998, Inkpen and Tsang, 2005). Cognitive social capital can bridge capital, and secure distant connections between people, characterised by weaker cross-cutting ties (Nahapiet and Ghoshal, 1998). This introduces the role of knowledge relatedness<sup>4</sup> (Makri, Hitt and Lane, 2010) between the people that interchange information.

Cognitive social capital is typically used in the opportunity development stage. In general, the ability of the entrepreneurs to transform cognitive social capital into bridging social capital allows them to derive maximum advantage from the entrepreneurial network in which they are embedded. Martinez and Aldrich (2011) state that this transformation depends on three factors: high levels of human capital, a particular style of learning and superior social skills (Figure 2.3).

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<sup>4</sup> Knowledge relatedness is connectedness in knowledge domains (Makri, Hitt and Lane, 2010).

**Figure 2.3 Factors moderating the transformation of cognitive social capital into bridging social capital**



Source: Adapted by author from Martinez and Aldrich (2011)

There are two key mechanisms for creating social knowledge which influence the acquisition of intellectual capital: combination (the process viewed by Schumpeter as the foundation for economic development to produce means to combine materials and forces within our reach) and exchange (since intellectual capital generally is created through a process of combining the knowledge and experience of different parties, dependent upon the exchange between these parties). Combination and exchange of knowledge are complex social processes and valuable knowledge is fundamentally, socially embedded in particular situations, coactivity and in relationships (Nahapiet and Ghoshal, 1998).

De Clercq et al. (2013) have identified a U-inverted relationship between absorptive capacity<sup>5</sup> (Cohen and Levinthal, 1990) and innovation, recognising the mediating role of cognitive distance (Wuyts et al., 2005). The role of absorptive capacity in entrepreneurial learning will be discussed in Chapter 3.

Knowledge is a critical resource in NTBFs that can be acquired in entrepreneurial networks but also in knowledge networks. A firm starts with the knowledge base of the entrepreneur(s) and an ecosystem surrounding it. The NVT's knowledge base is represented in the individual knowledge of its members and can be increased by the acquisition of new knowledge.

Members of NVTs create a collective knowledge base that is used by the firm when it is being created and established. This collective knowledge is a result of the interaction of individuals and, therefore, represents a mix of social capital (formal and informal networks) and human capital (PK) that was managed by the NVT in new ventures. Members of an NVT transform cognitive social capital into bridging social capital when interacting with potential sources of new knowledge such as networks. The next section presents the role of knowledge networks in new firms.

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<sup>5</sup> Absorptive capacity is "a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal, 1990:128).

### 2.4.2 Knowledge networks

Knowledge networks are a type of industrial network that focuses on the exchange of information and knowledge (Carlsson and Jacobsson, 1997). Given that the focus of this research is knowledge in entrepreneurship, it is important to understand the role of this type of network in an entrepreneurial ecosystem (see Section 2.5).

Effective knowledge sharing has been attributed to the existence of knowledge networks where knowledge flows between the members within the network. Thus, a new firm which has access to a knowledge network in an industry or a sector, benefits from the stock of information available. For instance, a corporate spin-off will benefit from the network of the organisation where it was created, and a university spin-off benefits from the university network and the surrounding institutions supporting entrepreneurship. Nevertheless, redundancy of information can generate confusion, making the entrepreneur delay the decision-making process or take longer paths to solve a problem (Hoang and Antoncic, 2003).

The acquisition and transformation of social capital generates important direct outcomes such as the opportunity for discovery, securing resources, gaining legitimacy and achieving higher rates of growth. Indirect outcomes are also achieved such as the acquisition of intellectual, human and financial capital.

Knowledge networks can be seen at the macro level, within regional and national institutions, as presented by Collinson and Gregson (2003), and at the micro level inside an institution, as presented by Hansen (2002) and Hansen, Mors and Løvås (2005).

At the macro level, a region can host several types of system and several technological clusters, therefore, the social capital available in the region will be determined by the several macro knowledge networks that coexist in the existing systems. This form of social capital is external to the new firm and can be defined by the “aggregate of actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition” (Bourdieu, 1985:248) and “made up of social obligations (connections), which is convertible, in certain conditions into economic capital and may be institutionalized in the form of a title of nobility” (Bourdieu, 1985:243).

New firms located in districts benefit from knowledge externalities<sup>6</sup> of the district. Thus, identifying what knowledge networks are available for a specific new firm or a new product implies identifying what institutions may be organised in a network where entrepreneurs can

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<sup>6</sup> An externality is the cost or benefit that affects a party who did not choose to incur that cost or benefit.



acquire knowledge (and resources) and explore opportunities. Several types of system<sup>7</sup> may be contributing to ready access to knowledge; several types of system can contribute into the transfer of new knowledge in organisations: technological systems (Carlsson and Stankiewicz, 1991), regional systems (Maskell, 2001), sectoral systems (Malerba, 2002) and innovation systems (Lundvall, 2010). Table 2.4 presents a definition of each of these systems.

**Table 2.4 Types of system**

Type of system	Definition (author)
Technological system	“A technological system may be described as a network of agents interacting in the economic/industrial area under a particular institution’s infrastructure and involved in the generation, diffusion, and utilization of technology. Technological systems are defined in terms of knowledge/competence flows rather than flows of ordinary goods and services” (Carlsson and Stankiewicz, 1991:111)
Regional system	“Economies that arise from the geographical agglomeration of related economic activities” (Maskell, 2001:922)
Sectoral system	“A sectoral system of innovation and production is a set of new and established products for specific uses and the set of agents carrying out market and non-market interactions for the creation, production and sale of those products. A sectoral system has a knowledge base, technologies, inputs and an existing, emergent and potential demand” (Malerba, 2002:250)
Innovation system (National system of innovation)	“A system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge and that a national system encompasses elements and relationships, either located within or rooted inside the borders of a nation state” (Lundvall, 2010:2)

Source: Developed by author

Systems are composed of agents. Agents are organisations with a contractual role that are linked through networks. This generates a set of norms, obligations and expectations regarding the role of the organisations in the system. Organisations may have direct action into the creation of a new firm but others may act as intermediaries which facilitate access to information in innovation (Howells, 2006). For instance, some organisations house incubation programmes and also provide legal, financial and managerial support to start-ups. Intermediaries are impartial, neutral and independent organisations that help to build effective paths because they share information easily. Intermediaries’ contribution in technological innovation is indirect and, therefore, not easy to measure (Ruiz and Robledo, 2013). When these agents (intermediaries) execute roles regarding entrepreneurship, they become part of the entrepreneurial network.

<sup>7</sup> “Anything formed of parts placed together or adjusted into a regular and connected whole”, Chambers Twentieth Century Dictionary.

In the particular case of NTBFs, technological clusters may also be contributing to offering ready access to knowledge. The concept of the technological system is closely linked to the technological cluster. Effective networks are vital for acquiring the necessary resources, therefore, the development of technology-based clusters such as Silicon Valley (Lécuyer, 2006) is a way for facilitating access to partners' organisations where entrepreneurial teams can increase their social, human, intellectual and financial capital.

Keeble and Wilkinson (2000) suggest that successful regional clusters have a common characteristic, they develop a localised collective learning capability, and "learning and knowledge creation are both crucially important for developing a firm's core competences" (p.10). Moreover, Lawson (2000) distinguishes two kinds of learning process, one at the firm level in which being part of a particular community enables learning, and another one at the regional level, in which lessons of its members are encoded into the routines and practices of their collectivity. When a specific industry has formal partnerships, knowledge transfer is smooth and network topologies determine significant advantages for knowledge-intensive firms (Owen-Smith and Powell, 2004).

In contrast with the macro level presented, the micro level makes reference to the internal social capital of the firm (Adler and Kwon, 2002). Fukuyama defines it as "the ability of people to work together for common purposes in groups and organizations" (1995:10) and "social capital can be defined simply as the existence of a certain set of informal values or norms shared among members of a group that permit cooperation among them" (1997:4). The micro level makes reference to firms or even units within firms. Although this type of social capital is not addressed in the literature as networks, this type of relationship (relationship between supervisors and employees, relationships among employees on teams) is addressed from the human resource management field and has not focused on "how relationships embedded in networks affect knowledge sharing, job and organisational performance and sustained competitive advantage" (Stahl et al., 2012:476). This is a field of research to explore, particularly in NTBFs because this type of firm is mostly created by teams rather than by individuals (Harrison et al., 2004).

Entrepreneurs need knowledge to create and establish NTBFs. They need to manage macro and micro levels when learning. In addition, entrepreneurs who want to pass through the entrepreneurial process must consider how entrepreneurial and knowledge networks can provide the necessary knowledge. Both types of network and several types of system coexist in the entrepreneurial ecosystem. Thus, it is important to understand what an entrepreneurial ecosystem is in order to appreciate the position of these other networks and systems within it.

Knowledge networks are embedded in systems that provide ready access to knowledge to entrepreneurs. Network dimensions – structural, governance and cognitive – are important elements for understanding how entrepreneurs use social capital to access knowledge. The structural dimension represents how ties are configured; the relational dimension how trust enables knowledge sharing and transfer; and the cognitive dimension represents how cognitive social capital can be transformed into bridging social capital. Although the focus of this study is not to understand better a particular dimension of networks, its understanding is relevant to describe and compare knowledge networks that are available for NVTs in the several systems coexisting in entrepreneurial ecosystems.

## **2.5 Entrepreneurial ecosystems**

The entrepreneurial ecosystem is an emerging concept in the literature that is central to the purpose of this study, as it influences the available stock of knowledge for the entrepreneur and NTBF. Although the terms “entrepreneurial region” and “systems of entrepreneurship” have been used in entrepreneurship literature, the term “entrepreneurial ecosystem” is new. One of the earliest to pick into the topic was Isenberg in 2010. A search using the criterion “entrepreneurial ecosystem” in the web of science presented ten papers and a search using the criteria “entrepreneurial ecosystems” presented three papers: one on university entrepreneurial ecosystems, another comparing an Asian and a Baltic ecosystem, and the last exploring the importance of the context. Three streams can be identified that stress the need for this term: innovation ecosystems, entrepreneurial systems at the regional level and national systems of entrepreneurship. Several types of ecosystems (innovation, business, regional and national) coexist in a country like Colombia, capabilities coevolve around a region, a new innovation, a set of technologies, knowledge or skills; in all ecosystems companies work cooperatively and competitively to develop new products and services, thus NTBFs can be benefited by belonging to any of these ecosystems.

### **2.5.1 Innovation ecosystems and business ecosystems**

The word “Ecosystem” has been borrowed from the literature of ecology (Moore, 1993). Teece (2009:16) defines ecosystem as “the community of organizations, institutions, and individuals that impact the enterprise and the enterprise’s customers and suppliers”. To extend

the systems approach to strategy, Moore (1993:76) proposed that “in a business ecosystem, companies coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovators”. Nambisan and Baron (2013:1071) proposed that “an innovation ecosystem refers to a loosely interconnected network of companies and other entities that coevolve capabilities around a shared set of technologies, knowledge, or skills, and work cooperatively and competitively to develop new products and services”. While business ecosystems develop capabilities around a new innovation, in innovation ecosystems capabilities development is around a shared set of technologies, knowledge or skills. Therefore, in some cases business ecosystems can become innovation ecosystems.

Nambisan and Baron (2013) presented a conceptual paper in which they explored innovation ecosystems and entrepreneurs. Their study explored the role of self-regulatory processes in a hub-based ecosystem. They stated that entrepreneurs have to manage multiple discrepant goals within the ecosystem and beyond it, thus they need to explore and exploit opportunities playing the role of a valuable member of the ecosystem within the ecosystem and playing the role of the independent company outside the ecosystem. To do so, entrepreneurs employ different cognitive processes. Nambisan and Baron’s model presents three discrepant goals: success/performance, relational (relations with competitors and collaborators) and technology development goals, focusing on three cognitive processes that have strong and general effects: self-control, grit (being focused on and persistent in the pursuit of long-term goals) and metacognition (individuals’ awareness and control over their cognitive process).

Zahra and Nambisan (2011) explore the role of global innovation ecosystems in new ventures. They identify three knowledge-related characteristics in ecosystems. (1) Knowledge dispersion: this is more than a matter of geography, this makes reference to “the different systems of organizations as well as differing frames of references and paradigms that attract groups of researchers and companies to a particular domain or set of applications” (p.7). (2) Diversity of knowledge: entrepreneurship is a combination process, different types of knowledge are combined when creating a new firm and developing new products, services or processes, thus ecosystems that hold a wide range of information sources offer the entrepreneur more diverse sources of opportunities. (3) Contextuality of knowledge: knowledge is context-specific, it is socially constructed and, therefore, its meaning can change when it is removed of the original setting or dissected. They also stress the challenge for the entrepreneur in converting knowledge and reshaping the ecosystem, and reflect on three roles that new ventures play in innovation ecosystems (breeder, feeder and niche leader).

As it was stated before, surrounding ecosystems are sources of knowledge for NTBFs, this is why it is important to acknowledge the studies that have examined the role of innovation ecosystems in new ventures for this PhD research.

### **2.5.2 Entrepreneurial systems at the regional level**

Given that this study examines the potential role of ecosystems as source of knowledge for NTBFs, this section considers entrepreneurial systems at the regional level. Entrepreneurial systems can be found in open systems of economic exchange because entrepreneurial activity is supported and new venture creation is driven by interactions in a dynamic system (Van de Ven, 1993).

Spilling (1996:91) defines an entrepreneurial system as the “complexity and diversity of actors, roles, and environmental factors that interact to determine the entrepreneurial performance of a region or location”. He proposes a model of interaction between entrepreneurial events and environmental factors such as business structure, socio-cultural structure, economic cycle, actors (potential entrepreneurs) and opportunities. He studied how a mega-event impacts the economy of a region by creating an ecosystem and generating learning lessons and the accumulation of business-related competence.

Feldman (2001) considers that in a regional context, entrepreneurial systems are characterised by the availability of venture capital, supportive social capital (effective networks), entrepreneurial expertise/support services and research universities as growth engines. For him, an entrepreneurial system comprises the external factors that have influence on entrepreneurship; an entrepreneurial ecosystem includes private and public institutions (universities, incubators, venture funds, industry), governmental strategies to support entrepreneurship (laws and policies), and even sociological factors such as culture.

Neck et al. (2004) presented a study that explores new venture creation in an entrepreneurial system of Colorado. They state that previous research has focused mainly on the study of single components of the entrepreneurial system, therefore they study the importance of several components (the incubator spin-off relationship, informal and formal networks, physical infrastructure and culture) in a system that seeds regional entrepreneurial activity. They identified seven important components of entrepreneurial ecosystems: Informal networks, formal networks, research universities, government, professional support, capital services and a talent pool. Based on the Neck et al. paper, Cohen (2006) links the impact of each of these components into the generation of sustainable entrepreneurial ecosystems taking as a case study one community in British Columbia.

Cooke and Leydesdorff (2006) identified two types of regional innovation system: institutional regional innovation systems and entrepreneurial regional innovation systems. Based on their work, Ylinenpää (2009) attempts to integrate both systems with the argument that both systems are complementary.

Based on Spilling's perspective, Harrison and Leitch (2010:1244) state that "not all regional economies will have entrepreneurial systems that function at the same level". They also identified that in some regions the action of universities regarding spin-off creation may not contribute into the economic development of the region.

Autio et al. (2014) state that the context is very important for entrepreneurial innovation. They describe different types of contexts: (1) industrial and technological contexts, (2) organisational context, (3) institutional and policy contexts, (4) social contexts, (5) temporal and (6) spatial contexts. They affirm that they "see the interplay between variations in these contextual elements and entrepreneurs as constituting different entrepreneurial innovation ecosystems that generate different types of innovation" (1100). By doing so they integrate the literature of systems of innovation with the literature of entrepreneurship, because the literature on systems of innovation has not considered the role of the entrepreneur while the academic literature on entrepreneurship has focused mostly on the individual.

Regions in Colombia are diverse not only in access to natural resources but also in the industrial and technological context, institutional and policy context and social context. These differences impact how external conditions influence entrepreneurs and new venture creation. For a better understanding regarding how NVTs manage knowledge in NTBFs in Colombia, it is important to have a comprehensive perspective of how different regional entrepreneurial ecosystems are in the country; this perspective is presented in chapter 5.

### **2.5.3 National Systems of Entrepreneurship**

Acs, Autio and Szerb (2014:479) introduce the concept of National Systems of Entrepreneurship: "A National System of Entrepreneurship is the dynamic, institutionally embedded interaction between entrepreneurial attitude, ability, and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures". They address the failure of the entrepreneurship literature in considering the systemic dimension of entrepreneurial action, proposing an index (Global Entrepreneurship and Development Index) that considers the interaction of components in system performance.

They state that, although individuals drive national entrepreneurial systems, institutions regulate who acts, thus the index includes individual and country-level variables. To finish, they recognise that countries are not homogeneous and, therefore, “research on regions might provide a useful avenue for research” (p.491).

#### **2.5.4 Entrepreneurial ecosystems: components and challenges**

The literature addressing the term “entrepreneurial ecosystems” is fragmented and has focused on different interests; however, the process of creating and establishing a new firm cannot be understood without considering the conditions of the entrepreneurial ecosystem where a new firm is being created. Entrepreneurship is contextual and literature in national and regional systems of innovation has limitations in considering the role of the entrepreneur (Autio et al., 2004) and the role of industry associations in innovation (Watkins et al., 2015).

For the literature in entrepreneurship regarding policy (Isenberg, 2010, World Economic Forum, 2013), entrepreneurial ecosystems “consist of a set of individual elements – such as leadership, culture, capital markets, and open-minded customers- that combine in complex ways. In isolation, each is conducive to entrepreneurship but insufficient to sustain it” (Isenberg, 2010:43). The essential elements of this framework are: public leaders, governments, culture at large, success stories, knowledgeable people, capital sources, non-profits and industry associations, educational institutions, public infrastructure, geographic locations, formal or informal groups, venture-oriented professionals, and local potential customers.

Pitelis (2012) presents a conceptual paper in which he links clusters, entrepreneurial ecosystem co-creation and appropriability. He introduces the key role of inter-firm cooperation (IFC)<sup>8</sup> and offers an integrative definition to developed or mature clusters “Clusters are geographical agglomerations of firms in particular, related, and/or complementary, activities, sharing a common vision, and exhibiting horizontal, vertical intra-and/or inter-sectoral linkages, embedded in a supportive socio-institutional setting, and cooperating and competing in national and international markets” (p.3). He addresses the importance of entrepreneurial action in the creation and co-creation of clusters and ecosystems.

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<sup>8</sup> Quasi-stable and durable, formal or informal arrangements between two or more independent firms, aiming to further the perceived interest of the parties involved.

As has been presented, the literature on entrepreneurial ecosystems has evolved into two streams, one based on the concept of innovation ecosystems and the other based on regional systems of entrepreneurship. A third new stream is the National System of Entrepreneurship that considers institutional and individual variables. All this literature emphasises the importance of the interaction between several components of the entrepreneurial ecosystem. Moreover, organisations supporting entrepreneurship and innovation interact and generate unique dynamics that are constrained by the social, temporal and spatial conditions that compose the entrepreneurial ecosystem. In summary, it can be said that an entrepreneurial ecosystem has several components that interact and one of these components is the entrepreneur as the actor that co-creates the ecosystem. NVTs are embedded in entrepreneurial ecosystems in which several contexts interact, spatially and temporally.

## **2.6 Summary**

As defined earlier, entrepreneurship is “the pursuit of opportunity beyond the resources you currently control” (Stevenson, 2000:1). Several theories of entrepreneurship and several modes of the entrepreneurial process have been presented in this chapter, however there is not a theory of entrepreneurship, nor a model of the entrepreneurial process, that captures the multifaceted dimensions of this phenomenon. A conceptualisation of an entrepreneurial ecosystem in which the entrepreneurial action triggers the co-creation of the ecosystem is a more integrated perspective of the reality of this phenomenon.

Entrepreneurs consider networks the most important source of knowledge: knowledge about the market (Musteen, Datta and Butts, 2013, Li and Calantone, 1998), funding (Semrau and Werner, 2013) and internationalisation (Naldi and Davidsson, 2013, Liu et al., 2010), or even information about potential employees, investors or partners. Networks are exogenous sources of knowledge (O'Donnell, 2014, Martinez and Aldrich, 2011, Kreiser, 2011, Lechner et al., 2006) where new knowledge, which is mostly tacit (Smith et al., 2009), can be acquired. Studies in the transfer of knowledge introduce the concepts of knowledge networks and spillovers (Acs and Sanders, 2013, Acs et al., 2009, Qian and Acs, 2013).

Organisational learning studies have identified the importance of an optimal cognitive distance where knowledge is transferred from one actor to another with a sufficient distance to allow innovation (Nooteboom et al., 2007, Nooteboom, 2000). It suggests that knowledge networks are more efficient when there is an optimal cognitive distance between the entrepreneurs and



the various agents that compose the macro and micro knowledge networks. Cognitive distance has been associated with the specific knowledge base, high human and social skills such as attitude to sharing and collaborating and a particular style of learning (Martinez and Aldrich, 2011). The surrounding ecosystem – with its networks – represents a source of knowledge from where NVTs acquire new knowledge and produce new knowledge for creating and establishing a new firm (Figure 2.4).

Knowledge is not the only intangible resource that entrepreneurs manage to gain in order to maintain competitive advantage in NTBFs; they also manage social capital<sup>9</sup>. From previous discussions, networks are intangibles that an entrepreneur manages when creating an NTBF, and networks are sources of new knowledge. A theory about entrepreneurial learning would benefit from consideration of empirical studies on the role of knowledge and the role of relationships; where knowledge, knowledge-related processes and networks have to be linked. In addition, a “theory of entrepreneurship requires a theory of entrepreneurial learning” (Minniti and Bygrave, 2001:7). If there were more clarity about how entrepreneurs learn when creating an NTBF, it would be easier to understand how important resources other than knowledge are in new venture creation.

In this chapter, the role of networks for new ventures and the importance of systems and teams in NTBFs is discussed; however, there are few studies on entrepreneurial ecosystems or studies of how NTBFs develop and are promoted in such ecosystems. There is also an absence of studies about how NTBFs manage knowledge resources in a particular entrepreneurial ecosystem. This chapter discussed the literature of entrepreneurial processes, NTBFs, networks and entrepreneurial ecosystems. Lastly, this literature review contributed to the understanding of the context of this research by recommending that knowledge resources (knowledge and networks) are the basis to explore entrepreneurial learning in NTBFs.

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<sup>9</sup> Bourdieu, P. & Wacquant, L. J. 1992. *An invitation to reflexive sociology*, University of Chicago Press defines social capital as the sum of resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalised relationships of mutual acquaintance and recognition.

## Chapter 3 **KNOWLEDGE, LEARNING AND NEW TECHNOLOGY-BASED FIRMS**

The objective of this chapter is to explore how knowledge is managed in NTBFs because this is a key resource for NTBFs. Thus, this review includes elements of the KBV, PK and capabilities, which are key to explore NVTs' learning processes in NTBFs.

The chapter is organised in nine sections. The first section presents the knowledge-based view; the second one explores entrepreneurial learning; the third presents a KBV of entrepreneurial learning and the fourth explores the role of PK in new ventures. The fifth one presents a critical literature review of capabilities in learning emphasising the role of knowledge integration (KI). The sixth section discusses capabilities in NTBFs while the seventh section proposes an integrative model of entrepreneurial learning in NTBFs in entrepreneurial ecosystems. The eighth and final section proposes a conceptual model of knowledge management in NTBFs.

### **3.1 Knowledge-Based View**

NVTs acquire new knowledge from networks in entrepreneurial ecosystems and they process prior and new knowledge to pursue capabilities development, innovation and competitive advantage. Given that KBV has received broad coverage in the literature, adopting a KBV is helpful to examine how NVTs process knowledge and succeed – how they learn. This section examines different theoretical perspectives that have been used in KBV to build an integrated framework to propose a KBV of entrepreneurial learning in section 3.3.

Knockaert et al. (2011) state that a firm's success will depend on how well it can (1) enhance its own knowledge base; (2) integrate knowledge (Cohen and Levinthal, 1990); and (3) apply knowledge to develop successfully either new products/services or improve current ones. Entrepreneurial learning is the process that entrepreneurs engage in to enhance their knowledge base, integrate it with existing knowledge and apply it successfully to develop

sustainable advantage. NVTs have to develop and commercialise new products/services or improve current ones in order to establish a new firm. Sales represent a specific form of growth: entrepreneurial growth, growing by launching new products or services and/or through the expansion into new geographic markets (Naldi and Davidsson, 2013).

The KBV has been explored from many perspectives. Thus, basic definitions have been changing by use and misuse of the concept. Moreover, criticisms of the Resource-based Theory (RBT), as a theory of the firm, can be extended to the KBV and the dynamic capabilities frameworks, for instance: RBT, KBV and dynamic capabilities lack a single framework and consideration of external factors.

The KBV of the firm has its origin in the RBT and has evolved into different schools of thought such as the dynamic capabilities (Teece, 1997, Zahra, Sapienza and Davidsson, 2006, Teece, 2007) and the competence perspective (Freiling, Gersch and Goeke, 2008). Despite the numerous empirical studies in both schools, fundamental problems with the RBT remain.

Barney (1991) presents the Resource-Based View (RBV) in strategic management. Sustained competitive advantage is derived from valuable, rare, imperfectly imitable and not substitutable (VRIN) resources and capabilities: sources of intangible and tangible assets. Resources are valuable because they enable the firm to gain and generate value. Resources have to be unique, imperfectly imitable and not easily substitutable because of the importance of differentiation. If a firm wants to gain competitive advantage, it has to offer differentiation and/or low prices in a specific industry (Porter, 1980).

In response to the transformation of the RBV into the RBT, Conner (1991) reveals a comparison of the RBT with five schools of thought within industrial organisation (IO) economics: Neoclassical, Bain-type IO, Schumpeter, Chicago, Transaction Cost. She finds that the “RBT both incorporates and rejects at least one major element from each of them; thus RBT reflects a strong IO heritage, but at the same time incorporates fundamental differences from any one of these theories” (Conner, 1991:121). Conner also states that the resource-based approach does not reject the existence of opportunities or the importance of making decisions for exploring opportunities because some decisions can “turn on specific asset creation/redeployment issues, and others on reducing opportunistic potential” (143).

Grant (1991) presents the implications of the RBT for strategy formulation that considers that intangible resources and people-based skills are probably the most strategically important resources. He presents four characteristics of resources and capabilities which determine the sustainability of competitive advantage: durability, transparency, transferability and

replicability. He concludes that “the key to a resource-based approach to strategy formulation is to understand the relationships between resources, capabilities, competitive advantage and profitability” (133).

Conner and Prahalad (1996:477) demonstrate that “a RBT of the firm thus entails a knowledge-based perspective”. They present a theoretical framework that articulates a knowledge-based perspective with a transaction-cost view that is independent of an opportunism-based perspective. They also find that important resources may include those containing the quality of managerial judgment and the cost of being flexible with employees’ activities.

Alvarez and Busenitz (2001) study the relationship between the RBT and entrepreneurship. They introduce two concepts related to resources: (1) entrepreneurial recognition that presents the recognition of opportunities and opportunity-seeking behaviour as a resource, and (2) the process of combining and organising resources as a resource. They affirm that although the most basic condition in the RBT is resource heterogeneity, that is not enough for a sustainable advantage. Moreover entrepreneurship has heterogeneous resources as basic conditions and heterogeneity outcomes are generated by cognition, discovery, pursuing market opportunities, and coordinating knowledge. Heterogeneity needs to be preserved to get sustained competitive advantage. The authors identify entrepreneurial alertness, insight, the ability to coordinate resources and entrepreneurial knowledge as resources. Moreover, they agree that “knowledge and dynamic capabilities are an extension of the boundaries of RBT” (Alvarez and Busenitz, 2001:772).

Several criticisms of the RBT have emerged. For instance, it is not possible to know whether a firm has unique capabilities, it is not easy to find VRIN resources, intangibles play a role in creating competitive advantage, and external factors such as industry analysis should be considered (Priem and Butler, 2001). However, despite these criticisms, Barney (2001) presents a review of RBT ten years after its creation and finds that this theory can be used in five areas of research: human resource management, economics and finance, marketing, international business, and entrepreneurship.

Fisher (2012) presents a critical examination of the current perspectives that the RBV has adopted in entrepreneurship: effectuation, causation and bricolage (Table 3.1). Effectuation was initially proposed by Sarasvathy in 2001. Her paper introduces the role of entrepreneurial contingency and effectuation as a theoretical framework that can be used when only some means for creating artefacts, such as firms, markets and economies, are given. In contrast to

effectuation, causation requires having all the means for creating the artefacts, and bricolage creates artefacts without having any means but access to resource environments.

Several authors have analysed the main resources needed for identifying and exploiting an opportunity: physical assets, knowledge, capabilities, and tacit skills (Penrose, 2009, Wernerfelt, 1984, Barney, 1986, Nonaka and Takeuchi, 1995). Bhide (1994) affirms that entrepreneurs must develop strategies considering resource uniqueness, risks and growth. However, entrepreneurs may consider that resources are limited by time. The first product launched in the market has an advantage that the others have not. RBT states that resources are the most important factors in firms for providing competitive advantage and, thus, for being successful. The KBV states that knowledge is the most important resource to gain and maintain a competitive advantage.

**Table 3.1 Comparing causation, effectuation and bricolage**

	<b>Causation</b>	<b>Effectuation</b>	<b>Bricolage</b>
Definition	Causation processes take a particular effect as given and focus on selecting between means to create that effect.	Effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means.	“Bricolage involves idiosyncratic combinations of heterogeneous resources applicable to new problems and opportunities” (362).
Authors	Sarasvathy, 2001, 2005, 2008	Sarasvathy, 2001, 2005, 2008	Baker and Nelson, 2005
Key elements	Exploitation of knowledge, expected return, market share in existing markets through competitive strategies.	Exploitation of contingencies, acceptable risk and affordable loss, new markets are created through alliances and other cooperative strategies.	Exploitation of resources in ways for which they were not originally designed, resource environments are socially constructed.

Source: Compiled by author, based on Sarasvathy (2001, 2005, 2008), Baker and Nelson (2005) and Fisher (2012)

Spender (1996:46) reveals that “it is the firm’s knowledge, and its ability to generate knowledge, that lies at the core of a more epistemologically sound theory of the firm”; he presents a first approach to make knowledge a base of a dynamic theory. He describes several conceptual frameworks of knowledge, and argues that KBT must include a discussion about whether the activities that generated organisational knowledge are external or internal, and dynamic or statics. He also presents some possible managerial heuristics when managing knowledge, but he underlines the problems of operationalising a KBT.

Grant (1996b) developed some key elements toward a KBT of the firm, with knowledge as the most strategic resource that resides within the individual and the organisation that applies it to

the development and commercialisation of products, goods and services. In contrast to Spender, Grant does not emphasise the problems of the proposed theory; he explains the existence of the firm as a result of integrating knowledge. He explores the nature of the coordination within the firm, its organisational structure and its boundaries.

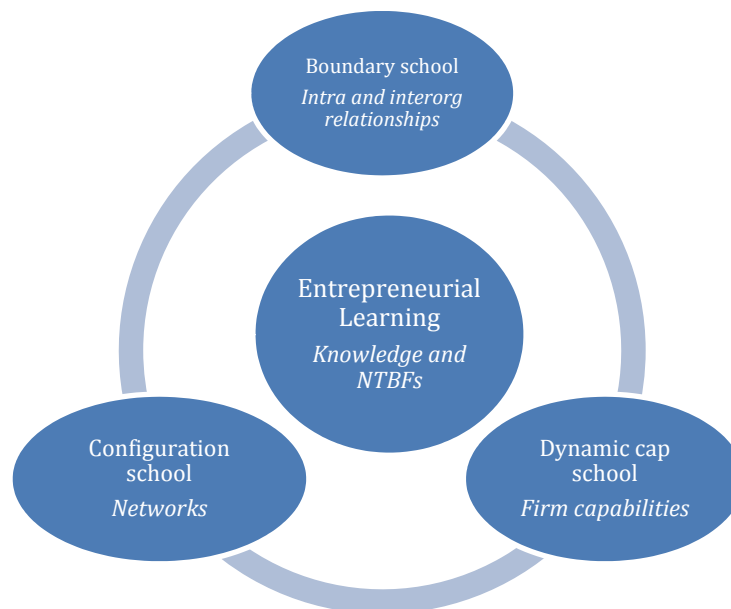
Hoskisson et al. (1999) presented the KBV as an extension of the RBT; the KBV is “a behavioural approach that predicts the superiority of firms over markets” (p. 442). In their discussion, they grouped organisational learning, dynamic capabilities and absorptive capacity as an integrated view of managing knowledge as a resource. They allege that academics have followed another sub-stream simultaneously to the KBV: Strategic leadership and strategic decision theory. This second stream focuses on the strategic leaders, which are unique resources, and the importance of managing resources and making decisions. However, strategic leaders manage knowledge, and then they orchestrate resources (Sirmon et al., 2011). This suggests that boundaries between the KBV and strategic management are problematic (fictitious and tautological).

Researchers have stated that schools of thoughts in strategic management are fragmented (Elfring and Volberda, 2001, Carter, Clegg and Kornberger, 2008), it might be the cause of that problematic boundaries between the KBV and strategic management. The synthesising characteristics of the strategic management field can be found in three emerging schools of thought: the boundary school, the dynamic capability school and the configuration school. The boundary school focuses on the boundary between a firm and its environment: the intra and inter-organisational relationships. The dynamic capability school considers the learning process within the firm, more precisely its abilities to reconfigure routines. The configuration school's main interest is the organisational environment, its configurations and dynamic trajectories of change, for instance networks providing knowledge.

This fragmentation suggests considering parallel but complementary perspectives of research regarding the role and management of knowledge in firms. The environment and the firm interact constantly; knowledge is managed in inter- and intra-organisational relationships. Looking inside the firm is not enough; neither is looking outside the firm. In addition, new ventures have fuzzy boundaries and new knowledge is constantly managed to create new commercialisable products. Intra- and inter-organisational relationships play key roles in knowledge management. There is a need to integrate the several ontologies, where knowledge is used as a main resource, in a single framework.

Exploring how entrepreneurs in new firms (NVTs) learn and process knowledge will contribute to understanding the connections within theoretical frameworks used in strategic management because when entrepreneurs learn they manage knowledge and networks in inter and intra relationships. Entrepreneurial learning in NBTBs can offer a setting to propose an integrated framework with elements of the three schools of thought of strategic management because knowledge is a key resource for NTBFs and (1) networks are recognised as the most important source of new knowledge; (2) NVTs use capabilities when managing knowledge and sources of knowledge; and (3) knowledge is acquired from intra- and inteorganisational relationships (Figure 3.1). A review of literature on networks was presented in Section 2.4, a literature review of capabilities is presented in Section 3.5 and entrepreneurial learning is presented in Sections 3.2 and 3.3.

**Figure 3.1 Strategic management and entrepreneurial learning**



Source: Developed by author based on Elfring and Volberda (2001) and Carter et al. (2008)

### **3.2 Entrepreneurial learning**

The topic of entrepreneurial learning has received much attention in the literature. A search of “entrepreneurial learning” in the ABI/INFORM database, which includes databases of business, science and technology (S+T) and social science, reported 696 peer-reviewed

papers; 331 from 2000 to 2009 and 302 from 2010 to 2014. Entrepreneurial learning is also a field that continues to grow and develop, influenced by other related fields and theoretical lens. For example, two frameworks of strategic management – KBV and organisational learning – have been used by scholars to explore entrepreneurial learning and knowledge management in entrepreneurship.

This section provides evidence of the high diversity of theoretical frameworks to study entrepreneurial learning and identify the lack of a commonly accepted theory. Given that it is only since 2000 that the field had really developed, this literature review focuses on papers published since that year.

Cognitive and behavioural frameworks are the most commonly used in Harrison and Leitch's book on Entrepreneurial learning, although more than 15 theoretical lenses have been used in this book for studying entrepreneurial learning in entrepreneurial ventures (Appendix 1). All papers presented in the Special Issue "Entrepreneurial Learning" published in *Entrepreneurship Theory and Practice* (ET&P) in 2005 (Appendix 2)<sup>10</sup> used behavioural perspectives, but only Cope's paper also included experiential learning and learning by doing (Cope, 2005).

Wang and Chugh (2014) state that the literature regarding entrepreneurial learning "is highly individualistic and fragmented, calling for both theoretical and empirical development" (p.42). They agree that two theoretical perspectives are dominant: "Experiential Learning" and "Theories of Organisational Learning". They identified that experiential learning has been used as a theoretical framework and as a learning mechanism, including a perspective based on Kolb's model (1984, 2005) and a perspective based on learning by doing, learning from past business experience, learning from positive and negative experiences, learning from past experience, learning from participation and learning from the experience of others. They identified that eight types of individual and organisational learning have been used to understand the entrepreneurial process (Table 3.2). This evidences the wide variety of theories within which entrepreneurial learning can be explored.

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<sup>10</sup> Two of these papers were published again in Harrison and Leitch's book (Politis and Corbett) and that is why this analysis only considers five articles.



**Table 3.2 Types of individual and organisational learning used to understand entrepreneurial learning**

Type of Learning	No. of articles citing it
March's exploratory and exploitative learning (exploration of new possibilities and exploitation of certainties in organisational learning)	22
Argyris and Schon's single-loop adaptive and double-loop/generative learning (double loop learning to manage problems effectively that were originated in rapidly changing and uncertain contexts)	21
Huber's organisational learning (knowledge acquisition, information distribution, information interpretation and organisational memory)	22
Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George) (ability to recognise and use new, external information for innovation and competitive advantage)	24
Situated learning and communities of practice (Lave and Wenger, Wenger, and Brown and Duguid) (learning takes place in social situations in which teams share a common goal or interest)	21
Senge's fifth discipline of the learning organisation (solving problems by fostering aspiration, developing reflective conversation and understanding complexity)	16
Fiol and Lyles' high level or lower-level learning (lower-level learning is at routine level and higher-level learning is the development of complex rules and associations in new actions)	11
OL: information processing and decision (cognitive and behavioural approach to use information to make decisions)	26

Source: Own elaboration based on Wang and Chugh (2014).

Some of the theoretical frameworks presented in table 3.2 have been used to study entrepreneurial learning that considers problem solving and decision making, while other theoretical frameworks have considered organisational learning and others' competitiveness. Cohen and Levinthal (1990) state that there is no significant difference between problem solving and learning, while the first one evidences knowledge creation, the second one involves knowledge assimilation. In contrast with problem solving and learning, gaining and maintaining a competitive advantage requires development of organisational capabilities that allow innovation. Problem solving and learning are themselves organisational routines and processes used by managers and entrepreneurs to pursue competitive advantage.

Another key theoretical framework of entrepreneurial learning is presented by Cope (Pittaway and Thorpe, 2012). He identified that entrepreneurial preparedness, reflection, learning tasks, doing (action) and the situated nature of learning, are important in entrepreneurial learning. Entrepreneurs have to deal with emotional and cognitive conflict when learning. While emotions are mostly associated with crisis and failure, cognition is mostly associated with the level of entrepreneurial preparedness (or prior knowledge) and therefore with other knowledge dimensions such as diversity and relatedness. Although this framework is integral in considering entrepreneurs' behaviour and cognition and context where learning happens, it

would benefit from understanding how entrepreneurial preparedness and access to knowledge from the external environment influence entrepreneurs' knowledge management.

Additionally, all the theoretical frameworks presented in Table 3.2 have been studied at the individual level, they study the manager or the entrepreneur that solves problems, makes decisions and pursues competitiveness. Only Kolb and Kolb's model of experiential learning also consider team levels in which reflective conversation, functional role leadership and experiential learning are the keys to team development. Although their model is robust in explaining experiential learning, it does not include self-imposed and externally imposed learning; both are higher forms of learning in entrepreneurs (Pittaway and Thorpe, 2012).

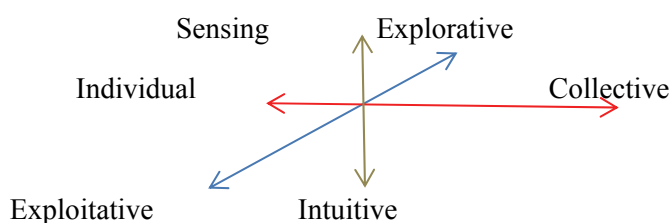
A comparative perspective of how knowledge is managed in entrepreneurial learning includes the mention of four key studies in organisational learning. Huber's (1990) includes four knowledge-related processes: knowledge acquisition, information distribution, information interpretation and organisational memory. Kolb and Kolb's (2005) include knowledge acquisition, knowledge specialisation of learning style and knowledge integration. Zahra and George's (2002) include knowledge acquisition, assimilation, transformation and exploitation. Kogut and Zander's (1992) include knowledge creation, transfer and transformation. While some of these studies (Zahra and George, and Kogut and Zander) consider the importance of external knowledge to create more knowledge, Kolb and Kolb only consider experiential learning and Huber presents a more complete conceptualisation of different forms of knowledge acquisition. All these knowledge processes will be discussed further in Section 3.5.

Wang and Chugh (2014) state that a theory of entrepreneurial learning must include three pairs of learning types (Figure 3.2). The first one is individual and collective learning, both are integrated in entrepreneurship and represent different ontologies to consider in knowledge management. The second pair is exploratory and exploitative learning; opportunity identification and exploitation are the processes that comprise entrepreneurship. Both processes have been explored in the literature and allow understanding entrepreneurship as a process that requires the development of skills and resources. The third pair is intuitive and sensing, which covers the discovery and the creation of approaches to entrepreneurial opportunities.

Figure 3.2 evidences six fields in which entrepreneurial learning has been studied and proposes an integrated continuous field in which all fields can interact. For the purpose of this research, all pairs of lenses identified will be considered; however, the main focus will be on

how individual knowledge is transformed into collective learning. These pairs of lenses allow the researcher to use an epistemological stance for knowledge which aims to contribute to how NVTs manage knowledge – learning – when creating and establishing a new firm because when a firm is created, its knowledge-base is the prior knowledge (PK) of the members of the NVT which is initially individual. As Wang and Chugh (2014) state “it is often an entrepreneurial team, rather than an individual, that drives the entrepreneurial process” (p.32) and “little is known about how collective learning takes place in entrepreneurial teams or firms” (p.30).

**Figure 3.2 Simultaneous pairs of learning types**



Source: Elaborated by author based on Wang and Chugh (2014)

To extend Wang and Chugh’s literature review beyond August 2012, a search was undertaken for the latest papers in entrepreneurial learning, using the same search criterion as Wang and Chugh: “entrepreneur\* AND learn\*” in six journals<sup>11</sup>; the search, executed in February 2014, generated 2,955 articles, 529 articles of which were published after August 2012 (Table 3.3).

During February and March 2014, and after re-reading the abstract and coding key themes, 96 of 529 articles were identified which address one or more of these key topics: networks, knowledge, entrepreneurial learning or new products/services. Only 17 of these 96 papers focus on knowledge or networks as a key resource (Appendix 3). As presented before, several theoretical frameworks are still being used when studying entrepreneurial learning; however, it was found that social capital (e.g. Jonsson and Lindbergh, 2013, De Clercq et al., 2013, O’Donnell, 2014, Semrau and Werner, 2014) and absorptive capacity are the most common ones (e.g. Chun and Mun, 2012, Maes and Sels, 2014, Naldi and Davidsson, 2013, Quin and

<sup>11</sup> *Journal of Business Venturing, Entrepreneurship Theory and Practice, International Small Business Journal, Small Business Economics, Entrepreneurship and Regional Development, Journal of Small Business Management.*

Acs, 2013) when considering knowledge and networks. It was also found that some of the types of entrepreneurial learning that were identified by Wang and Chugh (Argyris and Schon, Senge and, Fiol and Lyles), were not used in papers using knowledge as a key topic, and were not used in papers focusing on networks when entrepreneurial learning is being studied.

**Table 3.3 Numbers of papers published where search criterion was "entrepreneur\* AND learn\*"**

<b>JOURNAL</b>	<b>Total</b>	<b>After August 2012</b>
<i>Journal of Business Venturing</i>	692	85
<i>Entrepreneurship Theory and Practice</i>	519	122
<i>International Small Business Journal</i>	406	70
<i>Small Business Economics</i>	632	125
<i>Entrepreneurship and Regional Development</i>	415	48
<i>Journal of Small Business Management</i>	291	79
	2,955	529

Given that the interest of this PhD research is in exploring entrepreneurial learning in NTBFs, by examining how NVTs manage knowledge, ACAP is the theoretical framework that allows consideration of the processing of new knowledge, which can be created individually or collectively, and comes from external sources such as networks for gaining and maintaining competitive advantage. Moreover, this framework considers routines and processes to produce dynamic organisational capabilities. As stated previously, knowledge and networks are the key resources that NVTs manage when creating and establishing a NTBF. ACAP is a dynamic capability, it is knowledge that NVTs use when creating and establishing a new firm. The next section will present a KBV of entrepreneurial learning, discussing several knowledge dimensions that have been considered in recent literature studying entrepreneurial learning where knowledge and networks are key resources.

### **3.3 The KBV of entrepreneurial learning**

#### **3.3.1 Knowledge in entrepreneurship**

There is a need of a theory of knowledge construction in entrepreneurship: "There should be a specialized theory to at least explain the entrepreneur knowledge construction process, that is a theory to help us answer the question *how entrepreneurs construct knowledge?*" (Campos and Hormiga, 2012, p.198). Building on previous studies that have addressed the role of

knowledge in entrepreneurship, this section presents some patterns in the relevant literature and explains what networks and knowledge dimensions are more important for the present study.

Campos and Hormiga (2012) presented an in-depth analysis of state-of-the-art knowledge in the field of entrepreneurship. Their review was based on knowledge as an object of study of the knowledge management process. They identified 143 articles in five areas: psychology, sociology, management, economy and approaches to entrepreneurship. Theories in psychology are related to constructivism, decision-making, educational, cognitive and behavioural approaches. Although there are few studies in sociology, the authors agree on the importance of social relationships (and networks) in entrepreneurship when managing knowledge. Economic theories have not addressed the topic widely because they are focused on regional and environmental conditions rather than at the firm level. Management theories are often used; one of the most common is the RBT, but human capital theory has also been used. Some theories of entrepreneurship have also approached the topic from a knowledge perspective: in particular, education, experience and PK.

Campos and Hormiga's taxonomy studied four levels: the individual, group, organisation and inter-organisation. Borrowing the epistemological stance of Smith et al. (2009), Campos and Hormiga considered three core topics: Stock of knowledge, knowledge creation and knowledge transfer. Stock of knowledge is mostly addressed at the individual level and knowledge transfer at the organisation and inter-organisation level. These levels are in concordance with two of the categories selected by Harrison and Leitch (intra-organisational learning and inter-organisational learning) in their book.

Regarding knowledge properties, researchers use different variables, for instance, different contents of knowledge have been used such as market knowledge (Plummer and Acs, 2014, O'Donnell, 2014, Naldi and Davidsson, 2013, Fernhaber and Li, 2013, Fernhaber and Li, 2013) and financial knowledge (Jonsson and Lindbergh, 2013); some papers study knowledge relatedness (Wood, McKelvie and Haynie, 2014), knowledge depreciation (Parker, 2013) and knowledge homophily (Jonsson and Lindbergh, 2013). Although several of the papers have addressed knowledge market, only De Clercq et al. (2013) made reference to technical knowledge by considering data from managers that had technical oriented function and commercially oriented function. They state that both areas are key "in shaping a firm entrepreneurial endeavour".

Regarding network dimensions, only one of these papers considers all dimensions of networks (Jonsson and Lindbergh, 2013), three of them consider structural dimensions of networks (Semrau and Werner, 2014, Wincent et al., 2014, Tan et al., 2013) and four of them cognitive dimensions (O'Donnell, 2014, De Clercq et al., 2013, Fernhaber and Li, 2013, Milanov and Fernhaber, 2014). This suggests that all dimensions of networks contribute to entrepreneurial learning.

Adopting a knowledge perspective to explore entrepreneurial learning is convenient because it allows the consideration of studies from different theoretical approaches that have made key contributions into understanding how entrepreneurs manage knowledge. Moreover, it allows the consideration of inter-organisational and intra-organisational levels, and therefore allows the inclusion of networks as enablers of entrepreneurial learning. Given the interest into considering networks as sources of knowledge, it is also important to keep an open perspective regarding network dimensions. Although cognitive dimensions of networks seem to be more relevant to learning, network structures and governance have been considered important in knowledge acquisition, sharing and transfer.

### **3.3.2 Knowledge in entrepreneurial learning**

The main purpose of this selection is to identify papers that consider knowledge as a key resource in entrepreneurial learning. Although several theoretical frameworks coexist and have been used to explore entrepreneurial learning, few papers have studied entrepreneurial learning with knowledge as a key resource. Only 17 papers were identified in this review, which evidences that although knowledge is important in learning, very little of the literature has studied knowledge in entrepreneurial learning.

These papers (Table 3.4) were chosen for one of following reasons: (1) the KBV was used as a theoretical lens or (2) knowledge was considered as a key resource managed by the entrepreneurial team. Papers that use knowledge spillover theory were excluded because they focus on the generation of economic knowledge originated from R&D and this study offers a broader perspective of knowledge that is not necessarily originated from R&D. Table 3.4 lists the 17 papers with their key contribution and the type of entrepreneurial learning.

**Table 3.4 Papers chosen that consider knowledge a key resource in EL (Part A)**

<b>Author (year)</b>	<b>Title (and source: a, b, c, d or e)</b>	<b>Reason (1/2)</b>	<b>Key contribution - Type of EL (TEL: see table 3.2)</b>
Minniti and Bygrave (2001)	A dynamic model of entrepreneurial learning (c)	2	The conceptual dynamic model considers failure as an event to generate new knowledge in which decision making depends on direct knowledge of a specific market or/and general knowledge of "how to be entrepreneurial". TEL: OL: information processing and decision making. Theories of Entrepreneurship (Kirzner and Knight), Making decisions
Clercq and Sapienza (2005)	When do venture capital firms learn from their portfolio companies? (b)	1	There is a negative relationship between trust and learning in venture capital firms. TEL: Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George)
Politis (2005)	The process of entrepreneurial learning: a conceptual framework (b and c)	2	A conceptual model is presented to explain how entrepreneurs' expertise is transformed into entrepreneurial knowledge, by exploration of opportunities and exploitation of new knowledge. EL: OL: information processing and decision making. Experiential (Kolb)
Ravasi and Turati (2005)	Exploring entrepreneurial learning: a comparative study of technology development projects (c)	2	By studying longitudinally two technology development processes within a small established entrepreneurial firm, it was identified that success was related to high control of the process, high related knowledge base, low causal indeterminacy and high confidence in commercial return. No TEL identified
Corbett (2005)	Experiential learning within the process of opportunity identification and exploitation (a and d)	2	The conceptual model is based on the role of individuals' previous knowledge, perception, cognition and experience in entrepreneurial learning. This model states that four learning styles (convergent, assimilation, divergent, accommodative) can have different levels of efficiency during the different stages of opportunity identification and exploitation process. TEL: OL: information processing and decision making. Experiential (Kolb)
Corbett, (2007)	Learning asymmetries and the discovery of entrepreneurial opportunities (d)	2	Experiential learning asymmetries influence the discovery of opportunities. The forms that individuals use to acquire and transform information (comprehension or apprehension) depend on the level of specific human capital and the type of transformation preference (extension or intension) TEL: OL: information processing and decision making. Experiential (Kolb)
Sawyer and Gilsdorf (2008)	An exploration of knowledge management processes in start-up firms in the high-technology sector (a)	1	There is not a clear contribution to theory, however the authors propose five prepositions regarding KM (Nonaka, 1998) effectiveness. They identified enablers (a common context, frequency, variety and inclusiveness of integration and socialisation mechanism), mediators (culture of sharing and mutual trust), moderators (elaborated knowledge accumulation) and critical factors (external organisational linkages) No TEL identified

**Table 3.4.** Papers chosen that consider knowledge a key resource in EL (Part B)

<b>Author (year)</b>	<b>Title (and source: a, b, c, d or e)</b>	<b>Reason (1/2)</b>	<b>Key contribution – Type of EL (TEL: see table 3.2)</b>
Friga (2008)	Entrepreneurial knowledge flows and new venture creation (a)	1	In contrast to common literature: “There are no significant arguments for prescribed recommendations relating to experience, education and classes to increase new venture creation” p.223 This study confirms the impact of “formal assistance programs in the enhancement of new venture creation likelihood” p.224. TEL: OL: information processing and decision making
Waalkens, Jorna and Postma (2008)	Absorptive capacity (ACAP) of knowledge-intensive business services: the case of architectural and engineering SMEs (a)	1	Internal and external knowledge bases are stable constructs for PACAP. R&D-related variables are not enough to capture the role of ACAP in SMEs TEL: Argyris and Schon’s single-loop adaptive and double-loop/generative learning, Absorptive capacity and external learning, Experiential learning (Kolb), Dynamic capabilities (Teece)
Holcomb et al. (2009)	Architecture of Entrepreneurial Learning: Exploring the link among heuristics, knowledge and action (c)	2	A conceptual model is presented to relate the role of heuristics in transforming experiential and vicarious knowledge into decisions, actions and outcomes. The three forms of heuristics are described: availability, representativeness and anchoring and adjustment TEL: OL: information processing and decision making. Experiential (Kolb) and vicarious learning (Huber)
Fang, Tsai and Lin (2010)	Leveraging tenant-incubator social capital for organisational learning and performance in incubation programme (c)	1	Inter-organisational learning mechanisms such as participation and knowledge sharing have a positive impact on technological and managerial capabilities, and therefore in innovation capabilities. TEL: OL: information processing and decision making. Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George)
Westhead et al. (2011)	David Storey’s optimism and chance perspective: A case of the Emperor’s new clothes? (c)	2	There is not a clear contribution to theory, however the authors propose four constructs (human capital, entrepreneurial learning, entrepreneurial attitudes, networks) to consider for firm growth. TEL: OL: information processing and decision making. Experiential (Kolb).
Voudouris et al. (2011)	Entrepreneurial learning in the international new high-technology venture (c)	2	The Zhang et al. model is adapted to a longitudinal case study (9 years) where three learning loops based on similar learning mechanisms (epochs) are identified. Three modes of learning – whose presence vary in each epoch – were identified: experiential, informational and interactive. Three firms’ and entrepreneurial team’s approaches were identified: technological, industrial and international orientation TEL: OL: information processing and decision making
De Clercq et al. (2013)	Organisational social capital, formalisation, and internal K sharing in EO formation (e)	1	“The influence of such social capital on entrepreneurial outcomes cannot be determined in isolation from the broader internal structural environment in which the social capital operates” p.526. No TEL identified



**Table 3.4.** Papers chosen that consider knowledge a key resource in EL (Part C)

<b>Author (year)</b>	<b>Title (and source: a, b, c, d or e)</b>	<b>Reason (1/2)</b>	<b>Key contribution - Type of EL (TEL: see table 3.2)</b>
Wood et al. (2013)	Making it personal: Opportunity individuation and the shaping of opportunity beliefs (e)	2	When opportunities are highly related to the entrepreneur's knowledge, the opportunity context (i.e., industry conditions) becomes less impactful while some individual differences become more impactful. Entrepreneurs who are highly motivated to evaluate the opportunity are more heavily influenced by positive opportunity signals, less influenced by negative opportunity signals, and less concerned with knowledge relatedness TEL: OL: information processing and decision-making. Experiential (Kolb)
Naldi and Davidsson (2013)	Entrepreneurial growth: The role of international knowledge acquisition as moderated by firm age (e)	1	Knowledge acquisition from international markets is more positively related to entrepreneurial growth in international markets than in the domestic market. "International knowledge acquisition has a positive effect on growth via new product/service development in young firms, but a negative effect in mature firms" p.687. TEL: Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George). Huber's organisational learning
Maes and Sels (2014)	SMEs' Radical Product Innovation: The Role of Internally and Externally Oriented Knowledge Capabilities (e)	1	Exploitative learning and the knowledge sharing capability affects positively radical innovation No TEL identified

There is a need to understand how entrepreneurs construct knowledge (Campos and Hormiga, 2012) and to further develop the concept of entrepreneurial learning theoretically and empirically (Wang and Chugh, 2014). As presented in table 3.4, several researchers have attempted to understand how entrepreneurs learn by managing knowledge but there is a lack of a unified framework that considers the simultaneous pairs of entrepreneurial learning types not only in established firms but also in new ventures. Moreover, only one paper explores entrepreneurial learning in new high-technology ventures (Voudouris et al., 2011); however, this paper focuses on internationalisation without considering the development of capabilities when managing knowledge.

From a KBV perspective, absorptive capacity is one of the theoretical frameworks that has been studied more often in entrepreneurial learning because of the importance of external sources of knowledge in entrepreneurship. However, ACAP does not include the absorption of knowledge from other sources of new knowledge such as new members or formal education.

The concept of ACAP proposed by Cohen and Levinthal (1990) is based on the structure of communication between the firm and its environment, the subunits of the firm and the nature of the expertise (character and distribution). They state that “a firm's absorptive capacity is not, however, simply the sum of the absorptive capacities of its employees” (p.131), some organisational aspects must be considered which include not only acquisition and assimilation but also exploitation for innovation. Entrepreneurial teams need to have the capability to create and utilise knowledge in such a way that their firms can learn and innovate (Cohen and Levinthal, 1990).

Zahra and George (2002) categorise ACAP as a dynamic capability related to knowledge creation and utilisation. In contrast with Cohen and Levinthal, they state that ACAP is an organisational capability that enables a firm to be more competitive. They define ACAP as “a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability” (p.186). This capability allows for the study of how NVTs transform new external knowledge into competitive advantage.

To conclude, given the interest in selecting a theoretical framework to contribute to the understanding of entrepreneurial learning in NTBFs, in which knowledge is considered the most important resource and networks the most important source of new knowledge, this literature review has enabled the identification of the following: absorptive capacity is the most appropriate theoretical framework when studying entrepreneurial learning in NTBFs because it considers capabilities and external sources of knowledge which are critical in NTBFs. Moreover, it was identified that there has been little exploration about how NVTs manage prior and new knowledge in new ventures.

To explore the models that have been used to study entrepreneurial learning with knowledge as a main resource, the source of knowledge and the outcomes of entrepreneurial learning, the next section presents a critical literature review of entrepreneurial learning models that consider knowledge as a key resource.

### **3.3.3 Models of entrepreneurial learning**

Based on the papers reviewed, five papers presented models for entrepreneurial learning that consider knowledge a key resource for entrepreneurs (Minniti and Bygrave, 2001, Politis, 2005, Ravasi and Turati, 2005, Corbett, 2007, Holcomb et al., 2009). This section compares

and discusses them, and then provides the response that there is no integrated model of entrepreneurial learning that considers how entrepreneurs manage prior and new knowledge effectively. It then proposes a new model of entrepreneurial learning in new ventures.

Although these studies of entrepreneurial learning consider PK as a resource, they put emphasis on different factors interacting: different capabilities, different enablers of the entrepreneurial learning and different outcomes. Table 3.5 presents a summary of these different dimensions.

**Table 3.5 Comparing five entrepreneurial learning models**

<b>Author</b>	<b>Outcome</b>	<b>Capabilities (K-related processes and relationships)</b>	<b>Main enablers</b>
Minniti and Bygrave (2001)/Conceptual	Implicit but considering Entrepreneurial knowledge		Alertness (entrepreneurs' myopic foresight) and PK.
Politis (2005)/Conceptual	Entrepreneurial knowledge	Transformation using exploration and exploitation	PK, career orientation and logic of reasoning (control or prediction)
Ravasi and Turati (2005)/Empirical	Successful opportunity exploitation (technological project) in the same entrepreneurial venture	Accumulation and organisation of knowledge and information	Commitment (time, attention, resources), perceived uncertainty of return, causal indeterminacy, related knowledge base (knowledge relatedness), control of the process
Corbett (2007)/Conceptual and Empirical	Opportunity recognition	Acquisition, transformation.	Type of information acquisition (comprehension or apprehension) and level of specific knowledge (knowledge asymmetries)
Holcomb (2009)/Conceptual	Implicit but considering advantage-seeking behaviour	Acquisition (experiential and vicarious), Assimilation, Organisation and exploitation (in action)	Knowledge, Action, Heuristics (under uncertainty) and environmental context

Several studies of entrepreneurial learning have considered entrepreneurial knowledge to be the outcome of this process (Politis, 2005, Kempster and Cope, 2010, Pittaway and Thorpe, 2012, Minniti and Bygrave, 2001). Entrepreneurial knowledge is knowing how entrepreneurship is undertaken – the methods, practices, and decision-making styles used to act entrepreneurially. Some papers make reference to it as entrepreneurial capability (Rae, 2000) but some present the importance of having the ability to manage resources, using effectuation, bricolage or causation (Fisher, 2012). Others focus on the entrepreneurial knowledge as expertise that entrepreneurs develop from critical reflection under several

situations such as economic crises, experimentation and failure (Kempster and Cope, 2010, Cope, 2011, Cope and Watts, 2000, Cope, 2003, Pittaway and Cope, 2007).

Some empirical studies have focused on how serial entrepreneurs learn (Wright, Robbie and Ennew, 1997, Westhead et al., 2005a, Westhead et al., 2005b). Others have stated that entrepreneurs do not learn (Frankish et al., 2012) and that entrepreneurs' knowledge suffers from depreciation (Parker, 2013). However, if entrepreneurial knowledge were enough to create a firm, serial entrepreneurs and their firms would not fail because the entrepreneurial knowledge gained by creating the first firm would be enough to create a successful second firm. Creation and establishment of a new firm require the commercialisation of new products; new firms have to sell their products/services to survive and become part of an industry. New product development and commercialisation (NPD&C) is a tangible outcome that allows evidencing an effective learning process.

Only two of the models (Ravasi's and Holcomb's) focus their attention on opportunity exploitation as an outcome (successful project and exploitation of established market positions as a mean of creating wealth). In these two models opportunity exploitation is an action that demonstrates learning. Holcomb et al. (2009) define entrepreneurial learning as the process by which people acquire, assimilate and organise newly formed knowledge with pre-existing structures, and affirm that entrepreneurial learning is as important as how learning affects entrepreneurial action (e.g. Cope, 2003, Cope, 2005, Harrison and Leitch, 2005, Minniti and Bygrave, 2001).

Holcomb et al. (2009) present the most integrative conceptual model of entrepreneurial learning because they articulate the behavioural and cognitive dimensions of entrepreneurial learning at the same time. That includes the role of pre-existing structures in making decisions for opportunity exploitation. Holcomb's model also presents the environmental context, suggesting that the interaction between the entrepreneurs and their ecosystem is an important element in entrepreneurial learning. Holcomb's model is the only one that presents the interaction in the environmental context (the entrepreneurial ecosystem). However, this model is very conservative regarding the role of the entrepreneur's capabilities.

NVTs require capabilities to manage knowledge. Several capabilities were included in the selected models such as acquisition, exploration, transformation, creation, mastering critical knowledge platforms and exploitation (Minniti and Bygrave, 2001, Politis, 2005, Ravasi and Turati, 2005, Corbett, 2007, Holcomb et al., 2009). All these models consider knowledge acquisition from experience (experiential learning); experiential learning is common in

entrepreneurial learning but not sufficient to explain entrepreneurial learning in new ventures because NVTs also acquire knowledge from other sources that differ by experience.

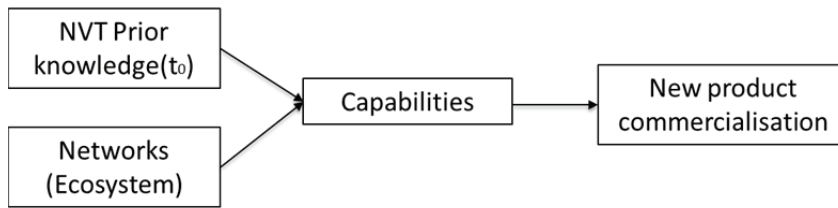
Holcomb et al. (2009) present a broad model that includes experiential and vicarious learning (two forms of knowledge acquisition). However, this model does not consider the role of the several capabilities required to transform acquired knowledge into action. Two models make a contribution regarding knowledge transformation, one categorises knowledge transformation into comprehension and apprehension (Corbett, 2007), the other into exploration and exploitation (Politis, 2005). Although other empirical studies consider the role of sharing and transfer, only Ravasi and Turati (2005) evidence the importance of collective interaction. None of the selected models presents an integrative framework to the knowledge-related process that can become capability (Section 3.5 will present them).

From a KBV perspective, knowledge is the key resource to manage in firms. Particularly, all new ventures have one basic resource: the NVT's prior knowledge. PK is the common enabler in all the models (Minniti and Bygrave, 2001, Politis, 2005, Ravasi and Turati, 2005, Corbett, 2007, Holcomb et al., 2009). Corbett considers the level of specific knowledge (knowledge asymmetries) and Ravasi and Turati consider related knowledge base (knowledge relatedness). This reinforces the importance of considering different levels and types of knowledge base in entrepreneurs when exploring how NVTs transform PK, which is initially individual.

### **3.3.4 Summary**

Building on previous discussions (Section 3.3.1, 3.3.2 and 3.3.3), Figure 3.3 illustrates a model of effective entrepreneurial learning in new ventures. This model represents how NVT prior knowledge, networks, capabilities and new product commercialisation interact in entrepreneurial learning in new ventures. The NVT's PK and networks are resources managed by entrepreneurs when they are creating and establishing a new firm; NVTs use capabilities to manage them, such as absorptive capacity when new knowledge comes from external sources. In addition, new firms have to commercialise new products to survive, therefore an effective transformation of PK and new knowledge is evidenced in a successful new product commercialisation. Effective entrepreneurial learning is achieved to gain and maintain competitive advantage by commercialising new products. New product commercialisation is the tangible outcome of entrepreneurial learning related to successful opportunity exploitation. Section 3.4 will discuss further PK and Section 3.5 capabilities in learning.

**Figure 3.3 Effective entrepreneurial learning in new ventures**



Source: Developed by author

### **3.4 Prior knowledge**

Some researchers present the importance of PK and a large knowledge base for the development of new knowledge of the firm (Shane, 2000, Dencker, Gruber and Shah, 2009). PK is also conceptualised as entrepreneurial preparedness, an individual's "unique range of accumulated skills and abilities" (Cope, 2005:378). This dimension includes personal and business skills and attributes, both intangible and tangible, which are brought to the new venture.

Shane (2000) explains that PK developed from work, experience, education or other means allows entrepreneurs to recognise certain opportunities, but not others. As Venkataraman (1997) argued, the sources of PK that lead to opportunity discovery are idiosyncratic, resulting from work experience, professional events and education. Moreover, this PK can be developed through a variety of roles, including experience as a supplier, user, and manufacturer, and education on a variety of dimensions, such as production processes, inputs, and user needs.

The process of discovery can be driven by recognition of knowledge already possessed rather than by search for knowledge needed (Kirzner, 1997). Consequently, individuals who have developed particular knowledge through education and work experience will be more likely than other people to discover particular entrepreneurial opportunities in response to a given technological change (Venkataraman, 1997). People will be more likely to discover opportunities in sectors that they know well than in sectors that are new, because the investment in the information necessary to recognise opportunities is likely to occur long before a particular sector is popular. Therefore, it is assumed that potential entrepreneurs are

expected to discover more opportunities in what they know rather than in information that is unrestricted to any potential entrepreneur.

West and Noel (2009), however, did not find a relationship between performance and relatedness of industry knowledge gained through previous experiences of the CEO, and they did not find any relationship between previous start-up experience and new venture performance; therefore, it suggests that previous background is not necessarily important for new business creation. Amason et al. (2006) did not find a relationship between firm performance and diversity of the NVT's prior experience. However, Song et al. (2008) found that the entrepreneurs' industry experience and marketing were important success factors for new technology ventures.

Klotz et al's (2014) literature review on NVTs identified that prior experience is one of the initial inputs of entrepreneurial teams. They state that the impact of NVTs' prior experience (functional background, education level, educational speciality, and managerial skill) on performance has been studied from different perspectives, for instance, from the role of shared prior experience, prior functional experience and diversity of NVT members' prior experience. Findings evidence the complexity of the topic, for instance, Hmieleski and Ensley (2007) found that the benefits of team diversity are related to particular conditions such as the type of leader.

Other studies (Clarysse, Bruneel and Wright, 2011 and Eisenhardt and Schoonhoven, 1990) state that strong Top Management Teams (TMTs) are relatively large (at least three founders), formed by heterogeneous and complementary members with at least three years of industry expertise and some joint past experience. These characteristics are relevant for entrepreneurial teams at the start-up stage and afterwards.

Specific knowledge bases are relevant to the typology of the firm that is being created and the origin of the opportunity (Shane and Venkataraman, 2000, Shane, 2003). For instance, when the idea comes from a technical group, from research or the development of a new technology (technology push), the NVT requires new market knowledge (know-how to commercialise the technology) to identify a market and commercialise the idea. NTBFs will require new technical knowledge (know-how to develop the technology) if the idea came from an expressed market need (market pull). Market and technical knowledge are substantive capabilities (Zahra, Sapienza and Davidsson, 2006) that may be associated with an individual or a group. A broader explanation of technical and market knowledge is presented in Section 3.4.

Klotz et al. (2014) state that the social capital of the NVT has a more positive impact on new firms' performance than the initial teamwork capabilities and that little is known about how NVTs build social capital or about how NVTs' social capital acts as a substitute resource while overcoming limitations in financial and human capital. However, if an NVT has social capital but it is not able to transform this capital to value for the new firm, its social capital will not represent a benefit for the new firm.

In NTBFs, the NVT members are strategic leaders whose PK and networks represent the initial stock of resources of the new firm. Although literature has identified that PK has an impact on the identification of opportunities, there is no consensus about the impact of NVT expertise on performance. Moreover, members of NVTs in NTBFs tend to have similar backgrounds; their PK is mostly technical, therefore they need to acquire new market knowledge and integrate it with their PK.

It could be stated that one of the reasons why new firms fail is not related to the knowledge base of the entrepreneur, but to the lack of ability of the NVT to acquire and use new knowledge. Following this argument, the next section presents a review of the different capabilities that NVTs master when learning.

### **3.5 A review of learning capabilities**

Most of the literature on entrepreneurial teams has focused on the relationships of TMT characteristics and behaviours with organisational performance (Hambrick, 2007). This approach is based on the "upper echelons" theory and its limitation is the lack of consideration of mediators between the top executive's characteristics and behaviours and organisational outcomes (Klotz et al., 2014). To address this gap this section presents a description of several organisational learning processes that have been identified in empirical and conceptual frameworks related to knowledge management and ACAP such as acquisition, exploration, assimilation, transformation, sharing, transfer, creation and coordination. These processes facilitate goal achievement and, therefore, they can be considered as action processes (Marks et al., 2001). Moreover, "no prior work has specifically addressed NVT action processes" (Klotz et al., 2014:241).

Nonaka and Takeuchi (1995) presented a model for knowledge creation in large firms. This model is based on the ontological assumption that individual knowledge (tacit and explicit) is



managed at the group level within the firm, and then at the intra-organisational level. In contrast, entrepreneurs identify networks as the most important source of knowledge. This suggests that knowledge is initially managed at the inter-organisational level and then inside the new firm. It also suggests that a knowledge management model in new ventures will include knowledge acquisition from external sources (inter-organisational relationships) as one of the main capabilities. There is a need to understand better how knowledge is managed while creating and establishing new firms, this section maps out the relationships between capabilities in learning and proposes an integrated framework of knowledge management and ACAP in new ventures.

### **3.5.1 Knowledge acquisition and exploration**

Knowledge acquisition and exploration are organisational capabilities that allow entrepreneurs to obtain new knowledge when learning. “Knowledge acquisition is the process by which knowledge is obtained” (Huber, 1990:90). Huber’s definition and model include not only external sources of new knowledge but also internal ones. Huber (1991) presents five processes that organisations use to acquire knowledge:

- Congenital learning (1), PK at the organisation’s birth. This type of knowledge represents the knowledge-base of the NVT and was presented in Section 3.2.
- Experiential learning (2) which comes from learning by doing. Experiential knowledge is acquired from direct experience such as organisational experiments, organisational self-appraisal, experimenting organisations, unintentional or unsystematic learning, and experience-based learning curves. Huber (1991) ascertains that the acquisition of experiential knowledge from external sources can be done by indirect experience, vicarious learning, and grafting.
- Vicarious learning considers (3) observing other firms. Organisations can learn from success cases and attempt to imitate other organisations. Although imitation is not always viable because the core competences of a firm are not easily imitable, information about what competitors are doing and how, can help firms to acquire new information that can be potentially useful.
- Vicarious learning also considers (4) noticing and searching the organisation’s environment and performance. This process of knowledge acquisition can occur in three forms: scanning, focused search and performance monitoring. Scanning the environment provides information to adapt to changes; scanning can be done with high intensity or as a

passive search. Focused search is executed when there is a clear intention to resolve a problem and a threshold has been reached in terms of cost and benefits of executing the search. Performance monitoring considers not only the firm's standards but also the stakeholders' standards.

- (5) Grafting internal knowledge that is not possessed by the organisation yet. Some of the forms of grafting are the acquisition of a whole organisation by another or joint ventures.

Huber's categories of knowledge acquisition can be used in new venture creation. Nonetheless, most entrepreneurial learning models have focused mostly in vicarious, experiential and congenital knowledge. Zahra and George (2002:189) include acquisition in their model of absorptive capacity and define it as "a firm's capability to identify and acquire externally generated knowledge that is critical to its operations".

Another capability to obtain new knowledge is knowledge exploration; exploration consists of the capture of things by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, or innovation (March, 1991). However, knowledge exploration does not consider the process of introducing new knowledge that was created by an external source (person, team or organisation) and acquired for the benefit of the firm. Both capabilities, exploration and acquisition, can be used by a new venture team and play a mediating role between social capital and knowledge exploitation (Yli-Renko, Autio and Sapienza, 2001, Nerkar, 2003).

Some researchers have stated that knowledge is also acquired through the addition of new members (Forbes et al., 2006) and training programmes (Klofsten, 2000). Entrepreneurs hire new members, undertake alliances, and use formal and informal networks to acquire new knowledge. When creating a firm, the boundaries of the entrepreneurial team tend to be more flexible because at this stage the team is being built. People working or participating in training programmes can become new members of the team or key contacts for a new partner. Therefore, the environment where the firm is being created can offer more or fewer options for acquiring and exploring new knowledge.

Knowledge acquisition and exploration are the capabilities that allow entrepreneurs to incorporate new knowledge into the new firm. However, this new knowledge has to be processed to create new knowledge to be exploited in new product development and commercialisation.

### **3.5.2 Knowledge creation and exploitation**

Knowledge management in new ventures has been explored from two perspectives; on one hand the role of external sources of knowledge has focused attention on knowledge transfer, exchange and sharing; on the other hand the creation of organisational capabilities has driven attention to abilities such as assimilation, transformation, coordination, socialisation and exploitation.

Entrepreneurs recognise entrepreneurial networks as the most important source of new knowledge (Tidd et al, 2011, Bessant and Tidd, 2007, Hansen, 1995). However, networks can be formal or informal. Through informal networks the tacitness of the information can be easily de-codified because the cognitive distance is easily reduced by asking questions and spending time there. Formal networks with similar content, such as knowledge networks, facilitate the transfer of knowledge (Argote and Ingram, 2000, Szulanski, 2000, Tsai, 2001) because of common conceptual frameworks; this suggests that we should consider the role of knowledge relatedness (Tanriverdi, 2005, Makri, Hitt and Lane, 2010, Breschi, Lissoni and Malerba, 2003) and entrepreneurial preparedness when thinking about knowledge management. Additionally, literature states that in environments (clusters, communities or regions) where formal networks are not efficient or are in the early stages of development, knowledge does not flow smoothly. Efficient networks are composed by members-actors who are disposed to share knowledge (Hansen, 2002, Srivastava et al., 2006, Hansen et al., 2005) in such a way that the cognitive distance can be decreased and knowledge transfer can happen. From this perspective, social capital becomes a key element for facilitating knowledge assimilation.

The role of knowledge assimilation is important because entrepreneurs interpret, comprehend and learn new knowledge to gain and maintain competitive advantage (Zahra and George, 2002). Entrepreneurs interpret new knowledge by considering the variations in the context where the knowledge is acquired. For instance, the nature of the new knowledge (explicit or tacit) depends on the source of the information; tacit knowledge can be acquired in an informal meeting and explicit knowledge in a document.

Tacit knowledge can be transferred under particular interactions where the cognitive distance is optimal. Explicit knowledge can be easily assimilated by an entrepreneur or an employee whose background allows him to understand it. However, too much or too little knowledge in common would limit learning and, hence, growth (Autio et al., 2000, Sapienza, Parhankangas

and Autio, 2004). Regardless of whether the new knowledge is tacit or explicit, PK facilitates the assimilation of new knowledge.

Cognitive processes require a common language to assimilate new knowledge; “a gap between a learner’s existing knowledge and a formal abstract may, however, cause learning difficulties, as it may be too abstract to assimilate” (Harrison, 2008:75). Entrepreneurs’ PK comprises a set of concepts where new ideas, comments and advice can be interpreted and comprehended. The likelihood of identifying opportunities is related to what the entrepreneur knows about the development, commercialisation and use of a new product. Therefore, it seems logical to affirm that the efficient use of new knowledge is related to common knowledge that the entrepreneur has identified or learned previously.

Zahra and George (2002:189) include assimilation in their model for absorptive capacity and define it as “the firm’s routines and processes that allow it to analyse, process, interpret, and understand the information obtained from external sources”. Holcomb et al. (2009:171) define it as “the process through which people process and interpret newly acquired information to derive meanings and form relationships in memory”. Regardless of the definition, entrepreneurs have to assimilate new knowledge if they want to use it. New knowledge has to be interpreted and comprehended by entrepreneurs before using it when creating a new firm; thus entrepreneurs assimilate new knowledge when creating and establishing a new firm.

Zahra and George’s model introduces the role of knowledge transformation into the construct of absorptive capacity. Knowledge transformation has been explored from an individual perspective. Corbett (2007) identified two modes of transformation: comprehension and concrete experience. His findings identify the importance of specific human capital in opportunity recognition. This capability – knowledge transformation – has been explored when NVTs create value and identify opportunities. However, once knowledge is transformed it has to be exploited; commercialisation of opportunities requires the exploitation of value in order to gain and maintain competitive advantage (Zahra and George, 2002, Porter, 1980).

Exploitation activities include refinement, choice, production, efficiency, selection, implementation, and execution (March, 1991). Several types of outcome are achieved when entrepreneurs learn: new knowledge is transformed into a new project, more knowledge, opportunity recognition and advantage-seeking behaviour. However, new knowledge creation and exploitation requires the knowledge base to be influenced *somehow* for new information; if this new information is similar to the knowledge base, it will be easier to assimilate but it will not represent enough novelty that can be transformed into something different.

Some papers have debated the role of knowledge diversity to generate radical innovation, Zhou and Li (2012) found “that the roles of knowledge breadth<sup>12</sup> and depth<sup>13</sup> critically depend on external and internal knowledge integration mechanism”; a firm with a deep knowledge base benefits more from external knowledge acquisition than from internal sharing. From these findings, it can be concluded that knowledge exploitation and integration require consideration of diverse knowledge domains and in-depth knowledge in specific domains.

Knowledge integration (KI) has been defined as a goal-oriented process aspiring to achieve a significant organisational outcome (Berggren et al., 2013). Grant (1996a:377) proposed KI as “a firm’s ability to perform repeatedly a productive task which relates either directly or indirectly to a firm’s capacity for creating value through effecting the transformation of inputs into outputs”. Murray (1995) defines KI as “the task of identifying how new and PK interact while incorporating new information into a knowledge base”.

There is no consensus regarding whether KI is a process that teams develop after or during knowledge transfer (Berggren et al., 2013). Some researchers argue that KI happens when the entrepreneurial team has acquired and assimilated new knowledge that allows it to achieve a satisfactory outcome that impacts upon firm performance. Others have stated that KI is the organisational capability that contains all the capabilities that a firm uses to gain competitive advantage, because even in the acquisition process, new knowledge is being integrated with previous knowledge to be assimilated. These two streams have evolved simultaneously since 1996 when a special edition of the KBV was published in *Strategic Management Journal*.

The first stream emphasises KI as the ability to transfer and share knowledge. This stream considers KI as a collective ability that is associated with the development of new knowledge which is initially tacit and difficult to transfer but which involves the willingness of people to work together and communicate ideas to find potential solutions to a problem. This stream has been focused mostly on the generation of value as an outcome; value that can be potentially used to solve a future problem and that is generated by reflection, exploration and failure. The extensive literature in knowledge transfer, sharing and generation of value remains intangible when sometimes is hard to identify how relevant the value generated is or even what new knowledge was the origin of the successful outcome.

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<sup>12</sup> Breadth: This attribute captures the horizontal dimension of knowledge and heterogeneous knowledge content.

<sup>13</sup> Depth: This attribute captures the vertical dimension and unique, complex, within-field knowledge content.

The second stream has studied KI as the generation of new knowledge through the transformation of specific and complementary knowledge, but two opposite preconditions have been agreed upon. On one hand, related knowledge is a necessary precondition to KI; on the other hand, differentiated but complementary knowledge is needed. This process implies that we need to consider the nature of the PK and the new knowledge needed. When the PK of the NVT is similar, there a level of specialisation is still required to generate KI. When PK (knowledge base) of the NVT is specialised and differentiated but complementary, knowledge processes and mechanisms that agents follow to innovate are referred to as a set of capabilities that constitute KI.

Another stance that has been used in the understanding of KI is that of the individual as a person who integrates knowledge. When integration is considered an individual ability (Kolb, 1984), it includes the process of apprehension and comprehension that transforms a concrete experience into abstract conceptualisation and active experimentation. When it is considered a collective ability (Grant, 1996a), it includes not only the role of sharing and transferring, but also the role of combinative capabilities<sup>14</sup> (Kogut and Zander, 1992) such as coordinating and socialising (Jansen, Van De Bosch and Volberda, 2005, Van Den Bosch et al., 1999, Roberts et al., 2012).

As Berggren et al. (2013) presented, KI outcomes can be categorised in three categories: efficiency, effectiveness and innovation. The efficiency category is used when KI is considered static, for instance, when studying task competition or timely project completion. Effectiveness is considered in relation to an organisation that is adapting itself to the environment. Aspects such as financial performance and stock valuation are measured outcomes. Innovation includes team creativity, new product performance and dynamic capabilities.

Although several definitions have been proposed for KI (Lawrence and Lorsch, 1967, Grant, 1996, Moenaert and Souder, 1990, Huang, 2000, Salazar et al., 2012, Gardner et al., 2012), for the purpose of developing and commercialising new products, it is assumed that KI is not only a process of combining and fusing different knowledge bases, but also a process of creating new knowledge needed for this integration to succeed. Several types of knowledge are integrated in order to achieve competitive advantage, for instance, managerial knowledge which can be experiential or from formal education, and technical knowledge which can be individual, collective, tacit or explicit.

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<sup>14</sup> Abilities of the firm to synthesise and apply current and acquired knowledge.

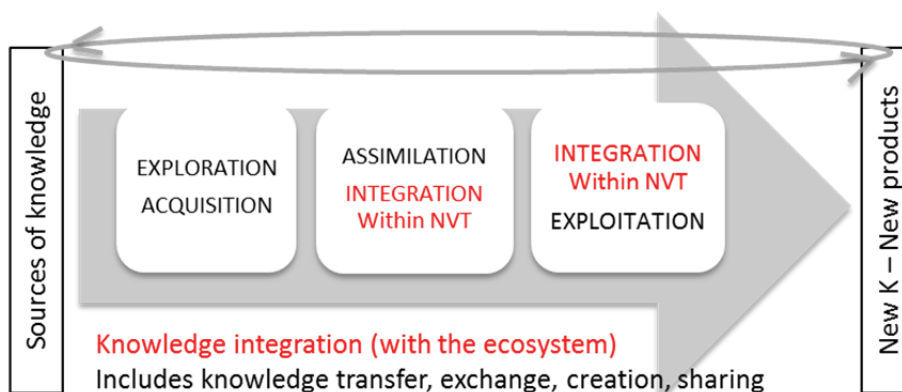
Regardless of the definition, from a general perspective it can be stated that KI is the capability that allows the transformation of input into output, therefore it comprises other capabilities such as acquisition, assimilation, transformation and exploitation. KI is a high-order capability that synthesises the process of learning.

### 3.5.3 Summary

If entrepreneurs have the ability to acquire or explore new knowledge (from internal or external sources), it does not guarantee that they can create and establish a new venture. Entrepreneurs have to be able to create and exploit new knowledge when creating new firms, they explore and acquire new knowledge, but they need to be able to use prior and new knowledge to create and exploit new knowledge. Firm creation and establishment involves managing knowledge while building organisational capabilities and pursuing simultaneous goals such as building a team and developing and commercialising a new product/service.

Building on ACAP's model, Figure 3.4 presents an integrative model of capabilities in learning presented in this section. It shows that NVTs explore and/or acquire new knowledge from sources of knowledge (PK and networks) to create new knowledge and new products. This figure represents two forms of KI, externally – with the ecosystem (ACAP) – and internally – within the NVT. It also presents a cycle in which new knowledge is continuously managed.

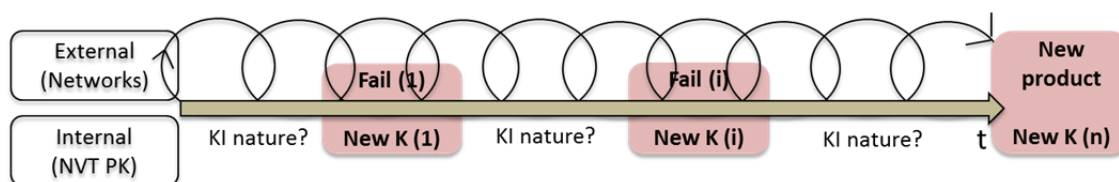
**Figure 3.4 Compilation of capabilities in learning in new ventures**



Source: Elaborated by author based on Zahra and George (2002)

Although Figure 3.4 shows a linear model, this is a representation of an ideal condition of knowledge management in time. Opportunity identification and commercialisation is a cycle with some successful and unsuccessful events; failure in commercialisation is a concurrent event in new ventures from which entrepreneurs can also learn (Cope, 2005). Learning by doing is required when the organisation needs to develop new solutions that are independent of the current state of knowledge (Sitkin, Sutcliffe and Schroeder, 1994). A more realistic model includes failure as an option for learning (value creation or new knowledge creation) in which entrepreneurs may be aware of lacking more knowledge and/or sources of knowledge. Therefore, external and internal sources of knowledge can be used at any time and after  $n$  failures a new product is commercialised (Figure 3.5).

**Figure 3.5 Model of knowledge integration in new ventures, time dimension**



Source: Developed by author

When an NVT manages knowledge, the source of new knowledge – external or internal – defines the form of knowledge acquisition and, therefore, the form of KI that the NVT uses. In addition, the NVT's knowledge base will define also what new knowledge is required – entrepreneurial, managerial, market or technical – and how this knowledge is integrated. This understanding helps to propose the third main research question of this study: *What is the nature of knowledge integration activities (individual or collective, external or internal) in new firms?*

### 3.6 Capabilities in learning in NTBFs

New ventures require different types of capabilities from established corporations (Zahra, Sapienza and Davidsson, 2006). Substantive capabilities are created, modified or extended by dynamic capabilities (Winter, 2003); some examples of substantive capabilities are



internationalisation and product development. Zahra, Sapienza and Davidsson (2006) presented a model in which, “organisational knowledge and substantive capabilities determine which dynamic capabilities are necessary to adapt to emerging conditions” (926). Their framework uses two types of capabilities: dynamic and substantive, in order to explain the role of dynamic capabilities in new and established firms. They conceptualise dynamic capabilities as the “abilities to re-configure a firm’s resources and routines in the manner envisioned and deemed appropriated by the firm’s principal decision-maker(s)” (924). Their model also includes the role of organisational knowledge, in order to explain why performance is not necessarily influenced by dynamic capabilities:

“(…) the effects of dynamic capabilities on organizational performance work through substantive capabilities (‘what the firm can do’) and depend on the quality of the organization’s knowledge base (‘what the firm knows’)” (p.943)

In comparison with new ventures, established firms have created a set of organisational capabilities that can be substantive, dynamic or combinative. As stated by Zahra, Sapienza and Davidsson (2006), “New ventures and dynamic established companies might have different types of advantages of their own when it comes to developing and harvesting dynamic capabilities” (p.946). For instance, established companies have many broad dynamic capabilities that are initially complex but then become simple and resistant to change. In contrast, new ventures have few focused dynamic capabilities that are initially simple and then complex, but that change can happen rapidly. New ventures develop organisational capabilities while established companies add new capabilities to their organisational capabilities.

When NVTs are formed, they are pursuing the materialisation of a business idea into a business, but the new business itself lacks organisational capabilities; organisational capabilities are built when NVTs are able to manage the knowledge they have and the resources they have or can obtain, to transform an idea into a firm, but specifically into a new product that reaches a market. What a firm knows when it is created is the knowledge of its founders (founders’ PK).

### **3.6.1 Technical and market knowledge**

NTBFs often have limited – and mostly specialised – knowledge bases because founding teams are typically composed of technical people who have a disclosure or have developed a

new technology that is likely to be exploited by creating a new firm. Given the importance of different specialised stocks of knowledge in knowledge integration in NTBFs, it is worth clarifying the difference between concepts such as technological knowledge, technical knowledge, technological capability and technological learning, market knowledge, market orientation and market capability.

“Technological learning is a multifaceted, and sometimes chaotic, process yielding knowledge that is often fragmented and unfocused” (Zahra, Sapienza and Davidsson, 2000:925). “Technological knowledge refers to knowledge associated with product, technologies and/or processes” (Clarysse, Wright and Van de Velde, 2011:1423). The innovation literature suggests that technological knowledge “is organized in two categories: product components and architectural design choices” (McEvily and Chakravarthy, 2002:293).

Kim (1999:177) states that technological knowledge is “the information about physical processes and social arrangements that underlies and is given operational expression in technology”. He states that this knowledge has technical and transactional elements, the former relating to product characteristics and physical processes, and the latter to social arrangements. He defines technological capability as “the ability to make effective use of the technological knowledge, it is the primary attribute of human and institutional capital” (171).

Science-based entrepreneurial firms are usually founded on a new technology and the very specific knowledge that is inextricably linked to that technology, which is typically embodied in the academic scientists and entrepreneurs (Clarysse et al., 2007, Markman et al., 2008). As the technology is rarely market-ready, knowledge surrounding the technology is needed to modify or tailor the technology and associated products/services to meet customer requirements (Di Gregorio and Shane, 2003, Zucker, Darby and Armstrong, 1998).

One of the most important causes of failure in new technology-based firm is the lack of market knowledge. A lack of market knowledge results in uncertainty and risk in commercialisation and lack of market knowledge is one of the main reasons why a firm cannot enter a market by selling its products (Erramilly and Rao, 1990).

Market knowledge can be defined as the knowledge relating to the market and the market-influencing factors (Johanson and Vahlne, 1977). Fletcher and Harris (2012:632) state that this type of knowledge “concerns institutional knowledge of government, institutional frameworks, rules and norms, knowledge of local conditions and opportunities, and business knowledge of the resources, capabilities and market behaviours of suppliers, competitors and local clients and their customers”.

Rossiter (2001) states that marketing knowledge has four forms: (1) marketing concepts, which are definitional building blocks of knowledge in our discipline; (2) structural frameworks, which are lists of concepts selected and organised to frame marketing problems so that they might better be solved; (3) strategic principles, which are conditional ‘if, do’ recommendations for managerial actions; and (4) research principles, which are conditional ‘if, use’ recommendations about the research techniques that are likely to give the best answers based on managers’ states of knowledge about the market.

Li and Calantone (1998:14) “suggest that market knowledge competence in new product development is composed of three processes: (1) a customer knowledge process, (2) a competitor knowledge process, and (3) the marketing-research and development (R&D) interface”. Kohli and Jaworski (1990:6) propose that “market orientation is the organizationwide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organizationwide responsiveness to it”.

Some studies have emphasised the role of internationalisation or international knowledge, as a form of market knowledge in NTBFs (Yli-Renko, Autio and Tontti, 2002, Yli-Renko, Autio and Sapienza, 2001). Knowing about an international market helps enable entrepreneurs to enter that market. Given the fact that growth in a firm can be related to increasing the size of the market, international knowledge has been broadly studied, in particular the role of social capital, knowledge-base, organisational learning, networks and entrepreneurial orientation. Internationalisation is a capability that can be developed in a new or in an established firm; however age has been identified as a factor that influences the development of this capability. New firms are more flexible and, therefore, they adapt more easily to changes.

Transforming an invention into a commercialisable technology implies developing technology-related knowledge and market-related knowledge in optimal periods of time. Market knowledge is a critical resource in NTBFs. When a new technology is created, the process of searching for a market has to be articulated with the technical process of transforming the invention in a marketable and competitive new product.

For the purpose of this research, following Johanson and Vahlne (1977), market knowledge is conceptualised as the set of data, information, abilities, competences and capabilities required to commercialise a new product and, following Clarysse, Wright and Van de Velde (2011) technical knowledge is conceptualised as the set data, information, abilities, competences and capabilities required to develop a technology. Both are substantive capabilities (Zahra,

Sapienza and Davidsson, 2006) that guarantee the development and commercialisation of the technology and, therefore, entrepreneurial growth.

### **3.6.2 Knowledge integration**

Learning in an NTBF implies the integration of PK that can be technical or market, with new knowledge. New knowledge can be exogenous and endogenous (Easterby-Smith, 1997). Exogenous knowledge is created from the interaction with external sources such as networks; this acquisition happens at the boundaries of the firm between two or more individuals. Endogenous knowledge is created from the interaction between the members of the entrepreneurial team or within the boundaries of the firm; this acquisition happens individually and a member (entrepreneur or employee) shares it and contributes to the exploitation of it for the benefit of the collective – the new firm. NVTs integrate market and technical knowledge from external sources and within the team when developing and commercialising new products while establishing the new firm.

External sources of knowledge (for instance, entrepreneurial networks) transfer new knowledge into the firm and the firm exploits it, generating tangible outcomes. The firm integrates knowledge from external sources of knowledge and uses absorptive capacity. Four knowledge-related processes constitute absorptive capacity and cumulatively facilitate rapid learning: knowledge acquisition, assimilation, transformation and exploitation (Zahra and George, 2002). “Absorptive capacity has been linked to valuable organizational outcomes such as learning and innovation” (George et al, 2001:206). The aim of the development of a firm’s absorptive capacity is to commercially apply the knowledge that is externally acquired and create new technical and organisational knowledge (Cohen and Levianthal, 1990). This dynamic organisational capability is called (for the purpose of this thesis) external knowledge integration.

The role of absorptive capacity has been addressed in entrepreneurship (e.g. Plummer and Acs, 2014, Qian and Acs, 2013) and in product innovation literatures (e.g. Maes and Sels, 2013), and it is recognised as playing an important role in learning; however, none of these streams has focused on NTBFs. The importance of external and internal sources of knowledge has been identified for SMEs more generally (Autio et al., 2010, Fernhaber et al., 2009 and Fletcher and Harris, 2012); however, it has not been studied in NTBFs. Capabilities in new ventures have been studied by several researchers (Presutti, Boari and Fratocchi, 2007,

Knockaert et al., 2010, Yli-Renko, Autio and Sapienza, 2001, Yli-Renko and Janakiraman, 2008, Prashantham and Young, 2011) however only Yli-Renko has focused on young TBFs.

Yli-Renko, Autio and Sapienza (2001) presented a study based on the KBV in TBFs. Their study highlights the importance of the links of social capital, knowledge acquisition and knowledge exploitation in young technology-based firms. Their findings contribute to the understanding of the role of inter-organisational relationships in competitive advantage in young TBFs in the UK from five sectors (pharmaceuticals, electronics, medical, communications and energy/environmental technologies). They studied the relationship of these firms with their key customers and found “that social capital is associated with knowledge acquisition, and that knowledge acquisition from key customers partially mediates effects of social capital on competitive advantage” (p.610). Whether these findings apply to other sectors and other countries represents an opportunity for further research.

Capabilities in learning are social processes, as discussed earlier. Cope (2005) demonstrates that behavioural and experiential frameworks are not enough to explain entrepreneurial learning. Therefore, he adds a third learning lens: the affective and social characteristics of the entrepreneur. These lenses are also included in Rae’s work (2006). Rae presents a conceptual framework for learning in technology-based enterprises whose outcome are entrepreneurial capabilities (Rae, 2000, Rae and Carswell, 2000, Rae and Carswell, 2001, Rae, 2006). He argues that “entrepreneurial learning is a dynamic social process of sensemaking, which is not only cognitive or behavioural but also affective and holistic” (Rae, 2006:40).

Rae’s main contribution is the importance of communities of practice (CofP) in entrepreneurial learning in TBFs and, therefore, the importance of Situated Learning Theory (SLT). His theoretical contribution is the addition of an affective and a holistic framework to entrepreneurial learning as a dynamic social process of sensemaking by introducing the importance of communities of practice when learning. Although his assumptions recognise a cognitive framework in entrepreneurial learning, he does not explain how this framework interacts with the behavioural, affective and holistic dimensions. He also suggests that there may well be value in investigating certain types of TBF in greater depth.

New knowledge in NTBFs can be acquired from multiple sources that can be external (informal or formal networks) or internal (new member of the team, expertise through working in communities of practice). The role of knowledge integration within a team has been studied from the dynamic capabilities perspective (Gardner et al., 2011) and from the organisational behaviour perspective (Cronin, et al., 2011, Cronin and Weingart, 2005). This form of

knowledge integration is more important in NTBFs because they are mainly created by teams rather than by individuals.

From an organisational behaviour perspective, the role of integration has been approached from the perspective of the creation of subgroups in teams (Cronin et al., 2011) and conflict in diverse teams (Cronin and Weingart, 2005). They propose two mechanisms that influence team performance: affective and cognitive integration. Both mechanisms present an interesting perspective from which to approach the behavioural and cognitive perspective of knowledge integration between individuals. Affective integration is related to the levels of respect, liking and trust between team members, and is part of the group atmosphere. Cognitive integration is related to the ability of team members to incorporate the perspectives of other team members with their own, therefore this type of integration enables the use of divergent information.

Gardner et al., (2011:1001) introduce “dynamic knowledge-integration capability for teams to refer to a reliable pattern of team communication that generates joint contributions to the understanding of complex problems in a team”. They state that this capability involves three interrelated aspects that influence team performance: reliable team communication, supportive participation and teamwork, to produce joint contributions and recombination of existing knowledge to solve problems. Although this study was based on a large knowledge intensive firm, it can be seen that this capability is related to the conceptualisation of communities of practice whose purpose is to develop members’ capabilities to build and exchange knowledge (Wenger and Snyder, 2000).

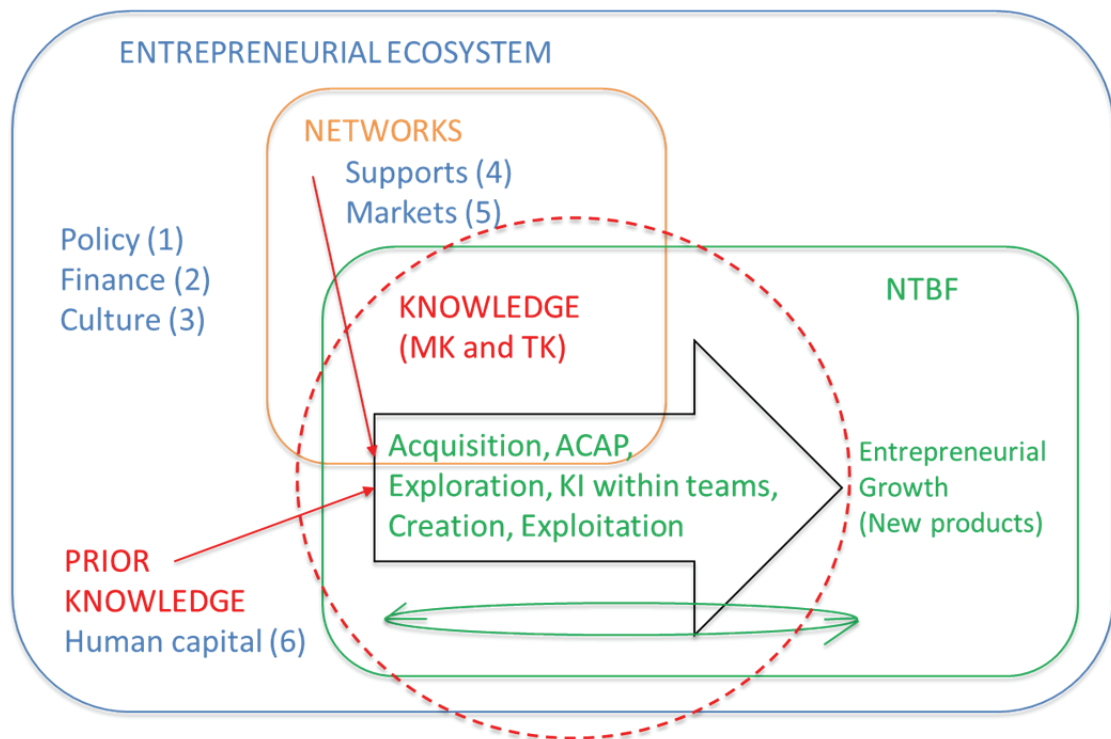
Previous studies (Teece et al., 1997, Eisenhardt and Martin, 2000, Zollo and Winter, 2002) state that successful performance depends upon continuous integration as circumstances change. Presented streams stress the importance of knowledge integration within teams for team performance and the importance of external knowledge integration for innovation and competitive advantage, however none of the studies explored the nature of knowledge integration in NTBFs and its role in developing substantive capabilities, such as product development and commercialisation.

To conclude, a KBV of entrepreneurial learning in NTBFs must consider the NVT’s PK, internal and external knowledge integration, development of substantive capabilities and the environmental context. The next sections will present the models that summarise the elements discussed in the literature review and that inform the methodology designed to answer the research questions.

### 3.7 Integrative model of entrepreneurial learning in NTBFs in entrepreneurial ecosystems

In this section an integrative model of entrepreneurial learning in NTBFs within an entrepreneurial ecosystem is presented (Figure 3.6). This model presents a systemic framework with elements of entrepreneurial ecosystems and knowledge management in NTBFs based on literature reviewed in Chapters 2 and 3. This model suggest how NVTs manage knowledge while creating and establishing NTBFs in an entrepreneurial ecosystem by identifying (1) key factors in an entrepreneurial ecosystem and (2) key capabilities that NVTs use and develop when new technologies are developed and commercialised.

**Figure 3.6 An integrative model of EL in NTBFs in an entrepreneurial ecosystem**



Source: Elaborated by author based on Isenberg (2010, 2011), Huber (1991), Zahra and George (2002), Cohen and Levinthal (1990), March (1991), Clarysse, B., Bruneel, J., & Wright, M. (2011), Gardner et al. (2011).

Since the model comprises many different concepts, it will be explained using two dimensions, that which is external to NTBFs and that which is internal, and the relationships between them when exploring entrepreneurial learning. The external dimension is comprised by the entrepreneurial ecosystem with its components. According to Isenberg (2010, 2011), an entrepreneurial ecosystem's main components are policy, finance, culture, support, human capital and markets. Three of these dimensions: support, markets and human capital, have a direct impact in knowledge management in new firms. Support and markets consider the several organisations that interact with the new firm, and these organisations can be organised in networks from which NVTs can acquire new knowledge. Human capital corresponds to the talent pool of people in which members of the NVT and employees can be found; their human capital (expertise and education) is the PK that they bring to the new firm. As was discussed in Section 3.4, PK has an impact on opportunity identification and knowledge assimilation and transfer but it is not clear how it impacts upon KI activities.

The internal dimension of NTBFs comprises the several capabilities in learning presented in Section 3.5 and 3.6 and the outcomes of learning. New knowledge and PK are managed by NVTs when pursuing new technology commercialisation and entrepreneurial growth. NVTs integrate market and technical knowledge from internal and external sources of new knowledge to achieve new technology commercialisation and entrepreneurial growth. Thus knowledge integration is the learning ability that NVTs use when transforming new and PK into organisational capabilities and, therefore, into new technology commercialisation.

NVTs integrate PK with new knowledge from external sources such as networks in the entrepreneurial ecosystem or from internal sources in the NTBF. Whether this process takes place at the individual or the collective level, externally or internally, is still not clear because NVTs' PK may create conditions under which some KI activities can be more appropriated than others.

In addition, this integrative model can be explored further to understand entrepreneurial growth. This PhD research does not focus on entrepreneurial growth but on technology commercialisation because of the limitations of a PhD study and because this PhD focuses on the existant gaps regarding PK and learning in the creation and establishment of NTBFs in entrepreneurial ecosystems.

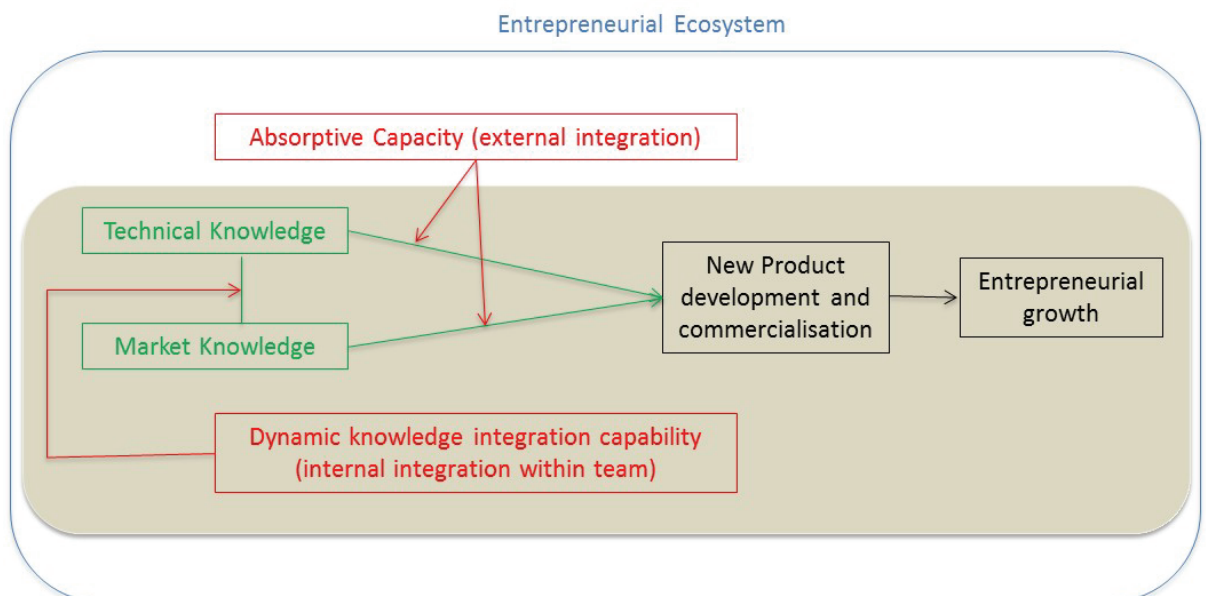


### 3.8 A model of knowledge and learning for NTBFs

This section describes a model (Figure 3.7) for NTBFs that considers the capabilities identified in Sections 3.6.1 and 3.6.2: market knowledge, technical knowledge and knowledge integration. The core of the model is about representing how NVTs develop capabilities by using a higher order capability: KI. This model suggests that NVTs in NTBFs use mainly two forms of knowledge integration: external and internal, and two specialised stocks of knowledge (substantive capabilities): market and technical knowledge. Different initial levels of substantive capabilities in the NVT may imply different forms of knowledge integration.

This model presents the role of external and internal KI to modify initial market and technical knowledge over time. The need for developing these capabilities emerges from the need to commercialise new technologies and achieve entrepreneurial growth. Thus substantive capabilities and KI capabilities are developed in response to a willingness of the NVT to enter new markets with their technologies. Successful new technology commercialisation is the evidence that technical and market knowledge capabilities have been developed.

**Figure 3.7 A model of knowledge and learning in NTBFs**



Source: Developed by author

This model suggests that internal knowledge integration (KI(2)) may take a more dominant role in NVTs whose members have complementary competences. For instance, if a member has a technical background and another one has a market background, this NVT will have to integrate knowledge internally. Moreover, if both members have high competences, this NVT may not need to integrate knowledge externally.

In entrepreneurial ecosystems in which new knowledge is transferred with ease to the NVT, external knowledge integration (KI(1)) may take on a more dominant role if NVT has high absorptive capacity. Thus NVTs may absorb new knowledge from networks and integrate it with PK to develop capabilities and commercialise new technologies.

Previous studies (Teece et al., 1997, Eisenhardt and Martin, 2000, Zollo and Winter, 2002) state that successful performance depends on continuous integration as circumstances change. Prior specific stocks of knowledge that are mostly technical in NTBFs, have to be integrated with knowledge of the market where the technology is expected to be sold. NVTs have to develop the ability to integrate not only knowledge from different types of sources (external and internal, individual and collective) but also stocks of knowledge with different content (market or technological, managerial or entrepreneurial).

Market knowledge, technical knowledge and knowledge integration capabilities are crucial in new technology commercialisation because sales is a critical factor for new venture entrance and because new knowledge is exploited to commercialise new technologies. Experienced entrepreneurs, for example, tend to choose actions that replicate or closely relate to those that have succeeded in the past, thereby exploiting PK and strengthening existing associations in memory (Politis, 2005). Stronger associations can speed decision-making and improve the efficiency of subsequent action, therefore, stronger knowledge integration capabilities can speed the new product development and commercialisation process.

Developing and commercialising a new technology is not only about the specific stock of knowledge required, but also about how NVT members enhance their competences and develop organisational capabilities to exploit their knowledge and the unexplored potential of the technology. Understanding remains limited concerning how knowledge might best be integrated for gaining competitive advantage in the context of NTBFs and whether different stocks of PK define different KI activities.

This model of how KI ability affects entrepreneurial growth postulates that substantive capabilities such as technical and market knowledge will have a direct effect in entry to new markets and sales. It also suggests that NTBFs embedded in entrepreneurial ecosystems will

acquire knowledge from external sources and external KI will mediate the development of substantive capabilities, technical and market knowledge, when pursuing entrepreneurial growth. The model also suggests that internal KI capability will mediate the interaction of technical and market knowledge.

### **3.9 Summary**

Aiming to establish a clear theoretical framework for the purposes of this PhD study, the concepts that lead the exploration of the literature regarding entrepreneurial learning were based on conceptual and empirical studies of organisational learning, social entrepreneurship (Gedajlovic et al., 2013) and strategic entrepreneurship (Kuratko and Audretsch, 2009). Although several researchers have attempted to understand how entrepreneurs create and establish new firms, the theoretical gap within the RBT remains (Lubik and Garnsey, 2014). Understanding how NVTs overcome the liabilities of newness by managing knowledge will contribute to understanding new firms' development of organisational capabilities and therefore into contributing key milestones to develop theories of survival and growth. There had been attempts to fill this gap in the theory of growth of the firm, however, a theory of entrepreneurship requires a theory of entrepreneurial learning.

The literature on networks, entrepreneurial ecosystems (Chapter 2), knowledge and entrepreneurial learning was examined (Chapter 3), with the aim to contribute to the KBV of entrepreneurial learning by proposing a theory to explain how entrepreneurs manage prior and new knowledge when they are creating and establishing an NTBF in an entrepreneurial ecosystem. This examination helped to identify that entrepreneurs use a particular style of learning to overcome the liabilities of newness, they manage networks and teams as sources of new knowledge, and integrate this new knowledge with PK while creating and establishing the new firm.

NVTs integrate knowledge while they are creating and establishing an NTBF. Knowledge integration can take different forms, individual or collective, external or internal. Literature suggests that the extent to which this integration takes one form or another depends on how related, diverse or complementary is the knowledge to be integrated. New and prior knowledge is integrated when creating NTBFs. However, there is little clarity regarding how important prior knowledge is for NTBF creation and establishment. Moreover, while external knowledge integration requires that prior and new knowledge be related, internal knowledge

integration requires diverse and complementary knowledge. It suggests that different stocks of prior knowledge may define different patterns of knowledge integration.

The examination of the role of NVT capabilities in knowledge management in NTBFs requires a framework in which dynamic (Teece, 1997) and substantive capabilities (Zahra, Sapienza and Davidsson, 2006) are developed through the interactions within the firm and with the entrepreneurial ecosystem. It also needs to include tangible outcomes that report the successful performance of the NTBF in terms of product/service commercialisation because, as was stated before, a new firm survives if it achieves entrepreneurial growth. New ventures require different types of capabilities from established corporations (Zahra, Sapienza and Davidsson, 2006). Established firms have already developed organisational capabilities that enable them to pursue competitiveness.

A better understanding of how NVTs, with different initial levels and stocks of knowledge, manage knowledge and their relationships within the firm and with their networks will shed light on the nature of knowledge integration activities in NTBFs. Whether these activities are individual or collective, external or internal, will help us to understand how NVTs manage knowledge. If these activities are linked to a tangible outcome such as the commercialisation of a new technology, exploring the nature of these activities will contribute to understanding how entrepreneurs learn effectively.

Previous literature on entrepreneurial learning has limitations in terms of the theoretical frameworks that have been used to study the phenomenon and in terms of the applicability of the models in new venture creation. Moreover, two gaps have been identified: the need to understand how entrepreneurs construct knowledge (Campos and Hormiga, 2012) and the need for theoretical development in entrepreneurial learning (Wang and Chugh, 2014). The adoption of a KBV perspective of entrepreneurial learning allows a contribution to be made to fill these gaps, combining previous findings into a structure by considering PK, new knowledge, sources of new knowledge and capabilities.

This thesis proposes a model that integrates the key elements of entrepreneurial learning in new ventures: PK, networks, capabilities and new product commercialisation (Figure 3.3). In addition, it provides a comprehensive and integrative framework that explains the interactions of key constructs to consider when examining a KBV of entrepreneurial learning in entrepreneurial ecosystems (Section 3.7). To operationalise entrepreneurial learning in NTBFs, a model of knowledge and learning is provided (Figure 3.7); this model recommends how substantive and dynamic capabilities (for instance, ACAP) interact in entrepreneurial

learning in NTBFs. These models contribute to the literature on entrepreneurial learning and will inform the design of the methodology of this research.

## Chapter 4 **METHODOLOGY**

This chapter presents the methodology designed for this study. It begins by reviewing the research questions (Section 4.1), then describes the chosen research philosophy, approach, strategy and design (Sections 4.2, 4.3, 4.4). Section 4.5 presents the procedures for collecting data (417.461 words in transcripts of interviews), data collected and data analysis for stage one of the methodology and Section 4.6 presents the procedures for collecting data, data collected and data analysis for stage two of the methodology. To conclude, it describes how quality was pursued and outlines the limitations of the research.

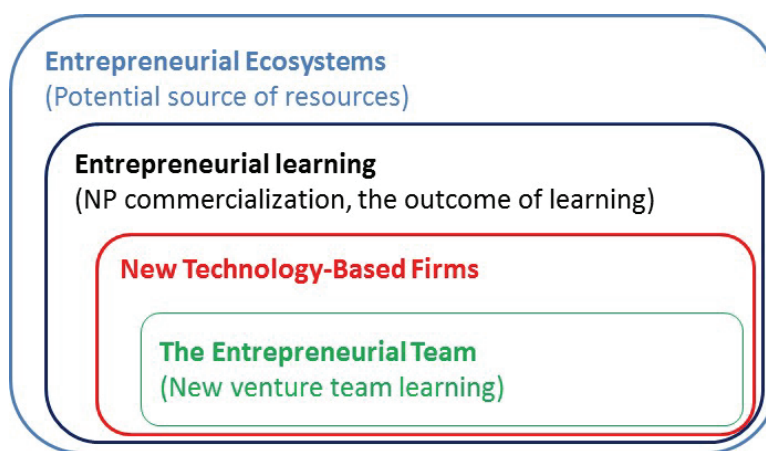
### **4.1 Aim and research questions**

Aiming to contribute into the understanding of entrepreneurial learning in new ventures, the purpose of this PhD study is to explore how entrepreneurs manage knowledge in NTBFs created in a particular entrepreneurial ecosystem. Given the limited theory about this phenomenon, (1) the need for theoretical development in entrepreneurial learning (Wang and Chugh, 2014); (2) the need to understand how entrepreneurs construct knowledge (Campos and Hormiga, 2012); and (3) the need for an extensive review of the existing literature in ecosystems, knowledge and entrepreneurial learning in new ventures, allowed the researcher to identify the importance of considering networks as sources of new knowledge and new venture teams as the learning agents.

Entrepreneurship cannot be explained by either environmental forces or individual characteristics in the absence of the others (Shane, 2003). Both dimensions come together through time in the entrepreneurial process, and it is possible to identify patterns of the creation and establishment of new ventures when the new firm is analysed as an organisation. Describing entrepreneurship by taking into account the individual level, the environment, the organisation, the entrepreneurial process (Gartner, 1985, Gartner, 1990) and the relations between them, will help to capture the multifaceted reality of entrepreneurship and, therefore, it will also help to capture the multifaceted reality of entrepreneurial learning.

“Entrepreneurship is a multifaceted, complex social construct” (Leitch, Hill and Harrison, 2009:79). In order to understand the environmental, organisational and individual realities that emerge during the first stages of development of NTBFs, this research is based in a framework that comprises four dimensions: entrepreneurial ecosystems, entrepreneurial learning with product commercialisation as the outcome of learning, NTBFs with knowledge as the most important resource, and the NVT as the entrepreneurs who manage knowledge. Figure 4.1 presents the dimensions of this research. These dimensions are elaborated upon Networks, ACAP, knowledge related processes and NVT prior knowledge.

**Figure 4.1 Dimensions of this research**



Source: Developed by author.

Considering that knowledge is the most important resource in NTBFs and the ecosystem, particularly networks of the ecosystem being the most important source of knowledge, the purpose of the first stage is to identify the different entrepreneurial ecosystems and networks coexisting in a particular country in order to describe the stage of the entrepreneurial ecosystems surrounding NTBFs. This understanding will help to identify key factors that influence the creation of NTBFs and, therefore, the role of the ecosystem in providing key resources such as knowledge.

The purpose of the second stage is to understand how NVTs manage prior and new knowledge when creating and establishing NTBFs in a particular entrepreneurial ecosystem.

This research has both exploratory and descriptive purposes, and will address three main research questions:

*To what extent is the Colombian entrepreneurial ecosystem promoting NTBFs? (From Chapter 2)*

*How do NVTs manage knowledge when creating NTBFs in the regional entrepreneurial ecosystem of Medellín? (From Chapter 3)*

*What is the nature of knowledge integration activities (KI) in NTBFs created in the regional entrepreneurial ecosystem of Medellín? (From Chapter 3)*

The central concepts for the first research question are: NTBF and entrepreneurial ecosystems. The central concepts for the second research question are: prior knowledge and new knowledge.

The central concept for the third research question is knowledge integration. The following subsidiary research questions provide focus and direction for answering it:

- ✓ What are the external sources of knowledge for NVT, and, what is this new knowledge used for?
- ✓ What are the internal sources of knowledge for NVT, and, what is this new knowledge used for?
- ✓ How do NVTs manage their sources of knowledge in new firms?
- ✓ Why do NVTs use some knowledge integration activities and not others?

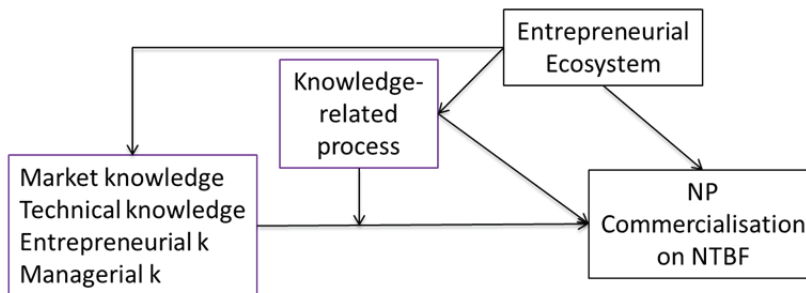
In order to describe how NVTs manage knowledge in NPD&C in NTBFs in early stage entrepreneurial ecosystem, the following connections between capabilities and the knowledge base of the NVT has been constructed (see Figure 4.2):

- “Creating new knowledge does not occur in abstraction from current abilities” (Kogut and Zander, 1996:391). Start-ups have routines to combine and exploit prior and external knowledge (Huber, 1991). NVTs aiming to create NTBFs need to have the capability to create and utilise knowledge in such a way that the new firm has the ability to gain and sustain competitive advantage (Cohen and Levinthal, 1990); they use knowledge-related processes.
- Forming effective and efficient teams is a challenge. Researchers have identified that establishing a well-balanced skilled team (functional expertise, management skills, decision-making styles, and experience) is a usual problem in new venture creation (Ucbasaran et al., 2003, Vanaelst et al., 2006, Lechler, 2001). NTBF creation requires a top team, with substantive, combinative and dynamic capabilities to process new knowledge and use it to develop and commercialise new products/services.



- Substantive capabilities are categorised using procedures required to develop and to commercialise a new product and create and establish an NTBF: market, technical, entrepreneurial and managerial knowledge. Capabilities (knowledge-related processes) are crucial in NTBF, because NVTs have to transform new and PK into a commercialisable technology.

**Figure 4.2 Constructs related to the academic gap**



Source: developed by author.

Therefore, the following can be concluded from this model:

- (1) The study underpins the role of knowledge in NTBF by exploring the integration of several stocks of knowledge.
- (2) Understanding the nature of knowledge integration activities (individual or collective, internal or external) helps to clarify what capabilities are used when creating and establishing a firm.
- (3) NTBFs manage knowledge to create value and commercialisable products, this learning process happens at multiple levels of the firm, within the team and with external organisations; the entrepreneurial learning model presented considers external and internal sources of knowledge: networks of the ecosystems and prior NVT knowledge (data, information, competences and capabilities).
- (4) NVTs achieve outcomes from learning using different (and parallel) modes of learning, by experience, by studying, by failure and by doing (Aldrich and Yang, 2014). Regardless of the mode of learning, new knowledge is needed, generated and used to face challenges; NVTs use this knowledge to act. Action is what makes the difference in transforming a business idea into a new established firm and action is constrained by time.

These statements will be examined to assess the relevance of knowledge integration and the NVT's PK mechanisms postulated in the models (Figures 3.4, 3.6, 3.7 and 4.2 inform the methodology and analysis). Figure 4.2 postulates relationships between the ecosystem (with its networks), the NTBF (with its capabilities) and the NVT's prior knowledge.

## **4.2 Research philosophy and approach**

In considering an appropriate research philosophy for this study, Saunders et al. (2009) identify four philosophical approaches in management research: positivism, realism, interpretivism and pragmatism. Positivism regards that reality is objective, external and independent of social actors. Realism regards that reality is objective and exists independently of human thoughts but is interpreted by human beings. Interpretivism regards that reality is socially constructed, subjective and multiple. Pragmatism regards that reality is external and multiple, and informed by observable phenomena and subjective meanings.

This research adopts an interpretivism approach in which realities are a social construction in which multiple realities are possible because "humans beings create their realities in the most fundamental ways, in an attempt to make their world intelligible to themselves and to others" (Morgan and Smircich, 1980:494). From this perspective, realities are understood as social and experiential constructions, mentally created in a local and specific setting although some individuals can have a shared perspective. These constructions depend on the human beings that created them and thus can be altered. They are more or less true, or just more or less informed (Gupa and Lincoln, 1994).

With this approach, knowledge is created around constructions with relative consensus, considering the perspectives of those involved individuals, and searching to interpret the core of the construction (Easterby-Smith, Thorpe and Jackson, 2012). Therefore, multiple realities can coexist if some of the individuals involved have different perspectives which can be influenced by factors such as ethnicity, gender, cultural, social, political backgrounds, among others. Constructions can change and are subjective to continuous revision.

The researcher is committed to reconstructing the reality using not only her understanding of the several constructs and concepts presented in the literature review but also the multiple voices of the several actors involved in the phenomenon of entrepreneurial learning in NTBFs in a particular entrepreneurial ecosystem. Therefore, constructions emerge as a consequence of interpreting reconstructions that are created while data are collected and analysed.

Bryman and Bell (2015) indicate that interpretivism is an appropriated approach when unexpected findings can be generated by the researcher. This occurred within this research when it was found that (1) even in entrepreneurial ecosystems in an early stage of development, entrepreneurs acquire knowledge from external networks that have been developed by local agents, and (2) NTBFs with different characteristics of NVTs' PK (level, relatedness and diversity) use external and internal knowledge integration. These findings will be discussed in Chapters 6 and 7.

Knowledge emerges as a creation in the researcher-respondent interaction (Guba and Lincoln, 1994). The aim of this approach is to understand and reconstruct the constructions that were initially held by the respondent and the researcher too. This understanding is expected to bring consensus but is open to new interpretations that can emerge in the process of research. The process is based on the construction of more sophisticated constructions that bring more content and meaning. The researcher is a dialogic facilitator (Blaikie, 2010).

In constructivism, constructions are brought together in a search to accumulate knowledge from more informed constructions by interpreting the multiple realities presented by the respondent. Knowledge is created based on the accumulation of more sophisticated constructions. "One important mechanism for transfer of knowledge from one setting to another is the provision of vicarious experience, often supplied by case study reports" (Guba and Lincoln, 1994:114).

A subtle realist ontological assumption and a conventionalist epistemological assumption are adopted, recognising that reality exists independently of scientists but they create theories to deal with the world using their judgement (Blaikie, N., 2010). This selection of research paradigms responds to the fact that successful entrepreneurs already found ways to learn; the researcher seeks to explore and describe entrepreneurial learning as a function of the relationships between knowledge and learning capabilities.

For the purpose of this research, reality will be constructed from accumulating knowledge from two different types of respondents. First, there is a need to know the local and specific constructed realities of practitioners in the industry of entrepreneurship. Exploring this collective reality will help to better select the sample of NTBFs and reshape the second stage of this methodology. Second, there is a need to know the perceptions of the entrepreneurs regarding how they manage their resources, but mainly their most important resource: knowledge; and, thus, the sources of knowledge.

A research approach can be qualitative or quantitative. A quantitative approach is based on postpositive claims, strategies of inquiry and statistical data (Creswell, 2008); in contrast, qualitative research uses unstandardised data and findings which are derived from categorising and conceptualising qualitative data (Saunders et al., 2009). This PhD study adopts a qualitative approach because meanings are constructed by respondents using their perception of social reality (Miles and Huberman, 1994) and the problem of interest requires in-depth exploratory research (Creswell, 2008).

### **4.3 Research strategy**

In considering the appropriate research strategy for the study, the literature suggests four types of research strategy: Inductive, deductive, abductive and retroductive. “Inductive strategy aims to establish descriptions of characteristics and patterns. Deductive aims to test theories, to eliminate false ones and corroborate the survivor. Retroductive aims to discover underlying mechanisms to explain observed regularities. Abductive aims to describe and understand social life in terms of social actors’ meanings and motives”. (Blaikie, 2010:84).

The first stage of this research uses an inductive research strategy because this research strategy involves analysing data with little or no predetermined theory, structure or framework, this is suitable for the first stage because little is known about entrepreneurial ecosystems. For conducting this stage, the researcher had an understanding of the dimensions of social capital in entrepreneurial networks; however, this is only one of the aspects of entrepreneurial ecosystems.

The second stage of this research uses an abductive research strategy because the researcher first developed models and frameworks deducting relationships from the literature, then she allowed the data to “speak” and patterns emerged. When using inductive strategy, patterns are not imposed and a deeper understanding of the meanings of relevant phenomena were gained (Miles and Huberman, 1994).

### **4.4 Research design**

Although every research method can be used for exploratory, descriptive and explanatory purposes, the case study method is more likely to be used when the type of the research questions are “how” and “why” because these are more explanatory and are related with

operational links that need to be mapped out over time (Yin, 2014). It is also used when there is a no need to control behavioural events since it is useful to examine contemporary events in which relevant behaviours cannot be manipulated. One of the most important advantages of this method is “its ability to deal with a full variety of evidence” (Yin, 2014:12).

A case study method is pertinent when the researcher wants to investigate a contemporary social phenomenon within its real context and undertake an in-depth description (Yin, 2014, Eisenhardt and Graebner, 2007). It can be used to build theories, it can involve either single or multiple cases and it can consider numerous levels of analysis (Eisenhardt, 1989). Therefore, this research adopts a case study method to contribute to the understanding of how entrepreneurs learn by exploring how NVTs manage knowledge while creating and establishing NTBFs in a particular entrepreneurial ecosystem.

Yin (2014) establishes four principles of data collection when using the case study method: (1) use multiple sources of evidence (documents, archival records, open-ended interviews, structured interviews and surveys, focus interviews, observations), (2) create a case study database in which you include data from field notes, case study documents, tabular materials and narratives, (3) maintain a chain of evidence, the reader can follow the derivation of any evidence from the initial research questions to the conclusions, and (4) exercise care when using data from electronic sources.

#### **4.4.1 Units of analysis**

Yin (2014) presents four types of research design for case studies: single-case (holistic) designs, single-case (embedded) designs, multiple-case (holistic) designs, and multiple-case (embedded) designs. This research uses an embedded case study design; a single case with multiple units of analysis. Yin (2014:63) states that “the same single-case study may involve units of analysis at more than one level. This occurs when, within a single case, attention is also given to a subunit or subunits”.

Single cases are considered when (a) the case is critical for the theory or theoretical propositions, (b) the case represents an extreme case or a usual case, (c) the objective is to capture the circumstances and conditions of an everyday situation, (d) the case is revelatory, (e) the case is longitudinal. Colombia is a critical case for exploring entrepreneurial learning in new ventures, because entrepreneurial networks may not be efficient, thus, it is unknown where NVTs creating and establishing NTBFs are acquiring the knowledge from.

The research design of this study is composed of two stages, one for each unit of analysis. In the first stage the unit of analysis is the region as a boundary of each regional entrepreneurial ecosystem. In the second stage the unit of analysis is the NTBF. In the case of Colombia, it was necessary to understand whether external factors were having an impact in the creation of NTBFs, and whether particular regional conditions of the entrepreneurial ecosystems were impacting NTBFs' creation in different ways. This understanding allowed the researcher to define criteria for the selection of the NTBFs for the second stage, such as focusing on one region instead of choosing NTBFs from all over the country.

#### **4.4.2 Comparative case studies**

Both stages use multiple-case design (collective case study). Stake (2000) identifies three types of case study: Intrinsic, instrumental and collective. Intrinsic case study is undertaken when the case itself is of interest. An instrumental case study is undertaken when the case provides insights into something else other than the case itself; it plays a supporting role. Collective case studies are undertaken to study a phenomenon, population, or general condition in which understanding is enhanced by observing more than one case and it allows better theorising about a larger collection of cases.

A case study design composed of two comparative cases, one in the first stage and another in the second stage, allowed "recognizing patterns of relationships among constructs within and across cases and their underlying logical arguments" (Eisenhardt and Graebner, 2007:25), as multiple cases are "powerful means to create theory" (Eisenhardt, 1991:620).

Yin (1994:46) states that "the logic underlying the use of multiple-case studies is the same. Each case must be carefully selected so that it either (a) predicts similar results (a literal replication) or (b) produces contrasting results but for predictable reasons (a theoretical replication)". The first stage case selection was aimed to predict similar results and second stage cases selection was aimed to produce contrasting results.

This study uses non-probability sampling (Saunders et al., 2009). Both stages use nonpurposeful and theory-driven sampling in which the selection of the cases is driven for the particular characteristics of the cases to answer the research questions (Miles, Huberman and Saldaña, 2014). Particularly, in the second stage, the researcher decided "to choose cases such as extreme situations and polar types in which the process of interest is transparently

observable” (Eisenhardt, 1989:537). Criteria for selection are discussed further in sections 4.5.2 and 4.6.2.

#### **4.4.3 Generalising from case studies to theory**

Following Eisenhardt’s (1989) advice to get started, to shape the design of theory building, the researcher developed several models that synthesised the literature review (Figures 3.3, 3.4, 3.6 and 3.7). This helped to shape the research design of the second stage. A defined set of research questions helped the researcher not to become overwhelmed by the volume of data.

In contrast to building theory from the bottom-up approach, an inductive top-down theorising approach was used (Shepherd and Sutcliffe, 2011) in which (1) the definition of the research questions was informed by the literature, (2) it represented the collective knowledge of the intellectual community and (3) doubt was the trigger; doubt about how NVTs create and establish NTBFs in early-stage entrepreneurial ecosystems in which formal entrepreneurial networks were not efficient (Birley, 1986), as stated by the respondents of the first stage of this study.

Yin (2014) states that, when building theory or theoretical propositions with case studies, five components of the research design are especially important: research questions, propositions, unit(s) of analysis, the logic linking the data to the proposition and the criteria for interpreting the findings. When linking data to propositions five analytic techniques can be used: pattern matching, explanation building, time-series analysis, logic models and cross-case synthesis. In this study, explanation building was done using narratives of the eight cases from the second stage. Logic models were used in the second stage and cross-case synthesis was used in both stages. The criteria for interpreting the findings will be presented in the analysis section of each stage.

### **4.5 Stage 1. Exploring the landscape within the Colombian entrepreneurial ecosystem**

This stage uses a cross-sectional design to identify the different entrepreneurial ecosystems and networks coexisting in a particular country. The aim of this stage is to describe the entrepreneurial ecosystems surrounding NTBF creation in Colombia. This stage seeks to

answer the first main research question and corresponds to the first dimension of this research: Entrepreneurial ecosystems (Figure 4.1).

In order to explore how entrepreneurs learn it is strategic to consider a country in which NTBFs are being created but there is not an evolved entrepreneurial ecosystem. Institutions promoting entrepreneurship in early stage entrepreneurial ecosystems do not have a shared set of norms, practices, procedures and communication channels that define them. They are focused on doing more to satisfy customers and a leader is expected to emerge to “initiate a process of rapid, ongoing improvement that draws the entire community toward a grander future” (Moore, 1993:79). Therefore, since NTBFs are being created and established in early stage ecosystems, it is likely that the NVT has to focus its efforts on grasping resources from the industrial networks where they want to enter. Barriers to entry may apply and NVTs need to overcome the liabilities of newness to survive.

In Colombia, the National Government has created a legal framework for promoting entrepreneurship based on the entrepreneurial law (Law 1014, 2006) which states that “the education system shall incorporate, in theory and in practice, the most advanced scientific and technical skills to develop entrepreneurial capacities in the students to create their own enterprise, manage new technologies in current science, and to be able to be an entrepreneur when being an employee”. In 2013, when the data were collected, there had been a National Government encouraging the support of entrepreneurship in the country for seven years. Nevertheless, the role of local government varies, for instance, while Medellín and Bogotá’s local governments have promoted entrepreneurship for more than four years, Cali is starting to give local governmental support. It seems that the several cities of the country have their own entrepreneurial ecosystems and have evolved into different paths. To describe the efficiency of the several entrepreneurial ecosystems of the country, would imply describing all the local entrepreneurial ecosystems, however this is not possible with a PhD study. This PhD study focuses on the Colombian entrepreneurial ecosystem and on Medellín’s regional entrepreneurial ecosystem to consider regional characteristics in NTBFs creation and establishment.

#### **4.5.1 Methods**

Practitioners in the industry of entrepreneurship – managers, academics, governors, and leaders – are conscious of the importance of working on improving the dimensions of their entrepreneurial systems. Their views, assumptions, interpretations, understanding, interactions



and purposes are making the systems exist and evolve. Therefore, their perceptions are the basis for building theories and for researchers to design tools to deal with that reality.

Semi-structured interviews were selected as the means of data collection because interviews are well suited for the exploration of the perceptions, assumptions and purposes of respondents (Mason, 2002). It was not appropriate to use a structured interview or an open interview because of the professional diversity of the sample group (managers, academics, governors, leaders). Construct validity was pursued by considering the perspectives of the sample group (Eisenhardt, 1989, Maxwell, 1992, Strauss and Corbin, 1994, Partington, 2000, Drennan, 2003, Suddaby, 2006, Eisenhardt and Graebner, 2007).

The semi-structured interview covered such aspects as: dimensions of the entrepreneurial networks, description of the national and regional entrepreneurial ecosystems, and the system that supports NTBFs, the role of each institution in the value of chain, and the creation/existence of NTBFs. The interview was composed of four main questions, with additional questions and two clarification questions (See Appendix 4). The interview was tested with some participants from the entrepreneurial ecosystem of Medellín in a pilot; the interview was improved three times before the final version was reached (Drennan, 2003).

The interview started by presenting the aim of the research and offering confidentiality to the interviewee. Once saturation was reached, the process of interviewing was stopped. Interviews were planned to last one hour, however in some cases they lasted less (40 minutes) or more (2.5 hours). This was related to the time availability of the interviewees and their disposition to share their perceptions of the ecosystems. Most of the interviews were carried out face-to-face, only five of them were undertaken via Skype.

#### **4.5.2 Data collection**

To explore the level of evolution of the national ecosystem data collection of this research focuses on a *purposive sample* comprised of two factors. Factor A considers the four largest cities in the country in terms of population because it is expected that the biggest cities would have the largest populations creating and establishing new firms; these cities are Bogotá (BOG), Medellín (MED), Cali and Barranquilla (BLLA). Almost 30% of the population of Colombia live in these four cities (DANE, 2012). Factor B considers key actors of the organisations of the country that offer any type of support to the entrepreneurs: governmental, universities and institutions supporting entrepreneurship. See table 4.1.

**Table 4.1 Organisation in which data were collected, Stage 1**

CITY	Nature of organisation	ORGANISATION	TYPE OF ORGANISATION		
			Governmental	University	Support
MED	Corporation	Parque Soft			1
MED	Corporation	Ciudad E (1 interview)			1
MED	Corporation	Creame			1
MED	Corporation	CTA			1
MED	Chamber of Commerce_Local	Cluster TIC			1
MED	Local Gov + University	Parque del Emprendimiento	1	1	
MED	Corporation	Technova			1
MED	Corporation	Ruta N			1
MED	Corporation	Intersoftware			1
MED	Private investor	Capitalia Colombia			1
MED	University	EAFIT		1	
MED	University	Universidad de Antioquia OTRI		1	
MED	Chamber of Commerce_Local	Camara de Comercio Ant			1
MED	Private large firm	Nal de Chocolates			1
MED	Private large firm	Corona			1
MED	Foundation	Proantioquia			1
<b>MED</b>		<b>TOT</b>	<b>1</b>	<b>3</b>	<b>13</b>
BOG	National Government	TecnoParque, SENA	1		
BOG	Corporation	FEDESOFIT			1
BOG	National Government	Colciencias	1		
BOG	National Government	Innpulsa	1		
BOG	University	Universidad Nacional		1	
BOG	National Government	Min TIC. Apps.co	1		
BOG	Chambers of Commerce	Confecamaras			1
BOG	National Government	DNP	1		
BOG	Chamber of Commerce_Local	Bogota Emprende			1
BOG	University	Universidad de los Andes		1	
BOG	National Government	Ministry of Commerce	2		
BOG	National Government	Experto SENA			1
<b>BOG</b>		<b>TOT</b>	<b>7</b>	<b>2</b>	<b>4</b>
BLLA	University	Universidad del Norte		1	
BLLA	Chamber of Commerce_Local	Red Avanza Atlantico – Chamber of Commerce			1
<b>BLLA</b>		<b>TOT</b>	<b>0</b>	<b>1</b>	<b>1</b>
CALI	University	ICESI		1	
CALI	Corporation	Comfandi			1
CALI	Foundation	Parque Soft			1
<b>CALI</b>		<b>TOT</b>	<b>0</b>	<b>1</b>	<b>2</b>

A total of 51 individuals with different roles (experts, leaders, coordinators, employees, entrepreneurs) in the three types of institutions promoting entrepreneurship were contacted. These institutions focus their actions at the national level and/or at local/regional levels. The list of institutions in which interviews were conducted is presented in Table 4.1.

Interviews were conducted with experts and practitioners in entrepreneurship, and with entrepreneurs in Colombia between June 2011 and August 2013. In each institution a key person was identified who was related to entrepreneurship regarding NTBFs; for doing so a total of 51 people were contacted: 16 in meetings (with non-structured interviews) and 35 in semi-structured interviews. Meetings allowed the researcher to identify additional key actors to interview. Interviewees belong to several types of institution: government, universities, and support institutions such as incubators, non-profit organisations, private institutions and chambers of commerce. Table 4.2 presents the total number of people interviewed by region and type of institution. The majority of the interviews were transcribed (there were some technical and human problems with a few of them).

**Table 4.2 Summary of sample of experts by city and type of institution**

	<i>Bogota</i>	<i>Medellín</i>	<i>Cali</i>	<i>Barranquilla</i>	<i>TOTAL</i>
<i>Governam. Inst.</i>	7	1			8
<i>Universities</i>	2	3	1	1	7
<i>Support Inst.</i>	4	13	2	1	20

Compared to Medellín and Bogota, information saturation was reached with fewer interviewees in Barranquilla and Cali, thus the number of people contacted in these two cities was lower. Regarding the National Entrepreneurial Network, Law 1014 establishes that 15 institutions belong to the National Entrepreneurial Network, all these institutions are based in Bogota, and at least a half of them were included in the sample.

#### **4.5.3 Data analysis**

NVivo was used to code the transcribed interviews. Analysis was carried out using thematic analysis. The following table (Table 4.3) presents preliminary organising categories and final coding categories.

**Table 4.3 Categories developed during the analysis process**

Preliminary Organising Categories	Examples	Final Coding Categories
Shape and operation of the entrepreneurial networks		
Actors	<i>Entrepreneurial Units at the Universities</i>	Structure of the system
Key institutions	<i>That is executed with governmental resources by the ICT Ministry</i>	
Stage of the system	<i>...for building trust, but that is not the strategy...</i>	Governance
	<i>We are on the way but none of the networks is efficient</i>	Efficiency
Definitions	<i>...NBTF can be originated by (...) that create a dynamic or high-impact entrepreneurship</i>	Content of networks
	<i>Technologies that are mostly being developed from the academy</i>	NTBF definition
Factors affecting NTBF creation		
Problems of the system	<i>There is a lack of dynamic, there is not leadership</i>	Challenges
Policies	<i>We are offering courses in IP but...</i>	Factors
Human capital	<i>The brain of our developers in Colombia is awesome</i>	
Sectors	<i>I am a little enemy of the wizards that define sectors</i>	
Cases to study	<i>There is another entrepreneur named (...), his phone number is (...), he has a firm that is called (...)</i>	For NTBF database

Given that the aim of Stage 1 was to describe the Colombian entrepreneurial ecosystem and to what extent it is promoting NTBFs' creation in Colombia, this was achieved by several codes and final categories regarding dimensions of the entrepreneurial ecosystems and networks (Isenberg, 2010, Hoang and Antoncic, 2003, Moore, 1993, Autio et al., 2014). Thematic coding was also used to identify external factors influencing NTBF creation. This analysis could have been taken further but by doing so the focus of the research would have been lost, therefore the researcher used first stage findings to made decisions regarding second stage research design and undertook the second stage of data collection.

#### **4.6 Stage 2: Understanding knowlege management in NTBFs**

The aim of this stage is to understand how NVTs manage knowledge when creating and establishing NTBFs. This stage uses a within-case and a cross-sectional comparative study to build theory around knowledge management in NTBFs in a particular entrepreneurial ecosystem. This stage seeks to answer the second and third main research questions and corresponds to the third dimension of this research: NTBFs (Figure 4.1).

Given that each region in Colombia has an entrepreneurial ecosystem, it was important to focus this stage on one region because all firms would be under the same external characteristics with access to same sources of resources. This decision was important because

it was necessary that selected NTBFs were exposed to the same external conditions, and as each region offers different entrepreneurial conditions, selected cases had to be created in the same region.

Asking entrepreneurs about knowledge management requires entrepreneurs to use their metacognition. They need to perform higher-order thinking that enables understanding, analysis, and control of one's cognitive processes. Therefore, this second stage considered the entrepreneurs metacognition ability (Haynie, Shepherd and Patzelt, 2012) in order to understand how entrepreneurs integrate knowledge and what motivates them to integrate it.

#### **4.6.1 Methods**

Semi-structured and open interviews were chosen for collecting data in order to capture the perceptions, assumptions and purposes of the entrepreneurs. Four pilot studies were done to improve the first interview and the criteria to select the cases; two were done with Scottish entrepreneurs<sup>15</sup> and two with Colombian entrepreneurs. One of the pilot studies became a case to study.

The researcher designed a case study protocol for the empirical study. This protocol was informed by the preliminary literature review.

Topics identified for addressing the research questions were:

- The entrepreneurial event (technology push or market pull, founder and team),
- The key events in the process regarding the NPPD in NTBF (prototype, IP and first product commercialised, new members, subgroups, alliances, networks),
- Aspects found in the literature review related to the knowledge-related processes (Chapter 3).

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<sup>15</sup> It was important to validate whether tools designed were allowing the collection of data needed. From the first pilot, it was identified that it was more important that the firm has commercialised the first innovative product than the age of the firm. From the second pilot, some questions were added. In comparison with pilots in Colombia, it was identified that Colombian entrepreneurs were more willing to talk and were more open to sharing their experience than were Scottish entrepreneurs. The first Colombian pilot was useful for designing the telephone questionnaire to select firms and the second Colombian pilot became a case to study because it accomplished all the criteria and there was no need to improve the questionnaire.

The methods applied in the comparative case study were:

1. A telephone questionnaire to collect information for choosing cases to study.
2. A first interview (semi-structured interview) with the founder (or the members of the NVT). When possible, all members of the NVT were interviewed.
3. A second interview (open interview) with the same person interviewed to validate information collected in the first interview. In two of the cases a focus group was conducted with all the members of the NVT to validate information collected in the first interview. During the second interview entrepreneurs were be asked to correct the mind maps constructed by the researcher after analysing information collected in the first interview. Moreover, some open questions were formulated about what resources and help were obtained in each interaction.
4. A third semi-structured interview with people belonging to external institutions that had contact with any of the cases and which were not interviewed in the first stage. These interviews were done using the same interview as the first stage.

Tools such as questionnaires and mind maps were designed to collect data during the interviews and to analyse data collected. The tools that were designed for collecting and analysis of the data are described in Table 4.4.

**Table 4.4 Tools designed to collect data in Stage 2**

	Content	Appendix No.
<i>Selection of cases</i>		
Telephone Questionnaire 1	Age, products/services, size, founders, certifications	5
<i>First interview</i>		
Questionnaire 2	Narrative of creation of the firm, driver, key events, team and subteams, networks, training programmes, financial capital	6
Mind map 1	Sources, team	7
Mind map 2	Sources, team and key events	8
<i>Second interview</i>		
Table for clarification	Sources of market, technical, managerial and entrepreneurial knowledge	9
Focus group protocol	Narratives about new products development and commercialisation	10

#### 4.6.2 Data collection

The researcher built a database<sup>16</sup> of NTBFs which have been created in the past 10 years in the ICT industry in Medellín, Colombia. This database includes 84 firms that were created in research groups, supported in incubators, educational entrepreneurial programmes and a networking corporation, and new firms recommended by several key actors of the entrepreneurial ecosystem (Table 4.5).

**Table 4.5 Sources of information for building database**

<b>Institution that provided information</b>	<b># Firms suggested</b>
Programme “Ciudad E” (Alliance with local government)	18
Bussines plan competition, Parque E	20
Parque Soft (Technological Park)	9
ProAntioquia (Foundation)	5
Creame (Incubator)	4
Intersoftware (Association)	23
Ministry of ICT	5

Primary and secondary information was gathered to choose the cases. Primary information was collected by a telephone questionnaire (Appendix 2) and secondary information was collected from online public information such as companies’ websites, YouTube channels and news. Totals of primary data collected are presented in Table 4.6. The eligibility criteria were:

- (1) NTBF that already commercialised at least one innovative product<sup>17</sup>.
- (2) Age: NTBFs that have been in the market for less than 10 years. Although there is a consensus regarding a cut-off of six years for NTBFs (Zahra, Ireland and Hitt, 2000), a 10-year upper limit is consistent with previous research on entrepreneurial firms and for studies in knowledge acquisition because young firms are the most affected by key external relationships (Yli-Renko, Autio and Sapienza, 2001).
- (3) Location: NTBFs created in Medellín. Medellín is the most evolved entrepreneurial ecosystem of Colombia and counts a broad portfolio of institutions supporting entrepreneurship because of the high support from local government.
- (4) Industry: ICT. NTBF developing and selling software. This type of technology requires

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<sup>16</sup> This database was created in the first stage of data collection. People interviewed provided information about NTBFs of the ICT sector in Medellín.

<sup>17</sup> An innovative product is a product that is offered only by that firm that is different to the competitors’.

low levels of financial capital to be developed and can be easily be commercialised globally. This industry “is characterized by high growth, knowledge intensity and keen global competition” (Saarendkto et al., 2008), moreover, this industry had a rapid technological advance that began in the early 1980s (Hyytinen and Pajarinen, 2005) and its products can be developed and delivered with less extra cost in comparison with other technologies (Oakey and Cooper, 1991).

- (5) Level of market knowledge. Broadness of customers: local, national or international, and the estimated number of customers (Table 4.8).
- (6) Level of technical knowledge. Number of software developers that are employee and founders in the firm, the number of certifications and the origin of the firm (when firms originated from research groups it was considered that there was at least a medium level of technical knowledge). See table 4.8.

**Table 4.6 Data collected in Stage 2 of the research**

YTBF	No. of Founders	No. of members of NVT	Data Collected
1	2	2	4 interviews
2	2	4	7 interviews, 1 focus group
3	2	2	4 interviews
4	2	2	4 interviews
5	3	3	4 interviews
6	5	2	3 interviews, 1 focus group
7	2	1	2 interviews
8	2	4	5 interviews

Theoretical sampling was undertaken in which enough cases needed to be selected to achieve sufficient data saturation and in order to draw theoretical generalisations and that represented the phenomenon of interest (Eisenhardt, 1989, Eisenhardt and Graebner, 2007, Langley, 1999, Zahra, 2007, Yin, 2014). Eight cases were chosen. They were expected to represent four polar situations in which every two firms represented an extreme case of market and technical knowledge: two cases with high market and technical knowledge, two cases with low market and technical knowledge, two cases with high market knowledge and low technical knowledge, and two cases with high technical knowledge and low market knowledge (Table 4.7).



**Table 4.7 Estimation of knowledge available for selection of cases**

	High Market Knowledge	Low Market Knowledge
High Technical Knowledge	2 cases	2 cases
Low Technical Knowledge	2 cases	2 cases

Technical knowledge was estimated using a surrogate that considers the formal education of the entrepreneur that is related to the type of technology that is offered by the firm (software). This estimation makes reference to one of the dimensions of human capital of the entrepreneur(s). It was considered that a firm had high technical knowledge when the firm had certifications and/or undergraduates related to software development, and/or entrepreneurs had certifications related to software development or had been engaged with research regarding software development. It was considered that a firm had low technical knowledge when entrepreneurs did not have more than five years of formal education related to software development.

Market knowledge was estimated using a surrogate that considers how long (years) the entrepreneur(s) has been selling products or how many customers the firm had in 2013. A firm was considered to have high market knowledge when it had a broad network of customers, or it had more than 10 customers. It was considered that the firm had low market knowledge when its first innovative product had been sold for less than one year, or the firm only had local customers.

The table below (4.8) presents the preliminary categorisation of the eight cases, before detailed data were collected. It was a theoretical sample in which the researcher was aiming to identify two polar cases for each of the four possible scenarios: (1) very low technical and market knowledge, (2) very low technical knowledge and very high market knowledge, (3) very low market knowledge and very high technical knowledge, (4) very high technical and market knowledge.

It is important to state that once primary data from entrepreneurs were gathered, it was realised that these categories were not good enough to estimate the level of technical and market knowledge of the firm.

**Table 4.8 Criteria and categorisation, before detailed data collection, of the eight cases**

MK	Firm has a broad network of customers, OR It has more than 10 customers.	“FIRM C” “FIRM G”	“FIRM A” “FIRM F”
	First innovative product has been sold for less than one year OR The firm only has local customers.	“FIRM B” “FIRM H”	“FIRM E” “FIRM D”
		Entrepreneurs do not have over five years of formal education related to software development.	Firm has certifications/undergraduates related to software development, AND/OR, Entrepreneurs have certifications related to software development or have been engaged with research regarding software development.
TK			

During and after data collection, firms were categorised again, improving the surrogate for each of the two variables. Levels of human capital of the NVTs were associated with the levels of market and technical knowledge.

Market knowledge level when creating the firm was estimated, resulting in the following figures:

- The number of years that the members of the NVT spent studying any undergraduate or masters programme related to business.
- The number of years that the members of the NVT spent in managerial positions such as Project Director, Department Director or CEO.
- The number of years that the members of the NVT spent as entrepreneurs before creating the firm divided by the number of members of the NVT that had created at least one firm. This is to consider that entrepreneurial knowledge is not necessarily accumulated and can decrease when time passes (knowledge depreciation).

Technical knowledge when creating the firm was estimated adding the following figures:

- The number of years that the members of the NVT spent studying any undergraduate or masters program related to software development.
- The number of years that the members of the NVT spent developing software.
- The number of certifications in software development of the members of the NVT when the firm was created.

The levels of market and technical knowledge of each NVT when the firm was created can be seen in Table 4.9.

**Table 4.9 Estimation of level of MK and TF of the NVT when creating the firm**

	FIRM A	FIRM B	FIRM C	FIRM D	FIRM E	FIRM F	FIRM G	FIRM H
TK	18	3	15	7	10	8	9	15
MK	20	0	14	0	6	0	11	18

In order to estimate the level of technical and market knowledge in 2013, the level of knowledge when the firm was created was considered, the age of the firm and the roles (technical – developing software – and/or managerial) that the members of the NVT developed since it was created until 2013.

For estimating the levels of technical knowledge of the NVT in 2013, the following were considered:

- If any member of the NVT obtained any degree related to software development (formal education: undergraduate or masters), the number of years of duration of the programme was added.
- If new members were added to the NVT with degrees related to software development (formal education: undergraduate or masters), the number of years of duration of the programme was added.
- If any member of the NVT developed software during the process of creation and establishment of the NTBF (technical expertise), the number of years that he/she developed software in the firm was added.

For estimating the levels of market knowledge of the NVT in 2013, the following were considered:

- If any member of the NVT obtained any degree related to business (formal education: undergraduate or masters), the number of years of duration of the programme was added.
- If there were added new members to the NVT with degrees related to business (formal education: undergraduate or masters), the number of years of duration of the programme was added.
- If any member of the NVT developed managerial roles during the process of creation and establishment of the NTBF (managerial and CEO expertise), the number of years that he/she developed this role was added.
- The age of the firm was added, as a surrogate of entrepreneurial expertise since the firm was created until 2013.

The levels of market and technical knowledge of each NVT in 2013 can be seen in Table 4.10.

**Table 4.10 Estimation of levels of TK and MK of the NVT of the eight cases in 2013**

Since legal creation until 2013		FIRM A	FIRM B	FIRM C	FIRM D
More TK	Formal education	14	0	1	1
	Technical expertise	1	0	3	4
	Formal ed. plus technical expertise	15	0	4	5
More MK	Managerial and CEO expertise	33	14	3	4
	Managerial formal education	2	0	0	0
	Entrepr. Expertise (=age of the firm)	9	7	3	4
SubTotals	TK	30	0	8	10
	MK	44	21	6	8
<b>Totals, 2013</b>	<b>TK</b>	<b>48</b>	<b>3</b>	<b>23</b>	<b>17</b>
	<b>MK</b>	<b>64</b>	<b>21</b>	<b>20</b>	<b>8</b>
Since legal creation until 2013		FIRM E	FIRM F	FIRM G	FIRM H
More TK	Formal education	0	4	0	0
	Technical expertise	0	12	4	4
	Formal ed. plus technical expertise	0	16	4	4
More MK	Managerial and CEO expertise	5	15	4	2
	Managerial formal education	0	2	0	1
	Entrepr. Expertise (=age of the firm)	5	9	4	1
SubTotals	TK	0	32	8	8
	MK	10	26	8	4
<b>Totals, 2013</b>	<b>TK</b>	<b>10</b>	<b>40</b>	<b>17</b>	<b>23</b>
	<b>MK</b>	<b>16</b>	<b>26</b>	<b>19</b>	<b>22</b>

Once the levels of TK and MK were estimated, two polar cases were identified. “FIRM B” had the lowest level of TK and the lowest level of MK, and “FIRM A” had the highest level of TK and the highest level of MK. It was also identified that none of the firms had the lowest level of TK and the highest level of MK, and none of the firms had the highest level of TK and the lowest level of MK. However, having two polar cases allow having representativeness of the NTBF of the ICT sector of Medellín.

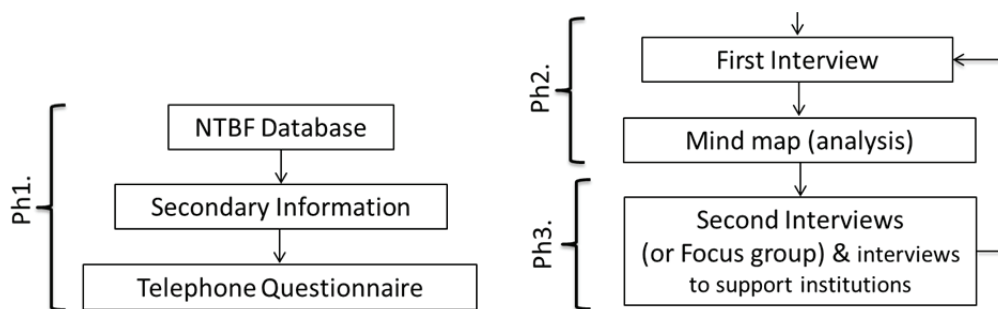
Data collection of this stage was undertaken between May and August 2013. The process of data collection was done in three phases. In the first one, primary information was collected using the telephone questionnaire and completed with secondary information from several websites. Once it was considered that the firm met the criteria to be selected, an e-mail was sent to the CEO of the firm asking whether he/she wanted to become one of the cases of the

study; if so, the date for first interview was requested. All CEOs contacted accepted the invitation to become part of the study.

The second phase was composed of the first interview which was fully recorded while the researcher took notes on mind map 1 and checked that the topics of the interview were covered by the entrepreneur. It is important to note that in some of the cases it was not necessary to ask all the questions because the entrepreneur has covered the answers while answering another question. This interview lasted around 60 minutes in many of the cases, in some cases the entrepreneur also described his own background in detail, so these interviews lasted longer. In all the firms chosen, the CEO was one of the founders and, thus, a member of the NVT, this entrepreneur was the first interviewed. The researcher listened to the interview several times to systematise the key events and key sources of resources that the entrepreneur had mentioned. This information was organised in a mind map with a timescale (mind map 2).

The third phase was the second interview with the same entrepreneur who answered the first one. During this interview the mind map was revised and the entrepreneur helped to clarify dates, key events and key sources of resources. What was provided by each new external institution was identified, including customers and the role of new members of the NVT or new employees. In some cases, the same mind map was used with another member of the NVT to rebuild his/her perspective of the creation and establishment of the new firm until the first innovative product was sold. In other cases the first stage was repeated with each member of the NVT. In two cases the mind map was revised with all the members of the NVT. To do so a focus group was formed to clarify the information and to decide whether it was necessary to collect more information. Figure 4.3 presents the phases of data collection described.

**Figure 4.3 Phases of data collection, Stage 2**



### 4.6.3 Data analysis

This stage used an interpretative phenomenological analysis. The aim of this type of analysis “is to explore the participant’s view of the world and to adopt, as far as is possible an insider’s perspective of the phenomenon under study” (Smith, 1996). As Cope (2005:170) states, an entrepreneur’s interpretations can change “at different times and in different contexts”, therefore phenomenological inquiry is a suitable practice to give explanations of a phenomenon that is a dynamic process where representations might change “in the next instant” (Lincoln and Guba, 1985:155). This type of analysis requires that the researcher engages “in a double hermeneutic because the researcher is trying to make sense of the participant trying to make sense of what is happening to them” (Smith, Flowers and Larkin, 2009:3)

This analysis was done based on the levels of interpretative phenomenological data analysis presented by Kempster and Cope (2010) in their paper about leadership learning in the entrepreneurial context. Narratives, matrices and tables are used in this analysis. Both within-case and cross-case analysis methods were used as recommended by Miles, Huberman and Saldaña (2014).

After listening to the interviews several times, preparing mind maps and rereading the transcripts and notes written by the researcher after each interview, the data analysis proceeded in four phases. First, several intra-case themes were identified, this led to a list of “master-theme list” for each case. Second, common information was identified in the eight cases that allow presenting them with similar content, each of the three broad categories or inter-case themes (the firm in 2013, building a team and innovation) was composed of preliminary codes derived from the structure of the semi-structured interviews that were informed by the researcher’s prior understanding of the phenomena and the several members of the NVT of each case in 2013. Narratives of the single cases were written in this stage of analysis, which are presented in Chapter 6. Third, three theoretical categories were identified that reflected the understanding of different aspects of overcoming the liabilities of newness in the ICT sector of Medellín (team building, knowledge management and making decisions). Each category was composed of preliminary codes informed from the literature. Fourth, a thematic coding was done considering data that sheds light on the subsidiary research questions related to knowledge management and the third main research question; codes and analysis related to the fourth stage are presented in Chapter 6 and Chapter 7.

In interpreting the outcomes of the analysis, the purpose was to create evident categories that captured the key sources of new information in the raw data, considering the research objectives. The aim of this interpretation was to organise and structure the outcomes of the analysis according to the topics that the researcher identified as important in exploring the knowledge-related processes involved in NPD&C in the eight cases.

#### **4.7 Research credibility and limitations**

The quality of the research was pursued following four criteria: trustworthiness, credibility, confirmability and data dependability. In order to do so, each stage developed different tactics for the four design tests: construct validity, internal validity, external validity and reliability (Yin, 2014).

Construct validity makes reference to the correct definition of measures for the concepts of interest. Yin (1994) proposes three tactics to increase construct validity: use of multiple sources of evidence, establishment of a chain of evidence and review of the case report by key respondents. For the first stage of data collection the researcher used multiple sources of evidence (documents, archival records, structured interviews, online public information) the data from which were triangulated by establishing a chain of evidence. Moreover, a meeting was developed with three experts on entrepreneurship in Colombia – key informants that reviewed findings at the first stage. For the second stage of data collection the researcher also used multiple sources of evidence (documents, structured interviews, open-ended interviews, focus interviews, online public information), and data collected in the first interview were validated in a second interview with the entrepreneurs; a chain of evidence was also established based on the concepts and constructs identified in the literature review (Chapter 2 and 3).

Yin (1994) states that internal validity is only relevant for explanatory studies, however, Miles, Huberman and Saldaña (2014) state that internal validity is concerned with three types of understanding that may emerge from a qualitative research: descriptive, theoretical, interpretive and evaluative. They suggest some aspects to consider that were taken into account in this PhD research, such as, thick descriptions, triangulation among methods and data sources, unified findings, and data presented linked to the categories of the emerging theory.

External validity refers to whether findings can be generalisable to other contexts (Yin, 1994, Miles, Huberman and Saldaña, 2014). One limitation of case studies is the lack of scope for generalising – findings cannot be generalised to other cases; however theories generated by comparative case studies can be generalised (Yin, 1994, Miles, Huberman and Saldaña, 2014). The researcher engaged in analytical generalisation by generalising findings to a broader theory (See Chapter 7). Theory proposed in this particular PhD research may be applicable to NTBFs created in entrepreneurial ecosystems with similar characteristics (presented in Chapter 5 and Section 6.1), however, this theory must be tested before generalising it (Yin, 1994).

Reliability refers to “whether the process of the study is consistent, reasonably stable over time and across researchers and methods” (Miles, Huberman and Saldaña, 2014:312). Findings of the first stage of data collection are difficult to replicate because they were relevant to a particular time in which the entrepreneurial ecosystems of Colombia were evolving. Although respondents can offer a version of past events, their perceptions may be influenced by new constructions that might be related to how these ecosystems have evolved and whether new factors have emerged. Regarding the second stage, a case study protocol was designed for data collection; additionally, the use of mindmaps (for validation of meanings of respondents) minimised bias associated with referring to past events. Both tools were used to approach reliability in the second stage. Regarding researcher bias in the second stage, integrated frameworks of entrepreneurial learning (Figure 3.4 and Figure 3.7) were developed before data collection and a critical literature review in theoretical frameworks in entrepreneurial learning were done after data collection, both actions allowed the researcher to proceed with reasonable care and will allow other researchers to “repeat the procedure and arrive to the same results” (Yin, 1994:37).

#### **4.7.1 Additional limitations**

This methodology was executed in two stages with two different types of informant. The first stage focuses in the country level and was allowed to infer characteristics of the entrepreneurial ecosystems of four regions. Other regions in Colombia and in other countries with different types of entrepreneurial ecosystems may have other characteristics. The second stage focuses in one region and one technology industry, which implies that the findings of the second stage are particular to this ecosystem. The second stage only used eight cases, but they included polar cases, therefore they may be considered representative of the population. Given



that “small-scale, qualitative studies in the interpretivist tradition do not allow for generalizability; their strength lies in their capacity to provide insights, rich details and thick descriptions” Leitch, McMullan and Harrison (2013:53).

#### **4.7.2 Ethical issues**

To ensure that this research was conducted ethically, the researcher sought out and obtained Level One Ethical Approval from the University of Edinburgh for the execution of this research and then utilised its Ethics Checklist to ensure that the execution of the research also complied with the University Ethics Policy.

The Colombia government funded this PhD, however, there were no conflicts of interest between the researcher and the funding institution in the execution of the study.

It was agreed with all the interviewees that all the interviews were recorded but that there would be confidentiality when managing the information. They were told that their real names would not be used in the thesis, and were also told that the names of their firms would not be used, nor the names of the institutions they worked with.

#### **4.8 Summary**

This chapter has described the research methodology of this study which aims to understand the learning process of entrepreneurs when creating and establishing NTBFs in an early-stage entrepreneurial ecosystem. The summary of the research methodology is presented in Table 4.11.

The study takes an interpretivist approach because the researcher’s stance considers that reality is socially constructed rather than objectively determined. A constructivist approach is used to build the multiple realities perceived by the informants. The analysis of the information is based initially in the literature review undertaken by the researcher in order to understand how NVTs manage knowledge and sources of knowledge in NBTFs created in an early stage entrepreneurial ecosystem. Cities selected in Stage 1 correspond to the four most important cities of Colombia. NTBFs selected in Stage 2 correspond to the NTBFs created in the most evolved regional entrepreneurial ecosystem of Colombia. All of them were younger than 10 years and belonged to the ICT sector (software development). The data analysis was

performed using codes and categories to identify themes, trends and patterns. These support inductive top-down theorising. The next three chapters will present findings of data emerging from Stage 1 (Chapter 5) and Stage 2 (Chapter 6) and discussion of the study (Chapter 7).

**Table 4.11 Summary of research methodology**

<b>Paradigm</b>	Interpretivist
<b>Approach</b>	Qualitative Subjective
<b><i>Stage 1. Inductive.</i></b>	
Research design	Cross-sectional comparative study
Data collection	Semi-structure interviews Documents Public sources of information (newspapers, company websites)
Analysis	Thematic analysis to identify categories, triangulation of information
<b><i>Stage 2. Abductive.</i></b>	
Research design	Cross-sectional comparative study
Data collection	Telephone questionnaire Semi-structured interviews Open-ended interviews Documents Public sources of information (newspapers, company websites)
Analysis	Within-case and cross-case analysis, interpretative phenomenological analysis Thematic analysis to identify categories

## Chapter 5 THE COLOMBIAN ENTREPRENEURIAL ECOSYSTEM

The previous chapter presented the various levels at which data were collected to explore how entrepreneurs acquire, use and exploit new and PK, and how they learn. This PhD research presents an in-depth analysis of how entrepreneurs manage knowledge when creating an NTBF in an entrepreneurial ecosystem. Arguing that entrepreneurship cannot be understood without understanding the context in which it occurs, the discourse of this research is a fusion of different levels (the ecosystem, the learning process, the NTBF and the NVT). This chapter illustrates the context of the national entrepreneurial ecosystem as well as the key factors which impact regional entrepreneurial ecosystems and NTBFs. Therefore, this chapter addresses the first research question:

- To what extent is the Colombian entrepreneurial ecosystem promoting NTBFs creation?

Colombia has a high rate of entrepreneurship (nascent plus new entrepreneurs) in comparison with other efficiency-driven economies; Total Early-stage entrepreneurial Activity (TEA) is 67% higher than the average TEA for necessity-driven economies and 42% higher for opportunity-driven economies (See Table 5.1). It evidences that the Colombian population is creating firms. Nevertheless, there are no NTBFs creation indicators (nor measurements), which allow comparisons of NTBF creation to be drawn with other countries or within the country. Therefore, the selection of regions to study has in consideration the largest cities of the country (the four of them represent 28.9% of the Colombian population).

This chapter is organised in three sections. The first section presents an in-depth study of the Colombian entrepreneurial ecosystem; it includes a description of the evolution of this ecosystem and of the several dimensions of the national entrepreneurial network. The second section discusses how key factors such as regional policies have generated different regional entrepreneurial ecosystems in four cities of Colombia. By doing so it shows a comparative analysis of these entrepreneurial ecosystems considering key external factors that influence NTBFs. The third section describes Medellín's entrepreneurial ecosystem; it includes local

entrepreneurial policies, organisations promoting entrepreneurship and multilayers of networks.

**Table 5.1 Comparing Colombian TEA with other economies**

	Total Early-stage entrepreneurial Activity (Nascent and New entrepreneurs)	
	Motivation:	
	Necessity-driven	Opportunity-driven
Colombia	15.9	5.4
Factor-driven economies	9.9	4.7
Efficiency-driven economies	9.5	3.8
Innovation-driven economies	5.4	1.3
Latin America and the Caribbean	12.5	4.4
TOTAL GEM	8.3	3.6

Source: GEM Colombia, 2012

## 5.1 The national entrepreneurial ecosystem and NTBFs

Findings reveal that the national system of entrepreneurship has passed through three stages<sup>18</sup>:

- The first was between 2004 and 2006, during which three important mechanisms were created: The Entrepreneurial Law<sup>19</sup>, “Fondo Emprender”<sup>20</sup> and the National Policy of Entrepreneurship<sup>21</sup>. The creation of these mechanisms is important, because all types of institutions were encouraged to promote entrepreneurship, including schools, universities, technical institutes, SMEs, large firms, local governments and institutions aimed at promoting competitiveness in the several regions of the country.
- The second stage was characterised by the creation of entrepreneurial programmes in all the regions, start-up entrepreneurship becoming a regular conversation topic. The Entrepreneurial Law and The National Policy of Entrepreneurship created a need to promote entrepreneurship in several levels of the productive and educational systems. New institutions, such as incubators, were created in order to accomplish the aims of policies. However, these institutions have emerged independently without following any specific patterns or guidelines. As a result, institutions were not coordinated within them.

<sup>18</sup>Informant in governmental institution.

<sup>19</sup>Created in 2004, to encourage an Entrepreneurial Culture in Colombia.

<sup>20</sup>Created in Law 789 2002, the aim is to finance start-ups created by people with technical or professional education level.

<sup>21</sup><https://www.mincomercio.gov.co/minindustria/publicaciones.php?id=16435>

- The third stage corresponds to the period of 2012 to 2013, when actors started to become aware of the importance of working together and to identify their strengths and challenges. All contacted institutions promoting entrepreneurship are conscious of the importance of developing efficient entrepreneurial networks to support and encourage the creation of strategic types of entrepreneurships, benefitting Colombia's economy. Colombia is focusing on promoting dynamic and high-impact entrepreneurship.

There is a national entrepreneurial ecosystem in Colombia that is a work-in-progress: *“If I had to assess the (National) Entrepreneurial System in a scale from 1 to 5, I would mark it with 2.5, it is an ecosystem under construction”* (Informant of governmental organisation). Agents identify different ways in which it can be improved. A variety of entrepreneurial networks can be identified that coexist in this ecosystem: the network composed of the investors, the network composed of the governmental institutions, the networks composed of the educational institutions and, the network composed of the institutions supporting new product development. However, the informants stated that the entrepreneurial networks are not efficient because their institutions do not have clear roles in the value chain of entrepreneurship and, therefore, it is not clear what institution provides what type of help. Therefore, if entrepreneurial networks are not efficiently supporting NTBFs but NTBFs are being created, it is interesting to try to understand what other factors are having an impact on NTBFs. These factors, emerging from the data, are presented below.

### **5.1.1 National policies**

Governments create entrepreneurial laws and policies to promote, encourage and support entrepreneurship depending on their particular purposes. This legal support has been identified as one of the key elements that boost networks and systems that help entrepreneurs to create their firms.

Colombian entrepreneurial policy states that the role of the government in promoting entrepreneurship is to encourage the public-private-academic alliance, to facilitate conditions for entrepreneurship and to develop the local dimension of entrepreneurship. The strategic aims of the entrepreneurial policy are: (1) to facilitate formal start-up creation, (2) to promote access to financial capital for potential and nascent entrepreneurs, (3) to promote institutional articulation for encouraging entrepreneurship, (4) to provide non-financial support for start-ups, and (5) to promote entrepreneurship based on science, technology and innovation.

The national government has created a legal framework for promoting entrepreneurship based in the entrepreneurial law in Colombia (Law 1014, 2006) which states that “the education system shall incorporate, in theory and in practice, the most advanced scientific and technical skills to develop entrepreneurial capacities in the students to create their own enterprise, manage new technologies in current science, and to be able to be an entrepreneur when being an employee”. The role of local governments varies, for instance: While Medellín and Bogotá’s local governments have promoted entrepreneurship for more than four years, Cali did not have local governmental support.

Key laws were also identified that have promoted, directly and indirectly, the creation and survival of new firms. Their year of creation and central focus are presented in Table 5.2.

**Table 5.2 Key national laws that have supported NTBFs**

Law, year	Central focus
Law 29, 1990	Dispositions for scientific research and technological development (S&T).
Law 344, 1996	Rationalisation of public funding (for instance, Fondo Emprender).
Law 590, 2000	Law SMEs, improvement of institutional conditions for creation and operation.
Law 1014, 2006	Development of the National Entrepreneurial Culture.
Law 1253, 2008	Regulation of productivity and competitiveness.
Law 1258, 2009	Creation of a typology of firm that offers more flexibility to create a new firm (Sociedad de Accion Simplificada, SAS).

Source: Developed by author.

The national government has enrolled in several strategies to promote entrepreneurship. They have assumed active participation and they have pursued the institutionalisation of entrepreneurship by creating laws that encourage new product creation and new venture creation. However, there are some expectations about what the government’s role should be.

Interviewees expected the national government to be a leader and not only a facilitator. Key actors identified the importance of promoting entrepreneurship strategically but at the national level there is a lot to do: “*there is a lack of dynamism, there is a lack of leadership, (...) to create stable business, business with potential to grow and with projection to internationalisation*”. (Informant of support organisation)

Some interviewees considered that the role of the government is not being assumed as it should be. The following quote demonstrates this assumption: “*It is because they do not understand the phenomenon (entrepreneurship) completely. Moreover, they want to focus in its small mission. (...) for me, that is a typical behaviour of the government and they behave depending on how they are measured*”. (University informant)

It suggests that Colombian national government is promoting entrepreneurship based on some indicators rather than as a long-term strategy, its active participation has enabled the creation of institutions and strategies to support entrepreneurship. However, the national government participation can be labelled as insufficient because of its lack of leadership.

Analysed data suggests that although the Ministry of Commerce, Industry and Tourism is the responsible institution for the Colombian entrepreneurial policy, several governmental institutions have active roles in the operationalisation of the national entrepreneurship policy. For instance: the Ministry of Education includes entrepreneurial education in the formal education system; SENA manages Fondo Emprender and Tecnoparques, and offers entrepreneurial training; the ICT Ministry promotes ICT new ventures; the Ministry of Culture promotes culture-base new firms; Colciencias promotes new S&T-based firms; and Innpulsa supports and promotes dynamic entrepreneurship<sup>22</sup> and innovation.

The National Government can play the role of a leader and/or a facilitator of entrepreneurship: *“The National Entrepreneurial System exists, but it is in charge of developing conditions to support and enhance all the ecosystem(...)”* (Informant of governmental organisation). The existence of entrepreneurial programmes at the national government level in several institutions evidences that there is an understanding of the several frameworks from within which entrepreneurship can be enhanced. This evidences the complexity of entrepreneurship within a specific country context like Colombia. However, successful entrepreneurship requires much more than a government committed to enhancing it.

### **5.1.2 Entrepreneurial networks (Support organisations)**

Entrepreneurial networks in Colombia are composed of many organisations that are not working with synergy as a system. There are over 700 organisations promoting entrepreneurship in Colombia: 832 institutions were identified by the University EAN (Escuela de Administracion de Negocios) report in 2011, while the National Department of Planning identified 730 institutions supporting entrepreneurship in 2012. *“I believe that Colombia has one of the more dense ecosystems regarding institutions, services, projects, mmm, it is not well coordinated and we are working on that coordination”*. (Informant of governmental organisation).

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<sup>22</sup> Dynamic entrepreneurship is a new firm (0–4 years) with high potential to grow and become an SME in approximately five years. This type of new firm has the potential to grow higher than the average firm of its sector.

Agents are conscious of the lack of coordination and the importance of exploiting the potential of the country, and they are working on developing efficient entrepreneurial networks:

*“(...)the country has the elements (for enhancing technology-based entrepreneurship), what is needed is to coordinate them (the institutions supporting entrepreneurship) on a value chain and it is important that all actors have clarity about their roles and their target market, and the value they (institutions) create (...) currently, we all do everything”. (Informant of governmental organisation).*

*“(...)we have a methodology for articulating the actors. It has five steps, identification, communication, collaboration, cooperation and collective action. Using these steps, we have been working in all these institutions to build trust and to work collectively with the entrepreneur’s needs and (...) well (...) we are moving”. (Informant of governmental organisation).*

Thus, even when entrepreneurial networks are considered inefficient, entrepreneurs are creating new firms and are making the best possible use of the several institutions and funds available to them. They have also stated that there is a difficulty in identifying how institutions could benefit them better; nevertheless they have had access to seed capital for developing their products and services.

Firms require financial capital to form and to operate (Cassar, 2004). *“The Colombian government has been an important dynamic actor developing national policies regarding finance” (Informant of support organisation).* The EAN study identified 170 institutions in Colombia giving financial support to entrepreneurs (EAN, 2011). Financial support varies depending on the developmental stage of the firm, for example seed capital for start-ups, venture capital for product development or private equity for medium and large firms. In Colombia, there are several national programmes which support entrepreneurship with financial capital such as Fondo Emprender, Ventures and Destapa Futuro. Governmental institutions such as Innpulsa and Colciencias also organise competitions for assigning financial capital. Some of the interviewees affirmed that there is an ongoing need for angel investors and venture capital. However, there are at least eight networks of angel investors across the country and entrepreneurs also participate in global competitions, such as Intel Global Challenge, to acquire financial resources.

New venture creation in Colombia has been supported by lots of institutions since the National Entrepreneurship Law was created, therefore entrepreneurs have a large amount of institutions



to help them and entrepreneurship might be considered an emerging sector in Colombia. NTBF creation has been supported and fomented by all the institutions that have focused their efforts in promoting dynamic entrepreneurship; this type of entrepreneurship is recognised in Latin America like the entrepreneurship that has an impact on National Economic Systems. However, Colombia is developing a layer of institutions that support High Impact Entrepreneurship because this type of entrepreneurship has positive direct effects on the national economy.

#### ***5.1.2.1 Categorisation of the institutions supporting entrepreneurship in Colombia (structural dimension)***

Regarding the structure of the National Entrepreneurial Network, four categories describe the role of the several actors that are integrated within it:

- 1). The Government is developing policies and support tools such as contests for choosing and encouraging the best initiatives. Six key actors were identified as promoting NTBF creation in this category: Colciencias (C&T National Department), SENA, Innpulsa, Ministry of Culture, Ministry of ICT, and Ministry of Commerce, Industry and Tourism. The Ministry of Commerce, Industry and Tourism is in charge of the National Network of Entrepreneurship.
- 2). Universities, the second category, are key actors because entrepreneurs and their teams gain human capital when they participate in educational programmes, both in formal and in informal education.

All universities have entrepreneurial offices in which students can have access to training programmes or to information regarding the local entrepreneurial ecosystem. Some universities have strong entrepreneurial units and offer strong support to its students, for instance EAFIT develop activities such as business plan competitions and incubation, and the Universidad Nacional (Bogota) offers psychological support when the start-up fails to enter into new markets.

- 3). Support institutions such as incubators, accelerators, and private institutions, among others. These institutions are a part of regional entrepreneurial networks, and their role in the value chain varies from focalised aims, such as providing financial capital, to transversal roles aimed at supporting all stages in the value chain.

There are some private institutions that support entrepreneurship, besides the fact that this may not be their main mission. Some of them were promoted by the national government to encourage entrepreneurship, such as: “Cajas de compensación familiar<sup>23</sup>”, but others, like Corona have developed internal processes which encourage the creation of spin-offs by intrapreneurs.

4). Finally, the industry that become an end user and associations of firms (such as the Chamber of Commerce). The Chamber of Commerce has identified entrepreneurs as potential key customers, and therefore this institution has assumed a key role in cities such as Bogota and Barranquilla. Local, regional and national SMEs and large firms are end users of NTBFs, their role as customers allows the existence of clusters and dynamic product cycles.

#### ***5.1.2.2 Types of entrepreneurship and team work in the Colombian Entrepreneurial Network (cognitive and relational dimensions)***

In Colombia, NTBF is not considered a strategic typology of new venture creation. This may be linked to the existing multiple definitions that actors use as well as the failure of several technology-based incubators. Four definitions of TBFs were identified: (1) knowledge-based firm, (2) research-based firm, (3) firm with income higher than the average income of its sector, (4) spin-offs created as a result of corporate entrepreneurship. Some of the actors (five of them) stated that opportunity-driven entrepreneurship generates NTBFs. They identified the important role of universities in this type of entrepreneurship, regardless of the definition.

The actors of the National Entrepreneurial Network are working together to define how institutions are going to focus their efforts into specific contents. They are meeting in order to clarify how they are going to promote entrepreneurship “*We have had to find general agreements like please let’s agree about the different paths to approach these four types of entrepreneurship*” (*Informant of governmental organisation*). They defined four types of entrepreneurships to encourage, and decided to categorise entrepreneurship using the GEM categorisation: Necessity-driven and opportunity-driven entrepreneurship – each of which is classified in two groups; necessity-driven entrepreneurship for subsistence and traditional, and opportunity-driven which can be dynamic and High Impact Entrepreneurship (HIE). The main difference between these two types of entrepreneurship is the level of sales: over COP

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<sup>23</sup> “Caja de compensación familiar” is a non-profit organisation that offers services of education, health and fun to employees; employers have to pay a percentage of these services.

\$6,000<sup>24</sup> million for HIE and higher than COP \$ 400<sup>25</sup> million if the business is less than three years old.

The National Entrepreneurial Network is chaired by the Ministry of Industry, Commerce and Tourism. However, this network is not efficient yet: *“with many actors, obliged and guests, but I think without coordination, without integration” (Informant of governmental organisation)*. Government institutions are developing building conditions for working together in focalised types of entrepreneurships, but building trust is a challenge because trust is based on people and government staffs change often. Although government institutions need to have a defined and strategic role in the system, as the entrepreneurial networks evolve and achieve a more mature stage, their roles will also evolve. Regardless of the stage of the networks, the main role of the National Entrepreneurial Network is to lead the entrepreneurial ecosystem by pursuing five goals: (1) to create policies and guidelines to promote entrepreneurial culture, (2) to design a strategic plan to develop entrepreneurial culture, (3) to articulate organisations promoting entrepreneurship, (4) to develop alliances that will strengthen efforts to boost business.

### **5.1.3 Talent pool**

Of all the interviewees, only one stated the entrepreneur as a key actor of the entrepreneurial ecosystem: *“First, the entrepreneur, the entrepreneur is the heart of all the process. He/she is the first actor of this ecosystem” (Informant of governmental organisation)*. Regarding formal education, universities and technical institutes educate engineers and technicians. Colombia has large and respected universities (Universidad de los Andes, Universidad Nacional, Universidad del Norte, among others) and SENA, the national institution that invests in the social and technical development of Colombian citizens with 33 regional centres spread across the country. Universities and SENA regional offices offer educational programmes considering the local industries and resources, they aim to provide qualified labour to fill industry’s needs and exploit the resources provided by Colombia’s biodiversity.

In Colombia there are three different types of undergraduate programme: technical professional, technologic and professional. These programmes vary in duration (3, 4 and 5 years respectively) and therefore in complexity. It is interesting to notice that 44.6% of the

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<sup>24</sup> £1,572,000 approx.

<sup>25</sup> £104,800 approx.

graduates have finished a professional undergraduate programme (see Table 5.3). It is also interesting to notice that more than 50% of the degrees that were given in Colombia in 2012 are related to business (32.5%) and engineering (21.4%) (see Table 5.4).

**Table 5.3 Higher education diplomas awarded in Colombia in 2012, per level of education**

Level of education (includes SENA)	2012	Part. %
Technical professional (3 yr)	21,450	6.9%
Technologic (4 yr)	81,169	26.2%
Professional (5 yr)	138,430	44.6%
Specialisation	60,048	19.4%
Masters	8,822	2.8%
PhD	310	0.1%
<b>Total</b>	<b>310,229</b>	<b>100%</b>

Source: Observatorio Laboral para la Educación (2013).

**Table 5.4 Higher education diplomas awarded in Colombia in 2012, per area**

Field	2012	Part %
Agronomy, and similar	7,688	2.5%
Arts	10,671	3.4%
Education	40,140	12.9%
Health	24,271	7.8%
Social Sciences	52,845	17.0%
Economy, business and similar	100,867	32.5%
Engineering, architecture and similar.	66,539	21.4%
Mathematics and Nature Science	4,855	1.6%
Others	2,353	0.8%
<b>Total</b>	<b>310,229</b>	<b>100%</b>

\* Including graduates of SENA 2012

Note: Total population of Colombia was estimated to be 46.295.000 in 2010

Source: Observatorio Laboral para la Educación (2013).

Some of the interviewees were aware that formal education is necessary but not sufficient for new venture creation and establishment. They pointed out the importance of soft skills, emotional intelligence and technical management capabilities. Regarding entrepreneurial teams: *“a minimum of empathy and understanding with the other ones is needed. (...) It is strongly related to the will and desire to move the project forward”* (Informant of support

organisation); “emotional intelligence is needed to work in teams” (Informant of support organisation), “(...) here (in Colombia) people have capabilities but there is no technical management” (Informant of governmental organisation), “here (in Colombia) there is talent, there are good entrepreneurs but they lack vision (...), when they create an NTBF they do not have big projections” (Informant of governmental organisation); “they need integral knowledge, it is like a capability to create bridges of information (...) but they receive only a technical education” (Informant of support organisation). “If all the actors were working together and there was strong leadership from the government, it would have a positive impact in Colombia because there are lots of people with high capabilities” (Informant of governmental organisation).

Although all universities have offices supporting entrepreneurship, these offices are not frequently related to Technology Transfer Offices (TTO) and, therefore, legal frameworks of technology transfer at the universities do not support NTBF creation processes. “(...) our contract (lecturer’s contract) with the university says that if I develop something the IP belongs to the university, and our universities are such bad commercial agencies, in fact, they do not have an interest in creating start-ups, this has implications because then all lecturers prefer to publish papers rather than develop patents...” (Informant of university).

SENA is the only institution that has a programme (Tecnoparques) with the infrastructure to support prototype design and development for free. Prototypes are one of the success factors of new product development, and there are 15 Tecnoparques in 11 regions of Colombia. Entrepreneurs state that access to Tecnoparques is easy and useful.

The Entrepreneurial Ecosystem of Medellín – aimed at creating new firms – offers entrepreneurs an infrastructure to enhance their entrepreneurial behaviour. As a consequence, some entrepreneurs from Barranquilla and Bogota have moved to Medellín to establish their firms. They have found an ecosystem where they can more easily acquire the resources they need, and develop and commercialise new products.

Medellín has two public universities (Universidad de Antioquia and Universidad Nacional) and over 30 private universities in the region. There are four important technological centres in Medellín: Metropolitan Institute of Technology, Jaime Isaza Cadavid’s Politecnico, Technologic of Antioquia and SENA – Colombia’s National Service of Learning. SENA’s mission is to invest in the social and technical training of Colombians, offering and executing formal education in productive activities that contribute to the social, economic and

technological development of the country<sup>26</sup>; SENA offers technical-professional and technical-formal education, and informal education and training for work. This governmental institution is part of the Work Ministry and has 33 campuses within the country, 15 of them are located in the Department of Antioquia whose capital is the city of Medellín (Colombia has 32 departments).

Lack of communication within the university schools and internal departments negatively affects the impact of the university-industry-government relationship in NTBFs. However, entrepreneurial offices in universities, contacted during data collection, affirmed that many NTBFs are being created, and that Colombia has human capital for creating NTBF.

#### **5.1.4 Entrepreneurial culture and entrepreneurs**

Considering the fact that entrepreneurial culture is becoming a societal norm, it was identified that regions in Colombia have different entrepreneurial cultures. For instance, while in Cali being an entrepreneur is not well recognised because it is associated more with being unemployed, in Medellín there is a general atmosphere of support to entrepreneurs and its citizens are recognised for being persistent, resourceful, and entrepreneurial. *“I believe that there is cultural aspect. There is a perception that people from Antioquia (whose capital is Medellín) have been entrepreneurs for hundreds of years, and that, somehow, this helps the theme of business creation” (Informant of support organisation).*

Culture was identified as a key aspect in NTBF creation because entrepreneurs have to face cultural challenges as individuals; they have to face their fears and the fears of the potential customers: *“Culture is a determinant in the model of technological management, determinant, and I mean at the city level, it can be a firm or a university (...) Culture is how people do everything, the natural way they do everything, and any of the initiatives we are talking about, entrepreneurship or knowledge management or entrepreneurial ecosystems, are done with people, thus people arrive there (to the initiatives) with their fears, with their expectations, that is why culture has to be considered” (Informant of support organisation), “The biggest barriers are from culture, because you are facing fears, paradigms, assumptions, and even the mood of business people or of your customer” (Informant of governmental organisation).*

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<sup>26</sup> <http://www.sena.edu.co/Paginas/Inicio.aspx>

It was also identified that entrepreneurship is a cultural process that has to be encouraged because some Colombian entrepreneurs lack vision or perceive the path to entrepreneurship as a difficult one. The following opinion illustrates these dynamics *“Finally, for me, NTBFs can be created, talent is here, there are good entrepreneurs, but there is a lack of vision. The issues of culture and mentality, we do everything very small (...) there are a huge amount of problems to solve, but when people create entrepreneurship they look at it like this, very small”* (Informant of governmental organisation), *“I think that this is a cultural process (...) we start telling how it can be achieved, with the aim that entrepreneurs that do not have a clear path, can begin to identify what is the path (...) I believe that is the best way, with models (...) we can show them that it is much easier to do it (to become entrepreneurs)”* (Informant of support organisation).

In addition, Innpulsa, the governmental institution that supports entrepreneurship and innovation, identified the need to change the public image of entrepreneurs. The report “Escalando el Emprendimiento 2012, Colombia” identified that the biggest barrier to entrepreneurship in Colombia is the mentality of the people. This report states that it is not culturally accepted that someone can become rich through honest work such as creating a successful new venture.

Colombian entrepreneurs have created and established NTBFs regardless of the mentality of the people and the early stage of the entrepreneurial networks. The existence of these firms stresses the importance of understanding how NTBFs manage knowledge. The KBV suggests that new firms execute several processes to acquire, distribute, integrate and use the knowledge required to perform. Successful entrepreneurs manage their knowledge-base and different potential sources of knowledge.

## **5.2 Regional systems of entrepreneurship and NTBFs**

Governments create entrepreneurial laws, plans and policies to promote, encourage and support entrepreneurship. Local, regional and national governments have realised the importance of supporting entrepreneurship as a strategy to improve the economy, however, it has been stated that new businesses based on science and technology are more likely to have a higher impact on the economy.

### 5.2.1 Different cities, different entrepreneurial ecosystems

Two aspects have been studied in order to characterise the cities of Colombia on which this section is focused: TEA (Total Early-Stage Entrepreneurial Activity rate) and indicator of Doing Business report (2012 and 2013). These indicators are not designed particularly for NTBFs, however, they allow a perspective from which to compare business creation in some cities of Colombia.

Three of the most important cities of Colombia have different TEA (Table 5.5), the maximum TEA is for Barranquilla, the minimum for Medellín and the closest value to Colombia's TEA is for Bogotá. It is also interesting to notice that in comparison to Colombia, Barranquilla has the highest rate of established entrepreneurs (population paying salaries for more than 42 months), Medellín has the lowest rate of entrepreneurs (population paying salaries for three to 42 months) and Bogotá is the only city where the entrepreneur rate is higher than the rate of established entrepreneurs and the city with the highest nascent entrepreneurs rate (population involved in any new business that is not paid any salary or have paid salaries only for 3 or less months).

Conditions for creating a business are similar in Medellín and Barranquilla, Bogotá is classified as a city in Colombia where it is easier to create a business (6th) although its established entrepreneurs' rate is the lowest in comparison with the other cities (World Bank, 2012). Medellín is recognised by its substantial improvement in the business regulatory environment (World Bank, 2013).

**Table 5.5 Comparative rates of entrepreneurs in five different cities and Colombia**

GEM Report data	TEA	Nasc. Entrepr.	Entrepreneurs	Stabl. Entrepr.
Bogotá	20.8%	10.0%	11.2%	8.6%
Medellín	15.7%	8.4%	7.4%	8.8%
Barranquilla	24.6%	8.1%	17.8%	17.7%
Cali	16.4%	7.2%	9.8%	12.5%
Bucaramanga	17.4%	4.4%	13.7%	12.9%
Colombia	20.62%	8.62%	12.66%	12.22%

Source: Gomez et al., 2010.



## **5.2.2 Regional entrepreneurial networks**

Although Manizales and Bucaramanga also have evolving entrepreneurial ecosystems, this stage of the research focused in the four biggest cities of the country: Bogota, Medellín, Barranquilla and Cali. The four of them represent 28.9% of the total population of the country. Although the National Policy encourages entrepreneurship throughout the whole country, regional networks are different; they have been influenced by different factors that impact NTBF creation and survival. These differences are considered below.

### ***5.2.2.1 Bogota, Capital of Colombia***

Several actors of the entrepreneurial network in Bogota also participate in the national entrepreneurial network, because all government and national institutions are based in Bogota. The Chamber of Commerce of Bogota has assumed a leadership in the city. The local government has been supporting entrepreneurship since 2006. The municipality of Bogota and the Chamber of Commerce have invested a total US\$ 8 million in promoting entrepreneurship, no other local government in the country has invested such an amount of resources.

All types of institutions are connected through the alliance University-Industry-Government (UIG), but the regional network is not efficient yet: *“It has many institutions working for entrepreneurship, but articulation is not good enough (...) the strength of this network is that the level of intervention is becoming strategically organised by type of entrepreneurship” (Informant of support organisation).*

The actors of the entrepreneurial networks in Bogota are focusing their roles and efforts on the same types defined by the National System. Regarding the content of networks, Bogota has the best indicator of High Impact Entrepreneurship: 67% of Colombia's HIE generated in Bogota (only 15% of HIE was created in Medellín). This implies that the efforts of Bogota's Networks are more aligned to this type of entrepreneurship.

### ***5.2.2.2 Medellín***

Medellín's entrepreneurial ecosystem has been supported by the local government since 2004, therefore there are many institutions promoting entrepreneurship while competing for financial resources. Medellín has strong and established institutions working toward competitiveness because the UIG relationship has been a key point in the economic and social development of the region since 1980.

Although there are some large institutions that are developing their own programmes with autonomy (Parque E, Creame, Centres of Technological Development), actors are conscious of the importance of working together and they are focusing on specific stages of the value chain, recognising their strengths and articulating their roles: *“they all (the actors) sit together and some of them redefine their target markets and/or programs in order to assume strategic roles and to identify empty spaces to fill in the value chain”* (Informant of support organisation). This is a step to building stronger links between the institutions; stronger links that may help to develop governance in the networks.

Regarding content, three levels of entrepreneurship can be identified: (1) necessity-driven entrepreneurship, which has been strongly supported by local government; (2) dynamic entrepreneurship, which has been supported by entrepreneurial units of universities, by government programme Ciudad E and by one of the “cajas de compensacion”; and (3) innovation-based entrepreneurship which has been based on transforming research findings into new firms.

#### **5.2.2.3 Barranquilla**

*“Barranquilla has an entrepreneurial network (...) it's an entrepreneurial network where the universities have a place”* (Informant of university). All large universities have entrepreneurial units which support preincubation. There are two institutions: one university and the Chamber of Commerce, supporting the whole value chain and leading the ecosystem.

This network is having an influence on its region (called the Caribbean region). *“It's showing significant results at the National level, people from other cities are visiting and looking what we are doing”* (Informant of support organisation). The potential of the Caribbean is high given the port and TLC (Free commerce agreement). The Caribbean strategy is focused in promoting innovation in the established firms; this is creating conditions for corporate entrepreneurship and future spin-offs.

#### **5.2.2.4 Cali**

Although Cali is one of the biggest cities in Colombia (2,319,648 habitants or 4.9% of the Colombian population) (DANE, 2012), there were no identified networks supporting NTBFs there.

It is important to state that entrepreneurship in Cali has not had local government support. Entrepreneurship has been promoted by: two universities, one of which has been promoting entrepreneurial programmes since 1985; the Chamber of Commerce, which has started

initiatives regarding entrepreneurship; and one of the “caja de compensacion familiar, Confecamaras”, which is assuming support of all the value chain for promoting entrepreneurship, including financial resources.

Regarding NTBF creation, Parque Soft is an incubator and a technological park of the software industry which has grown successfully in the country. Parque Soft was initially started-up in Cali; it is incubating more than 300 new firms in more than 13 cities in the country. The next section addresses the key differences of the four regional entrepreneurial ecosystems.

### 5.2.3 External factors in four regional entrepreneurial ecosystems

Regional entrepreneurial ecosystems have been contributing to the creation of NTBFs in different ways. Data presented suggests that external factors are impacting the creation of NTBFs in Colombia; for instance, in Medellín local policies are having a positive impact in the number of NTBFs that survive. Table 5.6 presents a summary of the findings related to the differences in four factors: policies, support institutions, finance and type of entrepreneurship.

**Table 5.6 Factors influencing regional entrepreneurial ecosystems (Part A)**

<b>Bogota</b>	<b>Medellín</b>	<b>Barranquilla</b>	<b>Cali</b>
<i>Policy: Government and leadership</i>			
Local government works in alliance with the Chamber of Commerce of Bogota, the leader of the entrepreneurial ecosystem.	Local government has supported entrepreneurship for 10 years; several institutions have assumed a leadership role.	One university and the Chamber of Commerce of Atlantico are leading the entrepreneurial ecosystem.	The local government is keen to have an active role in the entrepreneurial ecosystem.
<i>Support institutions</i>			
There is a strong relationship between the local and national entrepreneurial networks.	Many institutions promote new venture creation. They are working on the coordination of roles in the value chain of entrepreneurship.	Universities promote entrepreneurship and support the process in the early-stages of firm creation.	There is a network but institutions are working in their specific roles, there is isolation.
<i>Finance</i>			
Several institutions offer financial capital, but coordination of these institutions is needed.	There are several sources of financial capital but a couple of interviewees affirmed that more financial capital for HTBF creation is required.	In comparison with the other cities, there is strong support from capital angels.	Based mostly in the National Entrepreneurial Ecosystem.

**Table 5.6 Factors influencing regional entrepreneurial ecosystems (Part B)**

<b>Bogota</b>	<b>Medellín</b>	<b>Barranquilla</b>	<b>Cali</b>
<i>Type of entrepreneurship: Is NTBF creation being encouraged?</i>			
67% of the high impact entrepreneurship (HIE) created in Colombia is based in Bogota (Escalando el emprendimiento en Bogota, 2012).	Social and dynamic entrepreneurship have been strongly promoted by industry-government-academic alliances: 843 new ventures have been created in the last four years.	Focused on high impact and dynamic entrepreneurship.	Cali is in a very early stage regarding NTBF creation; only one program focusing on this specific type of entrepreneurship has been identified.

### **5.3 Medellín – Colombia (Mapping the networks: actors and roles)**

There are different layers of entrepreneurial networks in Colombia, the National and Regional, and in some regions such as Medellín, there are different layers of networks promoting entrepreneurship.

Isenberg (2010:48) identifies a legitimate entrepreneurial business environment in Medellín “with a coalition of universities, new private equity funds, large companies, such as the local power utility (EPM), private entrepreneurs, the non-profit Proantioquia Foundation, the social cooperative Comfama, and some diaspora Medellinians”. The triple-helix model (Sábato and Botana, 1968) is clearly identifiable in highly dynamic entrepreneurial activity in the city.

In Medellín, during the past two decades, there has been continuous effort to promote innovation because of the importance of competitiveness in the knowledge economy. Moreover, the local government has been supporting the promotion of an entrepreneurial culture over the past ten years.

#### **5.3.1 Local entrepreneurial policies**

Efforts to integrate industry, universities and local government have been undertaken since 1980 after an industrial crisis. However, it was only in 2004 that the local government implemented a policy to promote entrepreneurship and created “Cultura E”.

When “Cultura E” was created it had 13 components which include entrepreneurial courses for high school students, business plan contests and alliances between industry-university-

government (like Parque E<sup>27</sup>, Ciudad E<sup>28</sup> and Ruta N<sup>29</sup>). As a result, 1,843 new businesses were created from 2008 to 2011, generating more than 3,000 jobs (Parque E, 2012).

Currently, entrepreneurial policies support the programme “Cultura E”, but its main focus is on dynamic entrepreneurship and innovation, which is lead by “Ruta N”. Medellín’s entrepreneurial ecosystem has been supported by the local government since 2004, therefore, there are many institutions promoting entrepreneurship while competing for financial resources. *“What happens is that Medellín has very great features, (...) for 9 years, uninterruptedly, there have been deliberate programmes on the subject of entrepreneurship and business generation” (Informant of governmental organisation).*

Local government has a key role in the entrepreneurial ecosystem of Medellín. Its importance relies on the efforts that have been undertaken to promote a dynamic entrepreneurial environment. *“It is clearly the difference of Medellín (...) the local and regional government put money in, then there is some big money for all programs, then you may have programs for the entire community” (Informant of university).* Although the local government has supported entrepreneurship over the last 10 years, a shared leadership can be identified among universities, governmental programmes and private institutions.

### **5.3.2 Organisations promoting entrepreneurship**

Medellín has established a strong group of institutions working toward competitiveness, because of the University-Industry-Government relationship, which has been a key point in the economic and social development of the region since 1980. The University-Industry-Government Committee was created 10 years ago in the city. This Committee is a strategic alliance that generates joint agendas in Research, Development and Innovation (R&D&I) aimed at encouraging activities to improve the competitiveness and productiveness of the strategic productive sectors<sup>30</sup>. The local government is a key source of financial resources for promoting the creation of alliances between institutions and new firms.

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<sup>27</sup> <http://www.udea.edu.co/portal/page/portal/Programas/parqueEmprendimiento>

<sup>28</sup> <http://www.culturaemedellin.gov.co/sites/CulturaE/ciudade/Paginas/default.aspx> and <http://www.comfama.com/contenidos/Servicios/GerenciaSocial/Desarrollo%20Empresarial/Ciudad%20E/ciudad-e-dllo-innovacion.asp>

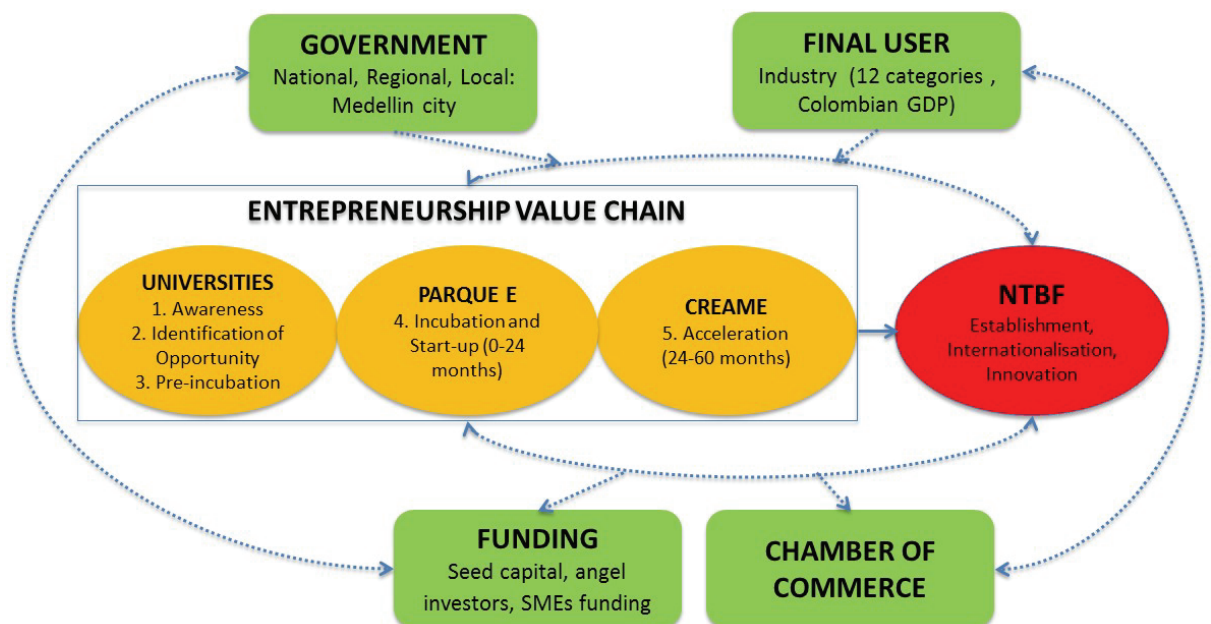
<sup>29</sup> <http://rutanmedellin.org/index.php/es>

<sup>30</sup> [http://www.universidadempresaestado.com.co/index.php?option=com\\_content&view=article&id=2&Itemid=8](http://www.universidadempresaestado.com.co/index.php?option=com_content&view=article&id=2&Itemid=8)

“Antioquia is a different case, because it has a public company of local order that generates an amount of surplus that can be invested in many things, including the ecosystem of entrepreneurship and innovation. That is why Ruta N exists, and there are other institutions that do not exist elsewhere. In the other cities (...) they are waiting to see how much national funding will be available” (Informant of governmental organisation).

The entrepreneurial ecosystem of Medellín is composed of actors belonging to the governmental, academic and industrial sectors (Figure 5.1). These actors have understood that each type of institution has their strengths and weakness for supporting entrepreneurship and this has represented a starting point for achieving effectiveness when supporting entrepreneurs. “In Medellín at least, (...) they are drawing up plans to transform existing organisations. Then they heard that Park E was going to do a thing, CREAME was going to do another thing. Universities cannot do everything; one cannot do everything with the universities.” (Informant of governmental organisation).

**Figure 5.1 Formal regional system of entrepreneurship for NTBF in Medellín**



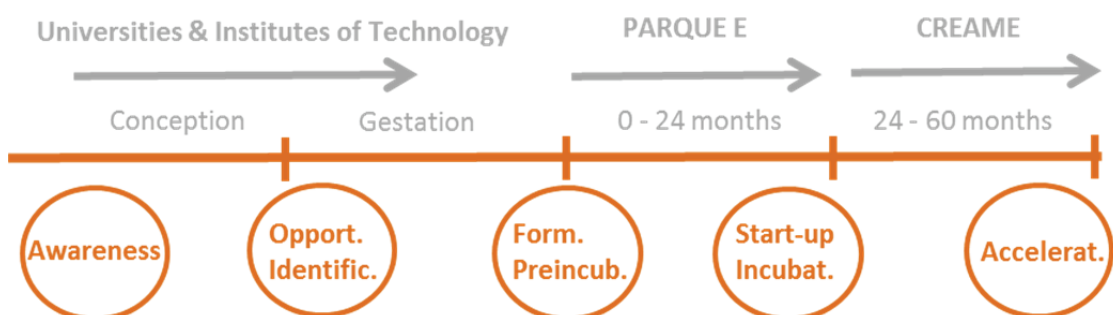
Source: Own elaboration based on consolidation of information.

The entrepreneurial network was not considered to be efficient by 2012 because all the actors were competing for the same resources; however they were aware of the importance of working together.

*“What I think is that the issue of business creation and income generation became a sector of the economy. There is money for that; everyone wants to be there. As we compete for resources, it does not allow us to have a deeper integration (...) Which is not to say we don’t know what we do, it does not mean that what don’t know what the others are engaged with and do. We integrate when it is needed and convenient to do so” (Informant of support organisation).*

Although there are some institutions that are developing their own autonomous programmes (Parque E, Creame, Tecno Parque, Ruta N), they are conscious of the importance of articulation and they decided to identify which institution would focus on at each specific stage of the value chain of entrepreneurship (Figure 5.2): *“(…) they all (the actors) sit together and some of them redefine their target markets and/or programs, in order to assume strategic roles and to identify empty spaces to fill in the value chain” (Informant of governmental organisation).* This is a step to building an efficient network based on trust; this step will help to develop governance in the entrepreneurial network. The role of the leader institution was self-defined in 2013 after several meetings and there is a clear framework with articulated institutions. This articulation is a key achievement in the effort to improve the efficiency of the formal entrepreneurial network of Medellín.

**Figure 5.2 Value chain of entrepreneurship in Medellín in 2014**



Source: Municipio de Medellín (2014)

A chronology of key laws and events related to the entrepreneurial ecosystem of Medellín is presented in Figure 5.3. It can be seen that since the law of S&T was created in 1990, efforts

were made to promote NTBFs, for instance the creation of the incubator (CREAME), a national Tech Park (TecnoParque) and a fund for new venture creation (Fondo Emprender).

**Figure 5.3 Chronology of key Colombian laws regarding entrepreneurship and creation of key agents supporting entrepreneurship in the regional entrepreneurial ecosystem of Medellín since 1990**

	1990	1996	1999	2000	2003	2006	2007	2008	2009	2012
KEY INSTITUTIONS AND PROGRAMMES	KEY LAWS	Law 29, 1990: S&T	Law 344, 1996: Rationalisation of public funding (for instance, creation of Fondo Emprender)	Law 590, 2000: Law SMEs, improvement of conditions for creation and operation		Law 1014, 2006: Development of the National Entrepreneurial Culture Entrepreneurship Law in Medellín (based on Development Plan 2004-2007)		Law 1253, 2008: Regulation of productivity and competitiveness	Law 1258, 2009: Creation of SAS typology of firms to promote formalisation of new business	
	Creation of Creame (Incubator in Medellín)		Creation of TecnoParque (Tech Park of SENA)	Creation of Parque Soft Cali-Colombia (Foundation, Tech Park for software NTBFs)	Creation of regional committee University-Industry-Government	Creation of Parque E (Tech Park, public university in alliance with local government)	Creation of Parque Soft Antioquia (Corporation, Tech Park for software NTBFs)	Creation of "Medellin, a cluster city"	Creation of Ruta N (Corporation in alliance with local government)	Creation of Ciudad E (Programme, alliance between local government and Comfama)
										Creation of Cluster ICT in Medellín

**Note:** The five most important universities in Medellín are Universidad Nacional, Universidad de Antioquia, EAFIT, Universidad de Medellín y Escuela de Ingeniería de Antioquia, all of them created before 1996.

Source: Own elaboration.

The creation of Law 1014 in 2006 to develop the national entrepreneurial culture in Colombia, and the regional Law of entrepreneurship in Medellín, generated the scenario for the creation of many agents supporting entrepreneurship throughout the country. In Medellín, these agents



were competing for the public funding that is allocated for promoting and supporting entrepreneurship until the value chain of entrepreneurship was organised in 2014.

### **5.3.3 Multilayers of networks**

Several layers of networks supporting NTBFs coexist in Medellín. Besides the entrepreneurial network of the institutions supporting entrepreneurship, the strategic clusters have their own networks in which innovation and internationalisation is supported. “Medellín, a cluster city” is a programme that was created in 2009 as an alliance of the local government with the Chamber of Commerce of the city. Moreover, this alliance is complemented with the commitment of educational and industrial sectors.

Medellín can be classified as a territorial system because of the multilayers of networks with the several types of nodes and relationships between them. “Territorial systems should be understood as networks of networks, with many types of relationships linking many types of nodes with different attributes” (Colovic, 2012:592). Medellín is a regional industrial zone which is aiming to become a technological district.

Medellín has six strategic clusters which are articulated by a development strategy in which industry, community and institutions are connected by business networks and the identification of opportunities in the market. The six clusters are: (1) Electric energy, (2) Fabrics, design and fashion, (3) Construction, (4) Health, (5) Tourism and business fairs, (6) Information Technology and Communications. The sixth cluster is a developing cluster (Waelbroeck-Rocha, 2001) which was created five years after the creation of the programme “Medellín, a cluster city”. Each cluster pursues national and international competitiveness.

Regarding the content of Colombian entrepreneurial networks, different respondents have identified four types of entrepreneurship; this categorisation considers the drivers (opportunity and necessity) and the potential to grow. These four typologies emerged from an effort to identify how to classify entrepreneurship in order to assign resources and develop institutional strategies for economic impact “*There are four types of entrepreneurship (...) there is a eh differentiation into two large groups which are undertakings by opportunity and entrepreneurship by necessity (...) if you paint on a Cartesian plane at the top there will be the dynamic entrepreneurship and they are high impact entrepreneurs. Hence we draw a line that is roughly 100 million pesos (...) we say having an initial investment in the first year of*

*more than 100 million pesos eh begins to emerge as a dynamic enterprise or high impact and on the bottom part we have some traditional enterprises such as stationary bakeries, all the types of things that manage to have a structure that generates a surplus but does not have a major differentiator and on the bottom part is the subsistence that is selling pies and juice on the street” (Informant of governmental organisation).*

Regarding the content of Medellín’s entrepreneurial networks, the programme “Cultura E”<sup>31</sup> has been promoting three types of entrepreneurship in Medellín for almost 10 years. “Social” for initiatives that do not require high levels of knowledge nor the use of technologies; this type of entrepreneurship is supported from different centres of business development (CEDEZO) located in different parts of the city. “Academic” for graduates with business ideas; this type of entrepreneurship has been supported by the programme “Ciudad E” that was created in 2009 and works with 35 universities of the region. “Research-based” entrepreneurs for business ideas that require extensive knowledge for their development are connected with the Innovation System of the city and have been mainly supported by Ruta N. *“Ruta N has been making efforts to generate that culture and support and create those additional elements that researchers need to identify opportunities (...) it is not only technology development, it is not only to develop the technology but also to have the intention to solve market needs” (Informant of support organisation).*

The existent University-Industry-Government alliance has created an invisible but effective net that supports innovation in the industry in the region. *“It has to be recognised that the leadership of the private sector with the committee University-Industry-Government, the interest of groups such as the “Grupo Empresarial Antioqueño” with the foundation “Proantioquia”(…) and the investment of “Promotora de Proyectos” that other cities do not have” (Informant of support organisation).*

The Ruta N programme, “Technological District”, considers not only a physical relocation of firms but also a technological, social, economic and logical transformation. The social aim is focused on inclusive growth, promoting the creation and development of endogenous talent. This is a programme that was included in the “Development plan” of the city in 2013. It is the result of many years working on the development of a city for the development of science, technology and new knowledge business. This technological district is strategically supported

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<sup>31</sup> This regional programme was created in the Development Plan of Medellín 2004-2008. Cultura E aims to promote the entrepreneurial culture, and the creation and establishment of new firms which respond to market needs and to dynamics of regional production chains with economic potential. This program also aims to use the innovation capability of the entrepreneurs of Medellín. Source: [www.culturaemedellin.gov.co](http://www.culturaemedellin.gov.co)

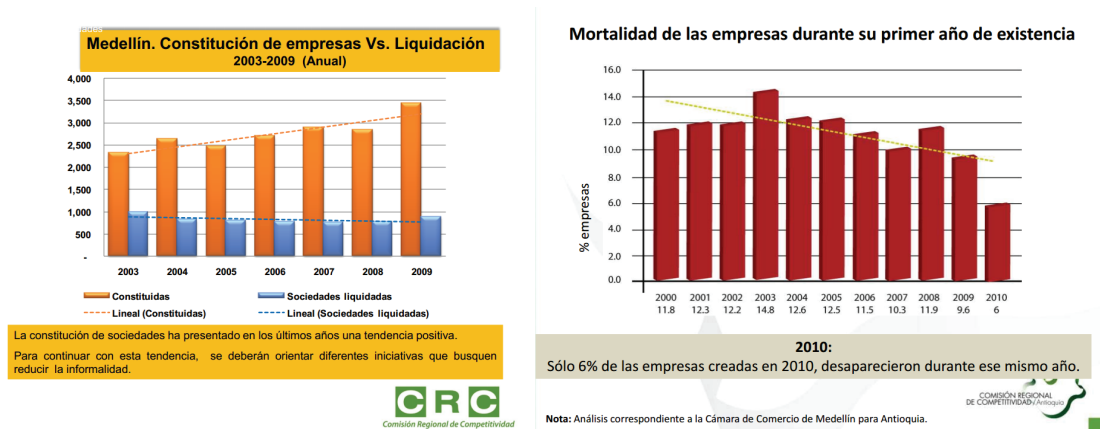
by the several clusters that co-exist in the region; each cluster has a business ecosystem composed of networks in which new firms interchange ideas, products and services.

### 5.3.4 Summary

In summary, Medellín has not only an evolving entrepreneurial ecosystem but also a system of innovation, supported by the local government, industry and universities. While the system of innovation has been supported since 1980, the system of entrepreneurship has been strongly supported since 2004. This entrepreneurial ecosystem is composed of business ecosystems in which NTBFs are being created and established.

Local government has a key role in developing innovation and entrepreneurial policies, which are executed through governmental programmes in which efforts have been addressed to six strategic clusters. Local policies since 2004 have strongly supported the creation of new firms. As a consequence there was an increasing average ratio between firms created and firms liquidated between 2003 and 2009 (See figure 5.4), a similar amount of firms have been liquidated while the amount of firms created has increased.

**Figure 5.4 Total of new firms created 2003-2009 and mortality of new firms in the first year of creation 2000-2010**



Source: Municipio de Medellín (2010, 2011).

## **5.4 Summary and conclusions**

### **5.4.1 Colombian Entrepreneurial Ecosystem and NTBFs**

Four key factors of the Colombian Entrepreneurial Ecosystem were identified, influencing: National policies, entrepreneurial networks, the talent pool and entrepreneurial culture. National policies can provide an infrastructure for entrepreneurs. National actions can promote opportunities and encourage the creation of different types of entrepreneurship. For instance, in countries like the USA where many people become entrepreneurs, the Bayh-Dole Act was a keystone for encouraging academic entrepreneurship.

There are many institutions supporting entrepreneurship and providing financial capital to entrepreneurs. Although all the interviewees stated that the National Entrepreneurial Network is not efficient yet, there is a consensus into promoting entrepreneurship based on opportunities and that can grow fast (dynamic entrepreneurship). Promoting this type of entrepreneurship is a trend in Latin America.

In Colombia, there is a talent pool of engineers and technicians that represents a potential human capital for creating and establishing NTBFs. However, there is still a need to develop further collaborative work in technical innovation management. Moreover, although all universities have programmes and an office to promote entrepreneurship, there are still challenges that go beyond entrepreneurs' hard skills, like the need for soft skills in building teams and the need to develop resilience when failure occurs.

It was identified that despite the general lack of cultural approval for entrepreneurs in Colombia and the difference of entrepreneurial culture in the several regions, entrepreneurs pursue the resources needed regardless of the resources under control. For instance, if financial capital is needed, entrepreneurs may move to cities where they have more access to financial capital. If institutions are not well disposed to support them, regardless of the formal existent or inexistent networks, entrepreneurs will search for access to the institutions and obtain the information needed.

These factors represent the institutional and individual framework of a National Entrepreneurial Ecosystem in which NTBFs are being created despite the lack of centralised leadership and in which regional entrepreneurial ecosystems have evolved independently into different paths and forms of entrepreneurship.

### **5.4.2 Regional entrepreneurial ecosystems and NTBFs**

Exploring regional entrepreneurial ecosystems is a mandatory task when studying new firms creation because once differences between regional ecosystems are identified, new venture creation can be contextualised and better understood. Particular regional entrepreneurial conditions can represent more or less access to resources for entrepreneurs. For example, NVTs creating NTBFs in cities like Medellín and Bogota have more networks available to provide information and financial resources than NVTs in Cali and Barranquilla.

Three key factors differentiate the four selected regional entrepreneurial ecosystems: policies, entrepreneurial networks and financial resources. Policies vary in each city, two of them – Bogota and Medellín – have had governmental support for more than five years, however only Bogota had an institution assuming leadership. Entrepreneurial networks are composed of many institutions that promote entrepreneurship but there is a lack of coordination; Bogota is the capital, thus any national institution is based in Bogota. This makes it difficult to differentiate its network from the National Entrepreneurial Network. Sources of finance are different in each city; all of them count with the National programmes. However, Medellín is recognised by the high amount of financial capital available from entrepreneurial governmental programs.

Although formal entrepreneurial networks were not considered efficient in Colombia in 2012 (institutions supporting entrepreneurship were not working together to cover the value chain of entrepreneurship), entrepreneurs develop their own networks (formal and informal) in order to gain the knowledge they need, and succeed. Colombian entrepreneurs, creating NTBFs in cities like Bogota and Medellín, have access to several networks. However, there is some oversaturation of entrepreneurial support programmes because there are several institutions offering similar resources, which makes it harder for entrepreneurs to engage in a more effective networking because he/she will need more time to figure out which institution can offer what they need. By contrast, entrepreneurs from cities like Barranquilla and Cali have specific institutions offering complete support for all stages of development of a new firm, but they have not had governmental support like Medellín or Bogota.

There are different layers of entrepreneurial networks in Colombia, the national and the regional, and in some regions such as Medellín there are different layers of networks promoting social and/or technological entrepreneurship. All entrepreneurial networks identified are in their early stages but they are evolving. Interviewees considered them inefficient. However, NTBFs have been created and are having an impact on Colombia's

economic system. Entrepreneurs are moving within regional, national and international entrepreneurial networks, searching the financial resources they need to pass through the valley of death.

Networks operate very differently according to the specific economic, social, political and cultural contexts of different regions (Curran and Blackburn, 1994, Morgan, 2007). It is important to identify regional networks and their stages because entrepreneurship is a contextual phenomenon. New venture creation is influenced by external factors such as culture, local governments, regional vocations and access to resources through networks. This understanding allows specific actors to assume a more relevant role in each ecosystem and allows leaders to focus efforts on exploiting strengths and addressing weakness.

The findings suggested that efficient entrepreneurial networks may not be that important in NTBF creation if the surrounding ecosystem promotes entrepreneurship. Colombian entrepreneurs develop their own networks; they search for local and international institutions that can offer what they need, and develop their teams. Additionally, the findings suggested that challenges in the creation and establishment of NTBFs in Colombia are related to cultural approval, team building and policies, and that Medellín has the most active and evolved ecosystem of entrepreneurship in Colombia because of the level of awareness and commitment of the several actors to working collaboratively and supporting entrepreneurs in a more efficient way. The next chapter will present eight cases of NTBFs in Medellín in order to understand how NVTs manage knowledge in NTBFs in Medellín's entrepreneurial ecosystems.

## Chapter 6 EIGHT NTBFs IN MEDELLÍN: SINGLE CASE ANALYSIS

This study aims to explore entrepreneurial learning from a KBV perspective when creating and establishing NTBFs in an entrepreneurial ecosystem. Although concerns have been expressed about the multidimensional framework that surrounds entrepreneurial learning, previous work has not specifically addressed how different prior stocks of general and specific knowledge determine the action processes that NVTs follow when commercialising new technologies in new firms. This chapter addresses the second research question:

*How do NVTs manage knowledge when ceating NTBFs in the regional entrepreneurial ecosystem of Medellín?*

This chapter is composed of two sections. The first section is a description of the particular characteristics of eight NTBFs in Medellín. The second section provides the narratives for each case. Narratives include the different activities that entrepreneurs perform when creating a new firm and pursuing new product commercialisation. These narratives are written with the entrepreneurs' words, and allow the identification and description of how similar and different these cases are. At the end of the chapter, an explanatory framework is presented, compiling the elements of the entrepreneurial process and the role of NVTs' prior knowledge in NTBFs in the ICT cluster of Medellín.

### 6.1 The eight cases

As a result of the first stage of data collection, the researcher built a database of 81 NTBFs in the ICT sector. The database includes firms that have been created in the past 10 years in Medellín, Colombia. This database includes firms that were created in research groups, incubators, educational entrepreneurial programmes, corporations, and new firms

recommended by several actors in the entrepreneurial ecosystem. Based on secondary information and information gathered with a telephone questionnaire, eight NTBFs were chosen. A description of different characteristics of the firms is presented below.

### **6.1.1 Industry**

All selected firms offer software which made them part of the ICT industry / software industry. The value chain of this industry includes the design, development, testing and commercialisation of their software. However, in comparison with other technologies, this type of technology does not require assuming a significant extra cost of infrastructure to develop prototypes and deliver the technology and has a short lead time (Oakey and Cooper, 1991). Moreover, this industry is knowledge intensive and has grown fast.

All of the selected firms develop software (bespoke and package software) for several sectors (Table 6.1). In some cases the service can be used by the customer or offered to an SME or large firm for business process outsourcing (BPO). For instance, in the entertainment sector the user can buy the software in order to play it, but in some cases it can be bought for a firm to make marketing campaigns with games. In other cases the software is used to monitor and improve industrial processes, for instance agricultural production or to analyse customers' data. *“A computer systems services company may produce software products, but more so, it is providing an advice and customisation service to its customers” (Informant of support organisation).*

### **6.1.2 Opportunity driver**

This characteristic is related to opportunity identification at the time of the entrepreneurial event. A technology-based firm can be the result of two different types of opportunities: Market pull<sup>32</sup> or Technological Push<sup>33</sup>. In order to draw generalisations on NTBF creation, each type of opportunity is considered a polar condition for the cases to study.

The following table (Table 6.1) presents background data on the firms including the number of founders, age, size, sectors and opportunity driver.

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<sup>32</sup> Market pull is when an opportunity emerges because there is a need in the market.

<sup>33</sup> Technological push is when an opportunity emerges because there is a technology that might be commercialised.



**Table 6.1 General background information on the eight firms (data collected in 2013)**

Case	NVT	Firm Age (years)	Employee Size	Opp Driver	Sectors
A	4 (2)*	9	180	Market push	Energy, Agriculture, Food, Health, Banking, Education, Manufacturing, Government, IT
B	2	7	8	Technology pull	Energy, Agriculture, Food, Health, Education
C	2	3	5	Market push	Education, Manufacturing, Food
D	2	4	7	Market push	Government, IT, Food, Construction, Entertainment, Mining
E	1	5	2	Market push	Health, Education
F	3	9	22	Technology pull	Agriculture, Banking, Food, Chemical, Manufacturing
G	2	4	45	Technology pull	Education
H	6	1.5	4	Technology pull	Education, Entertainment, Manufacturing, Entrepreneurship

\* It had two members at the legal creation but four in 2013.

### 6.1.3 Established firms which have sold at least one innovative product

Firms selected have already sold products and have already designed at least one innovative product. Many new firms have been created in Medellín, however, only some have managed to sell their products and stay in the market. All the firms selected have sold their products and have developed strategies that allow them to pass through the valley of death; they have developed business models that allow them to generate profits with their sales. The first innovative product was identified by each company as the first one that has unique characteristics in comparison with similar products in the market.

Following Park and Bae (2004), the eight firms have similar strategic types (see table 6.2). Selected firms have a new service to offer, they all are pioneer because they have developed at least an innovative enough service that gives them differentiation and therefore potential to compete in markets. Although technological capability has been identified as one of the most important factors in the performance of new ventures, market-related dimensions have implications for the strategy that firm uses that enable it to be sustainable, to grow and to learn.

**Table 6.2 Strategic type (data collected in 2013)**

CASE	Technological capability		Product market maturity		Target market		Strategic type
	Follower	Pioneer	Existing	Emerging	Local	Global	
A		Y	Y			Y	Global niche
B		Y		Y	Y		Creative imitation
C		Y		Y	Y		Creative imitation
D		Y		Y	Y		Creative imitation
E		Y		Y		Y	Global innovation
F		Y	Y			Y	Global niche
G		Y	Y			Y	Global niche
H		Y		Y	Y		Creative imitation

Four firms had global target markets in 2013. Three of them are global pioneers in the global existing market (global niche strategy) and Case 7 is a global pioneer in the global emerging market (global innovator strategy). Two of them (Case 1 and 7) focus in one or two sectors and thus can exploit technological differentiation; the other two cases (2 and 5) have customers in more than four sectors which implies that they have unique technological capabilities plus the versatility to satisfy different types of customers.

The four firms that operate in local markets are in an emerging development stage of the product market. In 2013, these firms presented a creative imitation strategy: they are in emerging industries and their competition boundary was the global market. These firms have diversified their target market in more than one sector which reflects the high market uncertainty that they face. However, this also reflects the level of the firm's proactivity and versatility, and the characteristic of participating simultaneously in different business ecosystems.

#### **6.1.4 Location**

Findings of the first stage of data collection allowed the researcher to identify that Medellín has the most evolved entrepreneurial network in Colombia (see Chapter 5). Medellín is an evolving and dynamic regional industrial zone (see Section 5.3.3).

Entrepreneurs have been strongly supported by local governmental programmes in Medellín; Medellín has more than 12 programmes supporting entrepreneurs. Entrepreneurs can apply to

these programmes to obtain financial resources, infrastructure support and mentoring. Selected cases have the same opportunity to access the resources that Medellín, Colombia and the world offer them to create and establish the new firm.

Although, at the initial stage of data collection, some of the entrepreneurs stated that the entrepreneurial ecosystem was not offering support because of the lack of articulation from the institutions, some firms have acquired resources such as new knowledge from the institutions supporting entrepreneurship in Medellín and in Colombia. Moreover, several of them have acquired new knowledge and funding from institutions in the innovation system of the city and the wider country. Each case will be presented in the next section.

## 6.2 Narratives

All cases were selected considering the criteria described in section 4.6.2. Technical knowledge (TK) and market knowledge (MK) are formative indices (Davidsson, 2005) and were estimated considering secondary information such as websites and NVT CVs, and primary information such as interviews, emails and telephone questionnaires.

The narratives of all cases present a case description and analysis using the words of the entrepreneurs. These narratives consider three dimensions: a summary of the firm in 2013, organisation of the founding team, and idea development and commercialisation. These dimensions allow the researcher to identify some of the key aspects of the several forms of knowledge integration that new venture teams (NVT) use when managing human and social capital. A list of the themes covered in each narrative of each case can be seen in Table 6.3.

**Table 6.3 Themes covered in narratives**

Inter-case themes	Themes covered in narratives
Running a newly established firm: The firm in 2013	Introduction of the case
Organisation of the founding team: The Team	For each entrepreneur – NVT (PK: Formal education, technical expertise, managerial expertise, entrepreneurial expertise, soft skills)
	How did they meet? Did they work together before? In what roles? How/why they decided to become part of this NVT? New members
	NVT (complementary, related, specific and different knowledge, MK, TK, ManK, EK, K gaps)
Idea development and commercialisation	New knowledge, key events, tacit-explicit, key customers, new sectors, sources.
	First innovative product/service: development and commercialisation

### **6.2.1.1“FIRM A”**

#### THE FIRM IN 2013 (Running a newly established firm):

“FIRM A” was created in May 2005. “FIRM A” is an organisation that offers software engineering services in order to improve the competitiveness of its customers with innovative solutions which can integrate three elements: technique solid capacity, software tools and knowledge. During the first three years “FIRM A” was offering bespoke and packaged software but they decided to focus on bespoke software because their performance was better in this area.

“FIRM A” has held a CMMI 1.2 certification since 2009 and they are preparing for a CMMI 1.3. CMMI is a certification to test processes and capacity for continuous improvement. “FIRM A” holds two Microsoft certifications: Silver Partner in Web Development Competence and in Software Development Competence. In 2013, “FIRM A” had 174 employees, 135 were software developers and 40 of them had certifications with a total of 57 certifications. In 2013, 77% of the employees of “FIRM A” were software developers and 30% of them had at least one certification. It can be stated that this firm had high technical knowledge represented in its employees and its certifications.

“FIRM A” holds partnerships with Google, Microsoft, Oracle, IBM, mercurio and Intersoftware. In 2011, they created a spin-off “Dataalytics Colombia” which offers support in data mining and business intelligence. “FIRM A” has had more than 30 customers in SMEs and large firms in more than three sectors in Colombia. “FIRM A” sold its first service in its first year. More than 1,000 projects have been executed since it was created.

“FIRM A” has an opportunity to supply a growing need of automation in several markets. It cannot be said that there was a specific moment when “FIRM A” started to grow; it has been a continuous process. Each year the growth rate has been around 40%. *“It is a constant theme and we are permanently hiring people”*. As the CEO states *“this is a great responsibility, is a great responsibility, when I think about the size, I think, oh God there are 175 families depending on it. This is a huge responsibility.”*

#### THE TEAM (Organisation of the founding team):

“FIRM A” was initially created by two people: JW and JJ. Their backgrounds before starting-up “FIRM A” are presented below; then, how they decided to work together and how and when they decided to let new members into the shareholders team is presented too.

JW is a Technologist in Systems from el Politecnico Colombiano Jaime Isaza Cadavid. He also had a professional career in Business Management. He worked as a systems analyst for three years at the Universidad Pontificia Bolivariana (UPB). Then, he started working at Suramericana<sup>34</sup> where he has taken different roles in different areas for 12 years: he started as a software developer, became a project leader, technology director and CEO of a corporate spin-off. He had technical knowledge but he considers himself not a good software developer.

From 1998 to 2002, JW was the first CEO of Enlace Operativo, a spin-off that was created from Suramericana, a company that develops integration processes of the social security companies of Grupo de Inversiones Suramericana. He was the CEO of this company for three years and three months and he was part of the New Venture Team. He left Suramericana in 2002 and became the CEO of Avansoft S.A. for 3 years. When he was the CEO of Avansoft S.A., the company grew 300% and achieved ISO 9000 certification; this firm was liquidated in 2010. After three years, he decided to exit the previous company and start-up “FIRM A”. He was part of the NVT in three firms and he decided to create his own firm in which he initially held 100% of the shares. JW has managerial capabilities; they were developed based on his formal education as a business manager and his expertise as a manager. He also has entrepreneurial knowledge. JW is the CEO of “FIRM A”, the man that had the business idea. He has more than 50% of the shares and he makes the decisions with his team.

JJ is a Software Architect. A technologist, he studied chemical engineering but decided not to finish it because he did not picture himself working in a laboratory. He worked as an analyst programmer at UPB for six years and that was the place where he met JW. After working in UPB, they developed packed information systems for one year in another organisation which does not exist anymore.

He worked for 12 years in Alcuadrado<sup>35</sup> where he had the opportunity to take on many different types of roles, from developer to I+D Director. While JJ worked at Alcuadrado, he was trained in several programs in different countries in Latin America where he had to teach

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<sup>34</sup> Suramericana is a subsidiary of Grupo de Inversiones Suramericana that handles investments in the insurance and social security sectors. Suramericana’s purpose is to fully satisfy the community needs with regard to security and savings, with products such as life and general insurance, occupational risk coverage and healthcare. Suramericana is a large firm in Colombia that was created in 1944, currently has branches in 9 countries of Latin America. From [www.gruposuramericana.com](http://www.gruposuramericana.com) and Informe Annual 2013, Grupo Suramericana.

<sup>35</sup> Alcuadrado is a firm specialising in developing general back office solutions. Its mission is to create innovative solutions with the agile application of knowledge and expertise. While JJ was working here, this institution won several awards such the best solution provider in Colombia in 1997.

to other people. At one point of his life, he taught several informal and formal courses in a university and informal educational centres.

Once “FIRM A” was created, JJ had achieved several certifications with Microsoft. He was accredited as a software developer by Microsoft, then a Microsoft Certified Technology Specialist (MCTS). JJ was “the top technical guy” in the firm, he was a recognised software developer and specialist in the field. Currently, JJ is SCRUM coach, CSD (Certified SCRUM Developer), CSM (Certified SCRUM Master). When JJ describes himself he thinks he is neither a social person nor a business person but he enjoys learning and teaching. He likes learning new things, he dislikes being project manager but he likes leading teams.

JW started “FIRM A” with his own money; he rented an office, hired a manager and bought desks, computers and chairs. When JW decided to create “FIRM A” he was conscious of the importance of having a technical partner who complements his business profile. He had met JJ in his first job and he knew that JJ had become a recognised software developer with many certifications from Microsoft.

JW presented JJ the business idea and showed him the new office. JW offered JJ a percentage of the shares of the company. JJ remembered that JW told him that he had an idea, an office and an infrastructure. JJ had to consider leaving a stable job with a good salary, assuming the risk of spending his savings and the risk of becoming unemployed if the idea did not work out. JJ assumed this change as a challenge, and he recognised that there was a possibility of improving his current quality of life too. JJ identified many things to put into the balance to decide whether it was worth assuming the risk. He liked the idea of becoming a partner in a company.

*“It was a bet based on how much I knew JW. I trusted him and his trajectory, and my own trajectory and the customers we know before. Yes, there were other factors involved that it may not be necessary to list like for instance it would be good to have change, there was some mess in the firm I was working for, yes, there were small things, a number of small things that you can collect together and make a checklist and give them weights. Some may have a higher percentage but others will have a low one, all of these will be summed and make me say hey JW, ok let’s start up that firm”.*

JJ was aware that he would have a lower salary and he would be less wealthy than before because he would spend his savings on buying shares. JJ felt the challenge was an adventure, an enjoyable adventure in which he felt at ease. He felt the comfort of knowing many people, customers that would welcome him. He felt confidence in his level of knowledge and his

expertise. He trusted JW and his abilities. He had a strong perception that they (JJ&JW) could make a success of the company; there was a sense that it was a good business idea.

JW and JJ worked together when both software developers. As JJ pointed out, both of them had a network that gave them the confidence to start the business. They both recognised the importance of the people they had met before *“it was about what contacts we have, who we meet and where we can enter”*. Previous contacts were key to opening doors to new customers. Since JJ had worked on many projects with Microsoft, they could offer new projects and the technical expertise that gave reassurance that they could do it. It was a good combination of managerial and technical expertise which was already acknowledged in the market. Once JW was presenting the business idea, potential customers asked who he was working with and it gave them confidence that the project could be carried out. JW said *“when I visited some of my contacts they asked me who I was working with and once I answered with JJ they were more willing to work with us”*.

During the first year (2005), JJ and JW identified SC’s technical and soft skills. SC is an Informatics Engineer from Politecnico Colombiano Jaime Isaza Cadavid with a specialisation in software development of EAFIT and a MBA specialising in Project Management. SC worked as a software developer for five years before working in “FIRM A”, he was working with a customer of “FIRM A” when JW invited him to become part of “FIRM A”.

A year later (February 2006) JW invited AF to become part of “FIRM A” as an employee. AF was working as a software developer with a customer of “FIRM A” when JW offered him the chance to work at “FIRM A”. AF is a Systems and Informatics Engineer from Universidad Nacional with a specialisation in software development of EAFIT (2005–2006). AF was a software developer for almost three years before working at “FIRM A”. In “FIRM A”, AF has worked as a software developer and project manager in a wide variety of business applications.

Similar to SC, once AF left his previous job, “FIRM A” was contracted by AF’s previous employer as a provider; SC and AF brought contacts for “FIRM A”. Moreover, JW offered SC and AF the opportunity to become shareholders in “FIRM A” after observing their performance as software developers and project managers, JW pointed out that their “enthusiasm and integrity” were outstanding and this is why he decided to offer them some shares in “FIRM A”.

JJ started “FIRM A” with eight employees: a manager (D) and seven people with technical roles. Four of them are shareholders. Legal and accountancy activities have been outsourced

since the creation. JJ also pointed out the role of D, she had a managerial role since “FIRM A” was created: “Let’s say that part of administrative and marketing was me, and the rest, well I and Diana in the administrative tasks, (...) we were in the administrative tasks Diana and I, and I did the marketing tasks, and the rest are all technical.” There was a high level of technical knowledge in the firm, people with expertise and reputation. Moreover, “FIRM A” also had a good network. As JJ states: “If you have trajectory to go and introduce yourself and offer services, it is very simple, many times firms are started-up not because of a good idea but because there have good contacts, this is a variable to consider”.

The following table (6.4) presents a summary of the human capital of the NVT when they started “FIRM A”, it can be seen that they had related technical knowledge bases, since all of them have developed software at least for two years. Both of them had managerial expertise and only one of them had entrepreneurial expertise.

**Table 6.4 Summary of HC of the NVT when "FIRM A" was created in 2005**

NAME	JW	JJ
CODE	F1	F2
Gender	M	M
Age	50s	40s
<b>Current Position</b>	CEO	SoftwArch
<b>Formal Education</b>		
High school	Y	Y
Undergraduate	1Tech, 1Prof	1Tech
Postgraduate	N	N
Research group	N	N
<b>Previous Expertise (years)</b>		
Technical Expertise different to software development	0	0
Technical Expertise in software development	8	10
Managerial Expertise: Project director or department director	4	7
CEO Expertise	6.5	0
Entrepreneurial Expertise	6.5	0
Number of firms created	2	0

“FIRM A”’s NVT was initially composed by JW and JJ. Current TMT is composed of four men (the four shareholders) plus two more directors (Marketing and Sales, and Infrastructure). Their current roles of the shareholders are: JW is the CEO, JJ is the Software Architect, SC is the Production Director and AF is the Technical Director.



## PRODUCTS-SERVICES (Idea development and commercialisation)

JW and JJ started presenting the firm to their previous contacts, they did have a plan but nothing concrete, it evidences that there was some flexibility regarding how they were going to operate and survive. JW brought the first customer (C1); it was an open product because this firm did not have any information systems. While this product was developed another business was opened (C2), by the end of the first year there were four customers and four shareholders.

The firm was entering into new markets; and this generated the need for structure and support areas. At the beginning there was no Director of Production, Marketing or Infrastructure, thus they started in a very simple way to attend a customer who gave them more projects. Their reputation helped them to enter into new markets. *“We contacted our previous network, or from the references that our customers gave, when they were asked about who was providing them with services, and we reached new customers, thus it was like a snowball effect. Because this is like a snowball effect positive or negative, you fail with a customer and this customer spreads the message about your mistake. Or you do a good job for a customer and this customer spreads the word about your success”.*

This is an organisation with a horizontal structure in which all the IP rights belong to the customer. Only five of the employees do not have any interaction with the customer, and to improve the service any member of the project can have direct interaction with the customer; it is related to the need to perform on time.

Regarding size, the firm's growth was a response to the need to gain internal strength, *“once we identified a need to support any process, then we got the support”.* However, from around 2011 there was a need to develop a horizontal hierarchy. Thus although there are five directors who have a high level of responsibility, there is not a figure of a director who employees have to obey; teamwork is highly promoted. *“We are searching more to build teams of people who are committed to a goal and the team pursue the goal. Therefore, let's say that directors began to play the role of removing barriers (...) every team develops communication skills and team abilities that allow the team to deliver on customer needs”.* They started using SCRUM because they realise that *“what they were taught at university was not what really worked in reality”.*

SCRUM is a methodology for managing product development that was created based on a paper by Takeuchi and Nonaka (Takeuchi, H. and Nonaka, I., 1986). “FIRM A” worked for

six years with the traditional model of software creation and understood that the team needed to adopt a more flexible strategy to develop its products in which team members (customers and employees) worked together to reach a common goal. This methodology is structured around daily communication with a clear path to follow, tasks to do with responsible and open communication.

It can be seen that this methodology requires members not only with technical skills but also with soft skills. It also requires the promotion of a different type of communication with the customer: *“we have been using this model for two years and we are working hard in moving our customers to this philosophy”*. The main outcome of this methodology is that it allows problem solving very quickly because mistakes are fixed soon.

One of the learned practices of the first few months of “FIRM A” was to assign an engineer to each customer, at the beginning each engineer had to accomplish customers’ needs. Engineers were assigned depending on how good they were. Expertise was also a key element when assigning engineers, for instance, engineers working with JAVA were assigned to customers whose platforms were based on JAVA.

The decision of a team to make changes and adapt to new strategies can be triggered by a number of factors, which in the case of “FIRM A” are related to losing customers, improving effectiveness and pursuing new opportunities with current customers. As one member of the NVT states, *“What we learn from university does not work”*, it is about teams that work together for a goal in which communication is clear, assertive and timely.

Teams are composed of employees, a manager and the customer. Any of the software developers that belong to a team can assume leadership when developing the product; however there is one person in charge of making decisions when deadlines might not be met.

This firm has identified strategies to promote good teamwork by: (1) empowering their employees to assume leadership roles in their teams, (2) encouraging frequent communication with the customer daily, (3) assigning a project manager (a SCRUM Master) who satisfies any administrative requirements. This is why “FIRM A” contracts software developers with high social skills *“They need to be punctual, responsible, with negotiation skills and communication skills”*.

A summary of the timescale of “FIRM A” is presented in the table below (Table 6.5).

**Table 6.5 Timescale of "FIRM A" since the entrepreneurial event in 2003 until 2013**

	2000–2003	2004–2007	2008–2011	2011–2013
Entrepreneurial event	2003			
Business Plan				
Legal creation		May 2004		
New Shareholders		2005 (S3E3, S4E4)		
First innovative product commercialisation		2005		
First sales of the first product		2004		
- Change of roles		2005		
- Establishment of TMT		2005		
Incubation				
Key decisions:				
- Funding		Law 344.		
- Awards or certifications		CMMI1	2009CMMI2	
- Memberships or alliances			2009Intersof.ClusterTIC	
- Spin-off(s)			2011Dataanalytics	

### 6.2.1.2 "FIRM B"

#### THE FIRM (Running a newly established firm):

"FIRM B" was created in 2006 while it was being incubated in CREAME (one of the two technological incubators of Colombia). "FIRM B" is a firm that offers a specialised application to integrate software and hardware which monitors industrial and commercial processes. They have offered bespoke and package software, however they have designed package software as a form of service that has been sold to several customers.

"FIRM B" holds a patent to commercialise its service, and trademarks for protecting the name of firm and of the four applications that have been developed to commercialise its service. This IP protection allows them to stay as the unique owners of the several components of its service.

"FIRM B" does not have any partnership. They have international suppliers but not international customers. Their markets are National because they offer their technology and its support to SMEs and large firms in Colombia. They have sold their products mainly in three different industries (Health, Food and BPO).

They have maintained cash flow by winning contests and calls offered by several institutions supporting entrepreneurship and innovation in the city and the wider country. These awards have given them financial capital to develop new products and improve their products.

“FIRM B” was incubated for one year, and they stated that they learned many things but *“no university teaches you how to be an entrepreneur, you can be a business manager but being an entrepreneur is more complex because you have to live many situations (...) you have to prove that you can make it.”*

#### THE NEW VENTURE TEAM (Organisation of the founding team):

OM and GM only worked for half a year in different companies before their graduation. They finished their undergraduate studies at the Universidad Nacional, and as a requisite for graduation they had to write a thesis or undertake an internship. Their only experience in any job was from this half-year internship. They are engineers; OM is an industrial engineer and GM an electronic engineer.

OM and GM met on a course at university. They had to present a business plan as an essay in a course called “Projects Assessment”. Although the business plan was written in 2003, they presented it to a local competition a year later. They won and this award allowed them to become incubated in CREAME.

OM’s interest in becoming an entrepreneur was stimulated by a book “Rich Dad, Poor Dad” because this book made him think that he could make money by creating his own business, by creating activities that allowed him to be financially independent. GM states that his interest in becoming an entrepreneur was stimulated when he did the internship and he realised that his career was not to be an employee. Both wanted to become entrepreneurs because they wanted to work for themselves rather than for others, they realised it after half a year of interning *“that what we did, that was not the way”*.

One year later, they identified an opportunity to participate at a local business plan contest organised by “Parque E”, called “Planes de negocio”. They thought that since they already had a business plan, they would participate in this contest with that plan, because they wanted to create that firm, and they won.

They have invited two more shareholders who do not work at “FIRM B”; both have enrolled in marketing and selling. As a marketing strategy and in the collaboration of Coomeva, they offered technical presentations with breakfast to potential customers. Through this event, they met the third shareholder, who helped them reach their first big customer. This shareholder is not an employee but he supports sales through his network and by his networking and sales skills.

The first shareholder was selected because of his wide network of potential customers for “FIRM B”. The second was selected because of his contacts in China, where the firm have acquired new suppliers and expected to have new customers. They are expecting this shareholder to help in marketing: *“if it is not with customers, with potential customers, and since he was in China, he was also able to help us assess the suppliers, the suppliers that we have in China, thus we made this person an offer and he accepted the offer and then the fourth member of the company was in, we are now working and he has brought an important strength to the company – he has helped with the marketing strategy regarding national and international customers thus we are working on getting information about what type of distributor we need: master, normal or freelance.”*

The following table (6.6) presents a summary of the human capital of the NVT (OM and GM) when they started “FIRM B”, it can be seen that they did not have a related technical knowledge base, none of them were software developers before. Both of them are engineers who worked less than one year before creating “FIRM B”. None of them is an IT engineer, thus their knowledge base was mainly explicit, specific and complementary. Moreover, none of them had managerial expertise and none of them had CEO or entrepreneurial expertise.

**Table 6.6 Summary of HC of the NVT when "FIRM B" was created in 2006**

NAME	OM	GM
CODE	F1	F2
Gender	M	M
Age	30s	30s
<b>Current Position</b>	CEO	InnDir
<b>Formal Education</b>		
High school	Y	Y
Undergraduate	1Prof	1Prof
Postgraduate	N	N
Research group	N	N
<b>Previous Expertise (years)</b>		
Technical Expertise different to software development	0.5	0.5
Technical Expertise in software development	0	0
Managerial Expertise: Project director or department director	0	0
CEO Expertise	0	0
Entrepreneurial Expertise	0	0
Number of firms created	0	0

OM manages the customers and the marketing strategy of the company for entering into new markets. GM manages the entrepreneurial network and the innovation strategy of the company. They have differentiated roles in the company but they make decisions as a team, OM is mainly focused in the industry relationships and GM in the performance of the organisation. New shareholders are not employees of the company thus they are not enrolled in the operational activities of the firm, on the top of their financial capital; they bring new customers and new suppliers.

### PRODUCTS-SERVICES (idea development and commercialisation)

Initially the product was composed of software and hardware. However, once they got the licence over the software and the IP of the service (a patent with commercial exploitation rights plus the protection of all the brands of the four services by trademark), they imported the hardware from China and decided to focus only on offering the software and offering support for installation and ongoing operations.

Product development has been supported by freelance software developers. They develop some pieces of the code and all the parts are assembled in a “FIRM B” platform which is mainly mastered by one employee and one founder (GM). They have developed an updated platform whose intellectual property rights belong exclusively to “FIRM B”.

The first prototype of the first product was developed with the financial support of SENA and the infrastructure of CREAME. While they were being incubated they applied to funding using “Law 344” which funds projects to create new firms and they developed their first product.

The incubator also helped them to reach out to the first potential customer, however, this initial approach was not successful. But since the initial target market – the flowers industry – was not responding to their efforts, they decided to offer the product to different sectors: health and food. Doing so, they contracted a distributor which already had a database of potential customers.

They also identified key customers, such as large firms which were interested in monitoring their production processes. They successfully reached some of them. One of the biggest customers was acceded because a new shareholder introduced the product to the CEO of the potential customer. Even though it was a public organisation, this linkage between the new shareholder and the CEO of the customer was key to accessing this customer.

Although the first product has had three different versions, the latest one compiles their learning lessons from the previous one and their differentiation style. Previous customers are being encouraged to merge from the preliminary platform to the new one, which is completely operated from employees inside “FIRM B”. This technology has been offered to three different sectors and represents a unique product in monitoring industrial processes.

A summary of the timescale of “FIRM B” is presented in the table below (Table 6.7).

**Table 6.7 Timescale of "FIRM B" since the entrepreneurial event in 2000 until 2013**

	2000-2003	2004-2007	2008-2011	2012- 2013
Entrepreneurial event	2003			
Business Plan	2003			
Legal creation		2006		
New Shareholders			2009 (S3)	2012 (S4)
First innovative product commercialisation		2007		
First sales of the first product		2006		
- Change of roles - Establishment of TMT				
Incubation (CREAME)		2004–2010		
Key decisions: - Funding - Awards or certifications - Memberships or alliances		Law 344	Ingenio2011	EDI2012 CIDET,Colciencias

### 6.2.1.3 “FIRM C”

THE FIRM (Running a newly established firm):

“FIRM C” was legally created in 2010. “FIRM C” builds, maintains and operates informatics systems for call centres and BPO using specialised technological tools. During the first year they were offering bespoke software but they decided to focus on packaged software while offering maintenance and a platform to follow up their needs using economies of scale.

“FIRM C” has property rights over its first innovative product EAGLE, which was finished by 2012; it also has trademarks over the name of the firm, and the name of its services. Its services and products were created as a result of the bespoke software they created and offered before. They have designed a second project, AGILITY whose property rights were being processed in 2013.

“FIRM C” has various types of customers in Colombia, it offers its products to large and small firms in more than three sectors. Although its target market was SMEs, its products have been

bought by large firms: *“This product is being sold in large firms, we have only one SME. All companies have been large; that's the paradox, one sometimes creates things for a market sector and ends up being bought by others”*. They don't have any partnerships; however, they work for other firms that sell software.

The CEO recognised that “FIRM C” did not have a market strategy. Their customers were referencing their work, and this was how they were getting new customers. *“Yes, what happens is that we have a problem, I think we will resolve it with new partners, the company has a feature I used to be proud of but not anymore (...) we used to say that we were so good that we did not have to advertise, (...) we always got referrals, it was done by word of mouth (...)”*.

In 2013, “FIRM C” had 5 employees, three software developers (two of them are the founders), a designer and a manager. The two founders are software developers who work at the company full time. When the founders were interviewed, they were working on a restructuring of the firm: “FIRM C” was going to have three new shareholders and one of them would take the CEO position. When asking one of the entrepreneurs about how big he would like “FIRM C” to become, he said *“well, large, more than 20 people.”*

#### THE NEW VENTURE TEAM (Organisation of the founding team):

“FIRM C” was initially created by two people, CC and VA. Although “FIRM C” was legally created in 2010, CC and VA were working together for six years before they started-up “FIRM C”. Their backgrounds before starting-up “FIRM C” are presented below; then, how they decided to work together and how and when they decided to invite new members into the shareholders team is also presented.

CC is an Informatics Engineer and an anthropologist. In 2004, he became the CEO of e-nterdev where he was also working as a software developer. CC considered himself an accidental entrepreneur, he does not consider himself a business man: *“because I do not consider myself a commercial person, I'm a bad salesman, and yes, I had done business relationships, and all that, or we have gone well, but it is not my strength, nor my comfort zone, or my area of happiness, well I don't feel very happy doing that kind of work, (...) I am easy to relate to because it is the part that I enjoy, but negotiations are very hard”*. He considers himself a stubborn person who persists until he finishes what he has started: *“I mean*



*my personality is as stubborn, persistent and to not let things go unfinished, that's already part of my essence”.*

VA is an Informatic Engineer from Politecnico Jaime Isaza Cadavid, he worked as a software developer since he was studying. He had been a software developer for 13 years. VA has learned several programming languages by himself, when asked where did you learn “x” or “y” language, he answered *“well, from expertise”.*

VA always had the entrepreneurial intention to create a firm. However, he said that creating a firm became reality because there was an opportunity, not because he was pursuing it: *“we had to do many tasks thus we said let’s work together, and we started to work like this, well, together, and the, well (the firm) started up not because I always wanted to (create a firm) but because there was an opportunity”.*

He worked in two different firms before working in e-nterdev. In the second firm, he was part of the entrepreneurial team. In 2004 he decided to work in alliance with CC. VA’s and CC’s interest in creating a firm has stood since they were studying Informatics Engineering at Politecnico Jaime Isaza Cadavid in 2002. They belonged to a study group in which they and other friends developed software.

Once they had graduated, both worked as software developers in small firms. In 2004, VA was working on a project as a software developer and they needed another software developer, thus he called CC. While they were employees of Afuera Link, they spent their spare time doing freelance work.

At one point VA moved to another city but they kept working together, VA was starting up a firm in Bogota at the same time that he was working on several projects with CC over the weekends and the evenings. Both indicated that they were not planning to start up a firm but they reached a point in which they had many customers. The workload was enough to work as an independent firm, thus they left their employments: *“the firm was not a planned project (...) we started as freelancers”.* There was a need in the market that they were supplying and this is why CC decided to register a firm.

In 2004, CC and VA decided to use a legal form in which CC was the individual owner of the company but VA and CC had a private contract between them. e-nterdev was a unipersonal firm (legal form) that CC and some friends adopted to offer freelance services of bespoke software. As CC stated, *“We had no product, there is also a thing that happened in 2004, 2005, (...) there were few software developers, (...) software was not as fashionable, because*

*there were people studying in colleges and stuff, but it was not like something in which much emphasis was being put*". They searched for some governmental help; they applied for some potential programmes in which they could find support. However, the available governmental programmes that were giving financial support in 2004 were focused on vulnerable people: low social class citizens and mothers in charge of their families. They couldn't find a governmental programme that would support them.

In 2008 they prepared a business plan while they were attending a training programme at Universidad de Antioquia. This business plan was not for the firm itself, it was for a specific product because the programme was oriented to business ideas rather than business plans. They created a product which became one of the components of EAGLE.

From 2009 to 2012, they had a partnership with Parque Soft Antioquia. Parque Soft Antioquia was a corporation that was being incubated in Parque E, CC remembers when a mentor in Parque E advised him to close the firm and how important it was to be surrounded by entrepreneurs at Parque Soft: *"we were all entrepreneurs and sometimes it was better to talk, because the mentor told me to exit, to close it voluntarily, and I was talking with the entrepreneurs, (...) and we said let's see, we were not that bad, and we saw other people and people persevere"*.

They stated that they received several informal training programmes while being incubated in Parque E, when asking what type of support they received from Parque E, CC expressed that: *"we received support mostly on training, it was very technical, like presentations with commercial purposes, things like that, strategic development, things like that"*. During this stage they were making lot of sales, they were growing. They won an award for the new firm with the highest invoices while they were being hosted by Parque Soft at Parque E. However, there were not making profits because their costs were very high.

They identified that they had to use a more convenient legal form (SAS) and that they had to create a product that could be paid easily by any SMEs. As CC state, *"I started to visualise more, everything was not as highly planned, I mean, it was more my intuition telling me, well, what can we do? We are missing something, we work, I mean, we work more than before and we earn less"*.

CC and VA had related knowledge because both were software developers. None of them had managerial expertise when they decided to work freelance. VA had entrepreneurial expertise and he is passionate about technology, he is a technology guy and he is the leader of the projects.

Since CC had social training, he was sent to negotiate with the customers. As CC states, he had to develop different skills to VA: *“because we both are founding partners, we had have technical training, for I complemented it with social, maybe that's why I had to develop other abilities different to VA, he always sent me to negotiate, although there is a good complement, because we love each other very much and what is most important is that he trust me very much (...)*”. However, CC affirms that they trusted each other to the point that VA always did what CC suggested. CC believed that it is not good for a firm, he thinks that it is important to have someone presenting different points of view or suggesting different ways to do what has to be done.

They were searching for other shareholders to complement the team, aware that the team was not multiskilled. They went to several events with angel investors but they were only offering money and they had the financial side sorted out. They did not want a shareholder with no initiative nor ideas nor contacts to enter into new markets. They wanted someone who proposes new products, new ideas: *“The new partner arrived with a product, we have this market and he said we can do this (business) (...) that has been great”*.

The following table (6.8) presents a summary of the human capital of the NVT when they started “FIRM C”, it can be seen that they had a related and specialised technical knowledge base, tacit and explicit, since both of them were software developers by education and have worked as such for more than 10 years. Both of them had managerial expertise in different forms (one as project director and the other as CEO). Moreover, one of them had entrepreneurial expertise.

Both entrepreneurs have been working as software developers in “FIRM C”. CC was the CEO until 2013 and he managed the customers in the commercialisation stage and the marketing strategy of the company for entering into new markets. VM has managed the customer in the development stage and the innovation strategy of the company, he has been the Project Director. They have different roles in the company, CC was mainly focused in the commercialisation and organisational strategy and VM in the development and customer strategy. In 2013, they were starting a process of introducing two new shareholders that will become employees in “FIRM C”. These shareholders were chosen to inject not only financial capital but also innovation strategies, one of them has proposed a new product that will become part of “FIRM C”’s portfolio and the other will become the CEO because of his networks and his profile, which is more market and sales oriented. CC will stop being the CEO to become a director.

**Table 6.8 Summary of HC of the NVT when "FIRM C" was created in 2010**

NAME	CC	VM
CODE	F1	F2
Gender	M	M
Age	30s	30s
<b>Current Position</b>	CEO	InnDir
<b>Formal Education</b>		
High school	Y	Y
Undergraduate	2Prof	1Prof
Postgraduate	N	1Spec
Research group	N	N
<b>Previous Expertise (years)</b>		
Technical Expertise different to software development	0	0
Technical Expertise in software development	14	14
Managerial Expertise: Project director or department director	0	9
CEO Expertise	6	0
Entrepreneurial Expertise	6	0
Number of firms created	1	0

PRODUCTS-SERVICES (idea development and commercialisation)

CC and VA were offering bespoke software for six years before creating “FIRM C”. They had passed through a difficult moment in which competitors were becoming stronger. Thus they identified that they had to offer their customers a unique technology and they decided to create their first package software (EAGLE). They identified a new niche, SMEs with small budgets, and developed a service which was adjusted to SMEs’ annual budgets for technology.

They had an idea that this product would be transversal to several departments of the firms and thus it would be useful for many firms and their different departments. *“We had seen further that it (EAGLE) could be useful for many topics, many organisations. Initially we added all the units, (...) lots of units thinking about making it bigger over time, therefore we had the vision since the beginning that it would be much more robust and would arrive at many more departments and enterprises.”*

EAGLE has had many different versions and its improvement has been due not only to customers’ requirements but also to the entrepreneurs’ initiative. They had added functions that they considered would be useful for the customer. *“The core concept of the product is based on customers’ needs, but the other systems, which are parallels to the main one, we have added them as our own initiative”.*

“FIRM C” has supported their process with the capabilities of its team. “FIRM C” has three software developers who have developed the several products and services that they sell. “FIRM C”’s technical capabilities are the technical capabilities of their team “*because our firm, well, it has been a firm supported by the technical capabilities of the entrepreneurs*”. Moreover, when developing a product, their roles are clearly defined.

Both founders started a specialisation in “Application development for mobile devices”, however only VA finished it. His new technical competence allowed him to put their products into a different platform and develop package software that users can easily manage from their tablets and mobile phones.

“FIRM C” had developed two core packages of software (EAGLE and AGILITY). EAGLE, the first innovative product, emerged as an idea to solve the need for a new target market with the technology that “FIRM C” manages. To improve it, they have added several applications including one which emerged from a business plan created in Universidad de Antioquia with the new product they were offering (EAGLE). Although they have received feedback from their customers, major improvements have emerged from the vision of the entrepreneurs to provide a unique product to any firm that is interested in measuring their employees’ performance, to control and optimise their processes.

A summary of the timescale of “FIRM C” is presented in the table below (Table 6.9).

**Table 6.9 Timescale of "FIRM C" since the entrepreneurial event in 2002 until 2013**

	2000-2003	2004-2007	2008-2011	2012- 2013
Entrepreneurial event	2002			
Business Plan			2008	
Legal creation			2010	
New Shareholders				2013
First innovative product commercialisation				2011
First sales of the first product			2002	
- Change of roles - Establishment of TMT				
Incubation (Parque Soft – Parque E)			2008–2011	
Key decisions: - Funding - Awards or certifications - Memberships or alliances - Spin-off(s)			2011MinTIC	

#### **6.2.1.4 “FIRM D”**

##### THE FIRM (Running a newly established firm):

“FIRM D” was legally created in 2009. This firm specialises in applied research, consulting and support in biomedical informatics and software engineering to the health sector. It provides not only the software but the hardware when needed; its services include stage productions, logistics and animation, *“Interaction, innovation and creativity are some of the pillars of its technologies”*.

This firm works with the technological capabilities of its five employees. Although they do not have any certification, their founders were part of a research group and both of them hold an undergraduate degree in electronic engineering. All employees are software developers, some of them were part of this research group too and others were trained in informal programmes offered by technical institutions such as SENA.

“FIRM D” does not hold any patent and does not have any partnership. It had international customers but most of its customers are local. Although its customers are not the final user, its final users belong to a diverse range of markets, for instance, food, sport, retail, mining, telecommunications, services and construction.

“FIRM D” emerged as an opportunity to commercialise a game that was developed by some members of a research group. They were not aimed to start up a business but some people were interested in buying its services. “FIRM D” was incubated in Parque Soft Antioquia and Tecnoparque.

“FIRM D” has developed two core innovative services based on interactive games. Some of them used augmented reality. Its founders are exploring more technologies and platforms such as Unity. They want to generate new services which can compete worldwide. They have also offered training programs which allow them to select people for future developments and opportunities.

##### THE NEW VENTURE TEAM (Organisation of the founding team):

“FIRM D” was started-up by five people, however after a difficult financial moment, only three of them became partners in 2009 (AP, JP and S). Two of them (AP and JP) remain in the NVT.

All of them were working in a research group at Universidad de Antioquia. This research group, called GEPAR (Grupo de Investigacion de Electronica de Potencia, Automatizacion y Robotica), was created in 2001 and is categorised as “B” by Colciencias. Although this research group accounts for 26 people and only nine of them are undergraduate students, this research group has several study groups with 40 undergraduate students: *“In addition, 40 students participate in the study groups, there is a permanent supervision of a lecturer and three engineers”*. All the founders of “FIRM D” are electronic engineers; none of them had any industrial expertise. JP took a course in “Domotic” in SENA and delivered a course in “Embedded Systems Programming for instructors”, he also holds a high school degree with emphasis in business (commercial and accounting).

“FIRM D” emerged in response to a market need and was supported by a research group and a technological park: *“we emerged in the research group and in the context of a Software Technology Park, Parque Soft”*. Their initial founders presented one of the games at a fair when they were asked about the price but they were not prepared to give an answer. However, it made them reflect and consider becoming a business. The entrepreneurial event happened by coincidence. They had developed a technology (product-game) that some customers were interested to buy, *“what we did was really very simple, no content, because it has very little graphic content really, what we did as engineers was not very attractive graphically, but let's say that the technology, at that time, were quite striking”*. Two of the members of the group (FA and JM) decided to start up the business because of the opportunity that emerged *“in 2008 when we all said let's start up “FIRM D”, and there arose the name as such, the logo and the first website”*.

FA and JM asked JP (the leader of the project) to work for them. JP thought that it was a good business idea however he did not want to work for them, he wanted to be one of the founders: *“they told us, good, we are going to start a business, come work with us, and I said no, no, (...) I will not work that way, if I'm going to make the process of starting a business it is because I am going to be a part of it and if not, I do not care”*. JP said that FA and JM were the ones that brought the initial motivation, however they were not engaged in the development of the software. FA was the one injecting the motivation and JM was in charge of the logistics and management.

“FIRM D” was based in Parque Soft Antioquia which supported them initially before they created the firm *“then let's say that much knowledge was transferred through the Park (...) role models that we had from other companies helped, if you had any doubts about how to invoice something or about how to manage an accounting issue, that was one thing that*

*helped a lot, as well as support among the companies*". "FIRM D" started with a small amount of financial capital, it was necessary for participating in an event. Its founders collected around 1,200,000 Col pesos (£400) and Parque Soft helped them with contacting the first customer. They asked the first customer to pay a percentage in advance, this cash allowed them to buy some computers. Their main resource was their knowledge *"the company was built from processes, then we say that initially the capital we were putting, the partners, was mostly in capital say as intellectual and the knowledge we had, and the same work, true, namely, what everyone does."*

During 2009 their sales were not going well. "FIRM D" sold two products in 2009. One of them was not paid for until 2010. They were running out of cash. They moved to TechnoParque because they were almost in bankruptcy and they did not have to pay for using TechnoParque facilities. Once there, they restructured the firm based on who had time to spend in the firm *"and there, we restructured the company, I mean, we became partners, whoever could not work much at that time was out"*. Only three founders became part of "FIRM D": AP, JP and S. "FIRM D" was legally created in 2009 after this crisis.

JM and FA decided to leave the team in 2009 because they had other responsibilities. FA was the CEO of Parque Soft Antioquia and JM started-up another firm. Once JM and FA left, AP became the CEO and JP the CPO (Chief Production Officer). Nevertheless, there was a web designer that offered his services even though "FIRM D" could not pay him. People arrived because they liked "FIRM D".

AP, the CEO, had a technical role at the beginning, as JP states *"he (AP) has added a lot of energy throughout the entire company life and has had very good attitude in the process"*. Once they decided to start selling the product, they needed someone to develop commercial tasks and AP decided to support them. AP and JM were meeting with the potential customers together.

The fifth initial member was S. S was doing research, and his studies were applied after two years of creating the firm. S is still a shareholder but he is not an employee anymore, he left the firm and became an employee at Unity, a multinational that have opened a support office in Colombia in 2013. Unity is a multinational that offers a platform to build and develop games and interactive content.

The following table (6.10) presents a summary of the human capital of the NVT when they started "FIRM D", it can be seen that all of them have a related technical knowledge base, because all of them were electronic engineers. Moreover, none of them had managerial



expertise and none of them had CEO and entrepreneurial expertise. Their initial managerial knowledge was acquired while they were being incubated in Parque Soft Medellín.

**Table 6.10 Summary of HC of the NVT when "FIRM D" was created in 2009**

NAME	AP	JP	S
CODE	F1	F2	F3
Gender	M	M	M
Age	30s	30s	30s
<b>Current Position</b>	CEO	CPO	None
<b>Formal Education</b>			
High school	Y	Y	Y
Undergraduate	1Prof	1Prof	1Prof
Postgraduate	N	N	N
Research group – Study group	Y	Y	Y
<b>Previous Expertise (years)</b>			
Technical Expertise different to software development	0	0	0
Technical Expertise in software development	2	2	2
Managerial Expertise: Project director or department director	0	0	0
CEO Expertise	0	0	0
Entrepreneurial Expertise	0	0	0
Number of firms created	0	0	0

AP manages the managerial and marketing strategies of the company. JP manages the innovation strategy of the company. They have differentiated roles in the company but they make decisions as a team, AP is mainly focused on the industry relationships and JP on the performance of the organisation. S is not an employee of the company thus he is not enrolled in the operational activities of the firm. "FIRM D" has seven employees; only two of them have managerial roles, the CEO and one employee who is in charge of finding customers for a new product. They have developed a model in which people that are developing and commercialising the product have shares in the product; all of the employees have at least two different roles.

#### PRODUCTS-SERVICES (idea development and commercialisation)

"FIRM D" has developed different games. The first software they sold has become a core product and the first innovative product. They have sourced many of their ideas from "YouTube". They observe a game or someone shows them some game and they assess

whether or not they can do it. If so, they develop the code and design the game. Its process of product development has been mostly based in reverse engineering and aimed to satisfy their customers' needs.

“FIRM D” had already built legitimacy around their brand; they had three big customers and they had learned some basic (know-how) managerial knowledge. They started developing bespoke software for several customers until they had a portfolio of games. These games are used by firms in fairs in order to generate publicity for their brand. They understood that their customers were active in the second semester and they needed to design software for a different industry in the first semester. Thus, they started to develop websites; this was not a profitable idea because their budget did not meet the reality as they were selling at lower prices than the overall cost.

The first product had several versions, and changes have been made based on customer needs. A new customer, who had seen the game, asked to adapt the game design with its brand. Thus design in most cases was provided by the customer. They did not worry about how “pretty” the game was, therefore they did not worry about having a qualified design team. *“Let’s say that when there have been changes in a product version, it has been usually because of a client request (...) let’s say that when we worked with advertising agencies they provided the images, they said we want this game but just with these graphics, (...) at the beginning we were very poor in graphic design (...) we did not worry much about how to improve that area, it is different now that we are making the effort to improve the design team”.*

“FIRM D” has not designed a selection process for hiring its employees, they had a flexible structure in which software developers that wanted to work with them were accepted. It had implications in the internal capabilities that the firm had: *“(...) at some point we realised that the company also needed a strong help from someone who is fully dedicated to the artistic part (...) he did not know (about design) but he was responsible for this (department) (...) and he left the firm this year, at the beginning of 2013”.* Their employees work with passion and learn while doing. They learn by scanning. *“Well, actually here, internally, there has not been something like formal training, we often learn via Internet, find tutorials, find different ways of doing things, there was not something specific before we started up the company, we all saw a course of processing images, we saw advanced programming in college, true, everything we saw in the University was important for doing this”.*

A summary of the timescale of “FIRM D” is presented in the table below (Table 6.11).

**Table 6.11 Timescale of "FIRM D" since the entrepreneurial event in 2002 until 2013**

	2000–2003	2004–2007	2008–2011	2012–2013
Entrepreneurial event			2008	
Business Plan				
Legal creation			2009	
New Shareholders				
First innovative product commercialisation			2008	
First sales of the first product			2008	
- Change of roles - Establishment of TMT				
Incubation (Parque Soft, Tecnoparque)			2008–2009– 2010	
Key decisions: - Funding - Awards or certifications - Memberships or alliances - Spin-off(s)			2010AntDeAnt, GlobalAccProg	2012Inngenio

#### **6.2.1.5 "FIRM E"**

##### THE FIRM (Running a newly established firm):

"FIRM E" was legally created in 2009. "FIRM E" offers applied research, consulting and support in biomedical informatics and software engineering to the health sector. "FIRM E" emerged after a couple of reasearch projects in biomedical imaging processing and teleradiology in which the entrepreneur (FA) was main developer member. The entrepreneur (FA) wanted to start up his own firm and there was a market interested in the application of the knowledge of FA.

"FIRM E" offers a tailored solution based on the needs of the customer. "FIRM E" has been involved in clinical informatics, public health informatics and bioinformatics projects. The methodologies used for processes and architecture modelling, representing actors, procedures and technologies involved in a process, have been fundamental for "FIRM E" projects.

The founder was part of the Bioengineering Research Group of the same university during 2004 to 2007, since then, he has continue focused on his startup projects. Although "FIRM E" only has one employee, a software developer, FA works in teams depending on the product. The "FIRM E" board is composed of six people, two engineers (FA the CEO and EP the CFO), one PhD, one specialist, a lawyer and an accountant.

“FIRM E” had three core projects in 2013. Telestroke, Peer support and a cardiovascular system (CS). Telemedicine for managing acute neurovascular events, called TeleStroke. Peer Support, an eMental Health project based on peer support process where people provide knowledge, experiences to help others. Telestroke is being developed with the CFO and one of the members of the board, it was sold for the first time in 2012. Peer support is based on providing support based on the customer needs, and this project is being developed with the employee and FA network. CS is at an early stage, it has not been sold but it has a prototype and has been developed with all the members of the board.

Although “FIRM E”’s mission is to offer services to the health industry, FA has also offered services to other industries such as education. FA identified that the health industry was an interesting niche and that it was a big market in Colombia because there were not many IT firms in the health industry in Colombia, and because of his affiliation with a research group. “(...) *the small immersion that we had with the research group opened an opportunity to do many new things*”. “FIRM E” has thus identified a target market and aims to grow.

#### THE NEW VENTURE TEAM (Organisation of the founding team):

“FIRM E” does not have an NVT. FA is the entrepreneur, the CEO and the project manager in “FIRM E”. FA is a system engineer from EAFIT (Escuela de Administracion, Finanzas y Tecnologia). He began to work in a bioengineering research group after taking a course in graphic computation. During this course he developed a system that represented his first engagement with biomedical images and he entered the world of health systems.

FA is aware that Biomedical Informatics is a very broad field, however he became an expert in electronic health records, interoperability, telehealth, databases, analytics and decision support systems. FA did an internship in Chile, worked with the Web Research Centre, and worked in data mining, web mining and information retrieval. He also worked in a research group in Chile.

While he was working on his project for graduation he was invited to meet with a customer that needed software for aviation. This need became the origin of FA’s first firm in 2005. This firm “Soft Air Ltd.” was created with a mentor of the customer “*there was, let’s say, a professional empathy and we began to create*”. Although they began with the aviation sector, they realised that the product might be of interest for different industries thus they decided to have a broader portfolio. They became recognised, and were building reputation and

legitimacy *“then it (the businesses) began in a supremely overwhelming way, many customers began to arrive, and people started to know who we were”*.

FA also started a spin-off in 2006, he was working on a business idea with a director of a research group in EAFIT. They had the support of the technology transfer of the university and the entrepreneurship department. They had a business plan and created it legally – it was called “eSoftMed Ltd.”. There were two more people in the entrepreneurial team, and one of them was FA’s partner in Soft Air Ltd.

Although Soft Air Ltd. was becoming very successful, FA and his partner had some ideological and organizational differences. FA decided to leave the company in 2006 and they liquidated it in 2007. These problems also impacted the team of “eSoftMed Ltd.”. eSoftMed Ltd. did not sell any products or services. After six months, it was liquidated too: *“we had made the project but we wanted to close it, because it disintegrated, the issue was very fleeting, but we only achieved the conceptualisation of the plan, to conceptualise some things.”* FA concludes that it was a good experience and that harmony is a very important element in a business based in knowledge *“look, a knowledge-based company requires a tremendous synergy, (...) there has to be a professional empathy, there must be a feeling, there must be a synergy, has to have harmony, that is very important to generate knowledge, to actually create and add value, then (...) when I start to have all this entropy with the partner, I said I will not be able to create what I wanted to create here”*.

Despite the failure, FA has realised that becoming an entrepreneur was his life project. He considers himself a good leader and this situation helped him to become stronger and carry on. *“Difficult moments and issues like Soft Air Ltd. lead me to get more strength, to say I must continue with the idea of generating innovation, to generate knowledge, to lead; I have considered myself a good leader (...) I will not fade away, I think a major, major element that an entrepreneur has to do, it is to persevere”*. He considers the main characteristic of an entrepreneur to be perseverance. He decided to create “FIRM E” because he identified many needs that could be fulfilled with IT and that he could specialise in the topic. In addition, it motivated him to use his knowledge and make use of excellent relationships with EAFIT.

FA is the only shareholder of “FIRM E”. He had a partner from the beginning until 2011 (EP), EP is a software engineer who left “FIRM E” because he decided to create his own firm for a different product in the same industry. However, FA works in partnership with two doctors one has a PhDs and another a specialization (BP and JF) who belong to the board of advisors. They are a lawyer and a financial consultant. BP started working with FA in 2010 in the

conceptualisation of the first product (Telestroke), he is the medical director. JF is the research director, he has supported some of the projects and has also been part of “FIRM E” since 2010. In 2012, FA hired a software developer (freelance) for the second product (PSPIS).

The following table (6.12) presents a summary of the human capital of FA when he started “FIRM E”. He had a strong technical knowledge base, he is a Systems Engineer (with emphasis in Software Engineering) with 5 years of expertise as a software developer and 3 years of expertise as an entrepreneur. FA also participated in a short specialisation course (one year) and he is a lecturer of Healthcare Informatics at the Universidad de Antioquia. Thus, his knowledge base was explicit and tacit, specific and complementary.

FA has always been the only shareholder of “FIRM E”. He started it with a software developer that decided to start up his own firm. Once they started, FA was the CEO because it was his idea, because he had a network of potential customers and potential partners and because of his expertise as an entrepreneur. He has also been in charge of developing software, however he hired a software developer and is training him in the several routines and programmes that FA has been using in “FIRM E”. Although FA is the only shareholder, “FIRM E” has a CTO (EP, a Systems Engineer), a research director (JF, has an MD, MS and Dr), a medical director (BP, has an MD and Dr) and two more members of the board of advisors: a lawyer and an accountant.

**Table 6.12 Summary of HC of the NVT when "FIRM E" was created in 2008**

NAME	FA
CODE	F1
Gender	M
Age	30s
<b>Current Position</b>	Many
<b>Formal Education</b>	
High school	Y
Undergraduate	1Prof
Postgraduate	N
Research group	Y
<b>Previous Expertise (years)</b>	
Technical Expertise different to software development	0
Technical Expertise in software development	5
Managerial Expertise: Project director or department director	0
CEO Expertise	3
Entrepreneurial Expertise	3
Number of firms created	3

## PRODUCTS-SERVICES (idea development and commercialisation)

FA aimed to focus his services in the health sector; however, since he had a strong network in which his work was recognised he kept offering services to previous customers in the form of consultancy.

His technical skills have been recognised, giving him a reputation as an expert. He was contacted by the Secretary of Health of Bogota to become an advisor; they wanted him to become the conceptual leader of a project based on medical informatics: *“And the senior adviser phones me and says F look I have information for you, we understand that you are an expert on the subject of medical informatics (...) I said, ok let’s talk (...) they make me an offer and we agree that I should be advisor for them in this important issue, and it was the experience I needed, I’ve been teaching, I have done research, I have been in private enterprise, have been out of the country doing research, I’ve been out of the country with my business, and I lacked a public experience different from being a professor at a public university, they told me they wanted me to lead this conceptually, I say, let’s do it”*

“FIRM E” had three main products in 2013: Telestrow, PSPIS (peer support) and CS. Telestroke was the first product created. Base on Telestroke a new project has been developed in partnership with Colciencias, Universidad de Antioquia, CEMDE. This product is still a prototype. This product started as a proposal written in collaboration with Harvard University and Universidad de Antioquia. This programme comprised eight projects, they wanted to propose it to Colciencias but they had some problems and they did not present it. They are still working on this product. Because of this work they were invited to participate in a seminar about remote telepresence.

A summary of the timescale of “FIRM E” is presented in the table below (Table 6.13).

PSPIS was the first innovative product sold. The second product, PSPIS, has been developed in partnership with PSACC-Canada. This project started because they needed someone of this University who could develop a platform to collect data for research in mental health. Someone who met FA in the research group was working at University of Toronto, Canada and he recommended FA because he had worked in health technologies, FA had also asked this person to consider him if he identified any opportunity and FA had also given him support in his master’s thesis. *“Before creating “FIRM E” I had already finished work with the research group in bioengineering, I had finished work, but look how important contacts are and references and (...) viral marketing, this person says yes I know who can develop this for us, and that’s when I got in touch with this Company”.*

**Table 6.13 Timescale of "FIRM E" since the entrepreneurial event in 2007 until 2013**

	2000–2003	2004–2007	2008–2011	2012–2013
Entrepreneurial event		2007		
Business Plan			2009	
Legal creation			2008	
New Shareholders				
First innovative product commercialisation				2013
First sales of the first product		2005		
- Change of roles - Establishment of TMT				2012
Incubation				
Key decisions: - Funding - Awards or certifications - Memberships or alliances - Spin-off(s)			Intersoftware	

#### 6.2.1.6 "FIRM F"

##### THE FIRM (Running a newly established firm):

"FIRM F" was legally created in 2004; its team was offering services to several sectors. They have customers in more than five different sectors and they offer bespoke and packaged software in Colombia and the USA. Their core innovative product has been sold more than 50 times and had had three different versions depending on the programme used.

"FIRM F" emerged as a market opportunity for a technical group of engineers. Mobile programming was a new field in which there was not a firm in 2003 and this group of tech guys developed software for fun: *"well, then at that time there were not even devices and there was an interest in undertaking this entrepreneurship, undertaking the technical part, well, that group of interest was in telematics"*.

Since software cannot be protected in Colombia and there are other firms in the world offering similar services, they have not protected the code of their core product. They have protected the brand and they have a team of software developers that represent the technological capabilities of the firm. None of their software developers have any certification and they do not hold an ISO certification anymore. However, all the members of the NVT are software engineers with a postgraduate degree related to their interest as individuals and as a firm.

"FIRM F" has branches in two countries, in Colombia and the USA. In Colombia, they have offices in Medellín and Bogotá. They were expecting to grow in Latin America but when the CEO did the MBA in Boston (USA) he identified a potential market and got some customers.



They have developed good relationships with Intersoftware and Fedesoft, however they are only members of Fedesoft because of their training programmes, their international network and its membership cost.

They searched for investors because they needed cash flow, they started in the garage of one of their grandmothers, but after that they were incubated by a larger firm which integrated some of its services, suppliers and customers to “FIRM F” and sold the other part of the business to an American firm. After this incubation, the NVT became aware of their lack of knowledge and defined a flexible and strategic plan to grow. “FIRM F” has 25 employees and more than 60 customers. Its customers are micro, SMEs and large firms. They are adjusting their marketing strategy to take all the opportunities that they have identified; they are adjusting their distribution channels. They are also starting to explore opportunities in governmental programmes such as Innova to grow.

#### THE NEW VENTURE TEAM (Organisation of the founding team):

Three people, JD, P and E, created “FIRM F”. All of them are Systems Engineers and none of them had worked before starting up “FIRM F”. They finished their undergraduate studies in EAFIT. Their interests before starting up “FIRM F” are presented below; then, how they decided to work together and how and when they decided to enter new members into the shareholders team is presented too.

P is the CEO of “FIRM F”. He is the IT Engineer. He always wanted to become an entrepreneur. Although he has also developed software, he has focused mostly on the managerial role because he likes this role and he is more skilful than E and JP at managing customers. While working in “FIRM F” he gained an MBA and did a short formal course in managing sales.

JD describes himself as a different case. He had not thought about creating a new firm and he had not thought about becoming an employee. He knew he wanted to do something that could be useful for many people: *“what I was very clear about was that I wanted to do something, an application or a product that will serve many people, let’s say that my motivation was, more, to make a product that works for many people and many people use it”*.

When JD started working in the telematic group he was not thinking about making money, he was thinking that this would be something useful for many people and that this would have a

good impact. Any task in the university was designed around mobile networks, thus after developing several projects JD started to consider starting up a firm.

JD and P met at university. They were not friends but they were both interested in doing something useful. P saw an advertisement about someone proposing to create a firm, he invited JD to join that opportunity and they met with that person. They worked on a project for some months but it did not become a firm.

JD and P also met some people with managerial backgrounds who were interested in starting a firm, but it did not happen either. They (JD and P) enrolled in a course called entrepreneurship in EAFIT. It was offered as an optional course by Jorge Meza (the director of entrepreneurship in EAFIT). They learned how to do a business plan, *“in that course we were taught to do a business plan and goodies (...) which helped us a lot in the part of entrepreneurship, as you said Jorge Meza was an excellent support in the part of entrepreneurship, and I would say it was the beginning of the topic”*.

JD and P met E, the third member of the NVT, in the telematics group. E is a tech guy, his interest has been in computers and developing software since he was in high school. While he was studying, he took two informal courses and private lessons. He learned to develop software in 1998 and he knew he wanted to become a systems engineer since 1995, the same year that his father gave him a computer.

E became interested in creating a firm when he was part of the telematics group in which he, JD, P and A were developing software for mobile phones in 2003. Eight people interested in telematics and networks made up this group, but only four of them (E, JD, P and A) were focused on mobile phones. E was not interested in becoming an entrepreneur but three of the members of the group were interested. They offered him a chance to leave the business if he disliked it, *“and that was the moment when, without having the will to create a business, I became part of it, (...) three of them were going to start up the company but I did not want, I did not want to create a company, it was not like my interest at that time, but they said come on, create it with us and then if you do not want it, you can leave, and I stayed (laughs)”*.

P, E, JD and A were studying the same undergraduate programme and they had some courses together, but they were only acquaintances. They had a common interest in technology and therefore their interest made them start up “FIRM F”. A left “FIRM F” in 2009 when he moved to the UK. His role was mainly technical, he was a software developer.

While E considers the starting point of “FIRM F” to be the telematics group in 2003, for JD and P this journey started in 2002 because they had tried a couple of times to start up a business; they took an entrepreneurship course and became a supplier for their university – their first customer. They were strongly motivated by the university to start up “FIRM F”, they had media (TV) attention and since they were going to be paid they had to create the firm legally.

Although JD and P had written two business plans when they were taking the entrepreneurship course, they did not write a business plan for starting up “FIRM F”. However, they wanted to become more organised and they achieved ISO 9001, 2000 in 2008 and kept it updated for four years.

The following table (6.14) presents a summary of the human capital of the NVT when they started “FIRM F”. It can be seen that they had related technical knowledge base, since all of them were Systems Engineers interested in developing apps. None of them had worked before but they were developing software for fun, thus their knowledge base was mainly specific and related. Moreover, none of them had CEO or entrepreneurial expertise. Although none of them had managerial expertise, they hired a manager once they got the first payment: *“the first thing we did when we got the first payment of the first project, was to hire a business person, she was very useful”*.

**Table 6.14 Summary of HC of the NVT when "FIRM F" was created in 2004**

NAME	P	JD	E
CODE	F1	F2	F3
Gender	M	M	M
Age	30s	30s	30s
<b>Current Position</b>	CEO	InnDir	ProdDir
<b>Formal Education</b>			
High school	Y	Y	Y
Undergraduate	1Prof	1Prof	1Prof
Postgraduate	N	N	N
Research group	N	N	N
<b>Previous Expertise (years)</b>			
Technical Expertise different to software development	0	0	0
Technical Expertise in software development	0	0	0
Managerial Expertise: Project director or department director	0	0	0
CEO Expertise	0	0	0
Entrepreneurial Expertise	0	0	0
Number of firms created	0	0	0

P is the CEO; he manages the customers and the marketing strategy of the company for entering into new markets. JD manages the innovation strategy of the company. E manages the big customers that have bespoke software and the software developers' team. They have differentiated roles in the company but they make decisions as a team. All of them have managed the industry relationships and the performance of the organisation because they decided to study postgraduate programmes while running the new firm and they had to switch their roles when needed. They have two more shareholders that are not employees of the company thus they are not enrolled in the operational activities of the firm; these shareholders had an IT company and offered them an office thus they were incubated there for one year. On top of their financial capital, these shareholders brought new customers and new suppliers.

#### PRODUCTS-SERVICES (idea development and commercialisation)

“FIRM F”’s first product was sold only once to EAFIT (C1), they attempted to sell it in different universities but they could not find any other customer. They assumed that each university could easily develop the product in-house and that it was likely that once they had heard the idea they had decided to create it by themselves. They developed a second product based on the infrastructure of the first one and the internship department at EAFIT helped them to get their second customer.

“FIRM F” transformed the first product into an application that was needed for salespeople. This second product became the most sold one and was called “fuerza de venta”. Both products emerged as a result of “FIRM F”’s ideas, however since EAFIT gave them access to their databases this was what helped them to develop the products’ platform: “*EAFIT never made a requirement to us... EAFIT helped us was to access information because we had access to their databases*”. In summary, EAFIT helped them to find the first two customers, to have access to data to develop a new app, to assume the responsibility of becoming a new firm and to learn how to write business plans.

The second product was a result of working with the second customer (C2), they expressed that they liked the idea of having an app but “FIRM F”’s knowledge about sales was poor. They did not know how to make an invoice, or what taxes were applicable. C2 transferred them key information, they even borrowed some books and built the first version of the second product (P2) “(...) *they told us they liked the idea, come and we will help you to develop the*

*product, thus they gave us some books, I remember some books about how to do an invoice, I mean, it was such a level of ignorance that when they were talking about bills, we did not know anything (...) they explained to us and we started developing the product”.*

The first version was very specific for this customer; however this was the starting point of P2. This version was not sold anymore but allowed “FIRM F” to develop a product that could be sold to many firms *“however such a product was so customised that we could not ever sell it to another customer (...) we learned more or less what was it about and we said let’s build something useful for more companies”.*

P2 was improved when working with a third customer (C3) and this opened the opportunity to have more customers and to improve the product *“C3 also helped us finish polishing the product, and thereafter it began: more and more customers, and the product has always been really running from the hand of customers, true, customers are asking us things and we annexed them to our product, some extra services are only for a few customers, some are for all, but that’s how the product has been offered”.*

“FIRM F” was composed of technical people; however, they were flexible enough to work with a new target market since they stopped trying to sell to universities and engage with their second and third customer. To survive, they developed a new product (P2) for a new target market.

“FIRM F”’s NVT was composed of three people, JD, E and P. P, the CEO, expressed that they needed to have more financial knowledge. He expressed that they had a good technical knowledge base but they needed to have more knowledge in areas that were different to the technical one because they wanted to become international. Thus, after he opened their branch in Bogota in 2010, he did an MBA at a university in North America.

Their roles changed in 2010 because they hired several software developers (80% of the employees were software developers in 2013) and decided what postgraduate to do. JD was the project manager (PM) but he became the R&D director. P assumed the role of PM because they had some people (five people) working in the commercial department and supporting sales.

P was not the only member that decided to study a postgraduate programme while working in “FIRM F”, the three members of “FIRM F”’s NVT did it. E did a postgraduate in software engineering and JD did a postgraduate related to human-computer interaction. They had chosen their programmes considering that they were free to choose what to study but at the

same time they wanted to do some complementary programmes. *“It was nothing mandatory, not imposed by the company, (...) what I chose I did thinking that P was studying the MBA and that with one MBA would be sufficient. E was studying software engineering, (...) I took mine on human-computer interaction, it was slightly different from software engineering. I was also thinking to complement the others, then I would say it really started with what each of us wanted; each one was (focused on) what was done in the company but at a very personal level, it was what each of us wanted and we found the affinities (...)”*.

“FIRM F” had a mentor, provided by Pro-Antioquia. He was helpful because none of the members of the NVT had any managerial tacit or explicit knowledge when they created it. This mentor helped to produce strategic information and allowed P to become aware of how important it was to have basic managerial knowledge; managerial knowledge that allowed them to project the potential of the company in figures such as the rate of return on assets and the projection of cash flows. This was one more reason why P decided to study an MBA, there was a common language in the business world that he – the CEO – had to learn and use.

The first two years were focused mostly on the second customer because all the members of the NVT were students and they had to finish their undergraduate degrees. It was about a year and a half that they worked with C2 and developed P2. The P1 platform was then adapted to P2. Although P2 is their core innovative product, it has had several different versions depending on the customers’ needs. They have a core product that can be adapted to fulfil the customer expectations. Some of the versions are generated as an improvement of the product but some of them are specific for the customer and are required to stay like that. They decided to prioritise sales and their studies instead of writing a business plan. They had a plan, they wanted to grow and sell, but they did it by working with the customer and improving the core innovative product.

“FIRM F”’s NVT decided to increase their firm’s knowledge base by studying postgraduate programmes, employing software developers and people for sales, marketing and strategy. They decided to become international and opened branches in Bogota (Colombia’s capital) and the USA. They have been flexible in their market and innovation strategy and developed several different roles when needed. Although they had a related knowledge base, they decided to assume complementary roles chosen by them. Their knowledge integration represents a type in which each member has the drive to learn more in specific tasks that are useful for a common goal, to make “FIRM F” grow. Their different and complementary interests: E as a software engineer, P as the CEO and JP as the innovation director, have

allowed “FIRM F” to grow naturally. This individual and collective learning process can be identified as an important capability to grow in sales and size.

On the top of their complementary interest and related knowledge, “FIRM F” NVT has assumed leadership in specific but flexible roles, for instance, JD assumed leadership as a project manager, E assumed leadership in software development and P assumed leadership in commercial issues. Once their team increased, JD assumed leadership in innovation and P in project management. They have been flexible but focus-oriented, with clear boundaries between their roles but still making decisions as a team.

“FIRM F”’s NVT identified their lack of knowledge in management, software architecture and human-computer interaction. This weakness has been transformed into opportunities to learn. It is important to state that this learning has been motivated by failure, reflection and peripheral vision. Failure when they were searching for shareholders because they needed cash flow but they could not offer reliable figures related to the future projections of the firm. Reflection, when they identified that they needed to strengthen their software architecture. And peripheral vision, when they identified that they could add an extra element of differentiation to their core products and competences if they understood human-computer interaction better: *“then that's what we learned, it's not that we have gone wrong, we did very well really, but we could have done much more if we had had more knowledge”*.

A summary of the timescale of “FIRM F” is presented in the table below (Figure 6.15).

**Table 6.15 Timescale of "FIRM F" since the entrepreneurial event in 2002 until 2013**

	2000–2003	2004–2007	2008–2011	2012–2013
Entrepreneurial event	2002			
Business Plan				
Legal creation		2004		
New Shareholders		2006 (S4, S5)		
First innovative product commercialisation				2005
First sales of the first product			2004	
- Change of roles - Establishment of TMT			2010	
Incubation (Shareholders' firm)		2006–2007		
Key decisions: - Funding - Awards or certifications - Memberships or alliances - Spin-off(s)			FedeSoft	

### 6.2.1.7 “FIRM G” – Acceso Virtual

#### THE FIRM (Running a newly established firm):

Acceso Virtual was legally created as a society (SAS) in 2009 with three partners. Although Acceso Virtual was a unipersonal company created in 2005, the CEO (JM) decided to create a society with AS in 2007 and with MA in 2009. His decision emerged from his identification of the opportunity to group all his educational products into a service that offered more than technology. The new concept is a firm that offers the service of a process of transformation in the classroom; this core service is called “FIRM G” and can be implemented by using several technologies (Tomi, e-Kampus, MIMU, among others) that have been created in Acceso Virtual.

“FIRM G” holds the trademarks for protecting the name of the firm and all its technologies. “FIRM G” had contracted distributors to sell its products and software developers (freelance) to develop its software. Moreover, they have employees that are web developers and a commercial department that has direct contact with the end users.

Although “FIRM G” does not have any partnership, the concept has been implemented in Latin America in Mexico, Colombia, Ecuador, Brazil and Argentina. More than 9,000 classrooms have this technology in Latin America. They have won three awards: Inngenio 2012, Accenture 2012 and 2013.

“FIRM G” emerged as a spin-off of Acceso Virtual Unipersonal and a need within the educational industry: *“when I start to see the market needs in regions, cities, municipalities and regions require more than technology, require more processes of educational transformation, then I settle a team dedicated to more psychological and cultural issues, associated with the implementation of technology in classrooms, then we not only offer technology but a whole – let’s say a methodology – that ensures that a teacher who says they have never applied technology, starts applying it. And in addition to that I add a third component – the educational content – then it begins to evolve, the business with a theme of education and content and I say this is going to be called ‘FIRM G’”.*

“FIRM G” has considered their customers’ perspectives to improve their services, nevertheless they have also travelled and observed potential competitors. They have attempted to remain competitive worldwide, considering their users’ level of involvement with technology and what technologies can be adapted using reverse engineering.



### THE NEW VENTURE TEAM (Organisation of the founding team):

Acceso Virtual SAS was created by JM and he invited two friends (AS and MA) that were working with him in a new product (Tomi). They had planned to be partners in the product but JM suggested they become a part of a society in which all his previous products for education were included. MA left the society a year after (2010) and moved to a different country. AS is still a partner of JM, and their backgrounds before starting-up this firm are presented below, followed by how they decided to work together and how their roles and shares had changed until 2013.

JM did not finish any undergraduate programme. Although he had a scholarship when he finished high school in 2003 and started a programme called Control Engineering at National University in 2004, he decided to quit in 2005 because he did not have enough funding for transport. He told his mother that he could start making some money and he decided to spend all his time on his second firm that was created in 2003.

In 1998 he participated in an S&T fair in which he presented a snowboard whose software was developed by him. This project was a success; people were queuing to interact with it. He remembered that this was the first time he thought about starting up a business and he created a logo. He thus became a freelance software developer.

His first firm was legally created in 2001 when he was a student at high school (he was 13 years old), he learned to develop software because he had spent his free time on the computer since he was 11 years old and his brother trained him.

Once he decided to quit his undergraduate degree and spend all his time on the second firm, he realised that the name of the firm was not good for offering software and he decided to liquidate that firm and create a new one (Acceso Virtual). While searching for new ideas in 2005, JM met a group of software developers at Universidad de Antioquia who were working on electronics and were interested in becoming entrepreneurs. AS was one of them. JM was interested in offering new technologies in the educational industry; he met with AS and they decided to develop products together.

JM and some of the other entrepreneurs of the group visited Parque Soft Cali and started-up Parque Soft Antioquia. This Park is based in a model of co-working in which several entrepreneurs share general costs such as rent, electricity bills and cleaning. JM and AS were developing software at JM's house before they moved to Parque Soft Antioquia: "*some boys*

*from the University of Antioquia told me there is a model in Cali called Parque Soft where many entrepreneurs join together to develop software, and there are like 400 today, it was like the sky of the developer, they were huge warehouses (...) everyone was developing software (...) it was like a space of software coworking in Colombia and it was an easy-going scenery with passionate people (...) and we said we want to create the same thing in Medellín.”*

In 2006, JM changed his focus in one of his products and went into bankruptcy. Thus he decided to start his studies again; he applied to Systems Engineering at Universidad de Antioquia. He had sold all his equipment and he felt he had failed as an entrepreneur (this was the second time he thought he had failed as an entrepreneur). However, a new business opportunity emerged as an application of one of his products and he was the only provider available, thus he retained a huge net profit and reactivated his firm and his self-confidence. *“With that (money) I bought a car and I was feeling more and entrepreneurial, I gave a first payment for a house and contracted a secretary and I felt I was a businessman”.*

JM and AS went to Bogota for a conference regarding virtual worlds for education and they were invited to join TechnoParque, a new type of Park that was created by SENA. SENA is a governmental institution that offers technical education in Colombia. In the first meeting, JM met the director of SENA who expressed a technical need and JM assumed the risk and responsibility of developing a prototype in 15 days. It did not work, however the director of SENA invited him to an event and provide him with technical and business mentors.

JM found an angel investor for the development of this technology, he hired a team of software developers that he met in TechnoParque and opened an office. JM left Parque Soft because of some differences in the management style in 2007 and because he had an investor. He used the co-working model and shared his rented house with other start-ups. The product was sold successfully but the relationship with the investor broke because of the investor's interest in the shares of another successful product, the product that originated the concept of “FIRM G”: Tomi.

While talking about his experience with the angel investor, JM expressed that this investor wanted to buy the rights of the product but he did not accept because he never thought about working for somebody else: *“that's not what I expected; the last thing I expected was to deliver all development and end up working for someone else”.* They decided to share the commercialisation rights of the product (50-50) and JM assumed all the leadership of the development and commercialisation of the product. He expressed that sadly the product was not sold anymore because of the problems between the shareholders, *“we managed to patch up*

*the relationship but sales decreased because of the problems and that is very sad, that I can gain an investment and the product begins to die for problems between investors, then I learned to be very careful when obtaining venture capital”.*

Tomi was originated while JM, MA and AS were playing Wii in 2008. JM and MA designed a prototype, AS helped with the software development and JM sold it to several customers. Since they did not have an external investor, the three of them were shareholders of this product. The net profit of this first version of the product was about 90% of the cost. They were also developing another product, e-Kampus. The three of them were shareholders of these two products, thus JM decided to invite them to create a society including all the products that had been developed for the educational industry. JM offered 15% to AS and 10% to MA. MA was part of the society for one year but he decided to travel abroad and he sold his shares to JM and AS, MA is still one of the freelance software developers of Acceso Virtual.

AS is the Product Director in Acceso Virtual. AS was motivated by JM’s projects, the ones that JM presented in the C&T fairs at school. He met JM in 2001 while attending one of the software development courses that JM was teaching in their high school. Although AS did not have a computer, he decided to learn and practise how to develop software on his uncle’s computer. He started an undergraduate programme in Physics at Universidad de Antioquia but he only did two semesters. While waiting to start his undergraduate, he worked as an employee but he didn’t like it. He worked only for one month and he decided to become a freelancer: *“I wanted to have autonomy and some freedom”*. He developed the website for his previous employer.

He considers himself a tech guy and an artist: *“I felt in love with systems too, I have always enjoyed drawing and playing guitar then I have been like an artist”*. His core motivation has been to make life easy through technologies: *“then I feel that technology can facilitate certain tasks, not all of them, then that is the motivation that I have always had to make software”*. He also considers himself a good communicator that promotes synergy in his groups and clear messages to their customers, he develops the platforms for the games because he is interested in the interaction of humans with technology. *“I like to listen and communicate well so there is good, good synergy with all the team, through the design of the user interface, I like to communicate to people facing interfaces (...) I’ve gotten very engaged in designing user experience, this is what most caught my attention lately and I’ve been studying and reading about it”*.

He did not have contact with JM after finishing high school. They met one year later and showed each other what they had been working on. AS had been a web developer since 2004. They decided to work together in 2005, and since JM already had created a firm, they decided to use this firm.

JM and AS were partners in some products. They worked together in several architectural projects, developing virtual paths in new projects and other projects related with 3D environments. After working from JM's house, they embraced the possibility of starting a technological park following the concept of Parque Soft. Nevertheless, they left the project and moved to a rented house. Three firms moved to this house, AS's was one of the firms.

AS decided to become an entrepreneur after having the opportunity to see Parque Soft Cali, his expectations were not fulfilled at the University but he got inspiration by observing successful cases in Parque Soft Antioquia.

Although AS formally entered the society with JM in 2007, it wasn't legally constituted until 2009. For AS, the main motivation of this decision was the negotiation of one product, Icampus, because this product was being very successful but had many partners. It had high sales projections and made JM consider the possibility of having more shareholders in Acceso Virtual – "FIRM G". Although AS was one of the software developers of Tomi, he only entered as a partner in 2007. AS became the PM of "FIRM G". His role is called Product Director, however he has been in charge of the internal operation of "FIRM G" since 2009 as the Chief Operator Officer (COO) and the Innovation Director. AS also started an undergraduate degree in organisational communication but he did not have time to start up a firm and study. He was very motivated to become part of "FIRM G" thus he did not continue his studies at university.

JM and AS met at high school. They worked together for five years until JM offered AS a percentage of his firm. AS was a partner of JM in several products, however since they were working in two products that both had high sales projections, JM decided to offer AS and MA some shares. They both accepted, however MA decided to leave the country in less than one year and become a software developer of "FIRM G". AS was very motivated with the opportunity of becoming – formally – a member of the NVT.

The following table (6.16) presents a summary of the human capital of the NVT when they started “FIRM G” – Acceso Virtual – it can be seen that they had related and specialised technical knowledge base, and tacit, since both of them were software developers but their learning was not certified by any institution. Both of them had entrepreneurial expertise since both had started their own businesses. Moreover, their managerial knowledge was tacit and exclusively related to any business they had made before. They outsourced the accounting activities. They also have a contract with a firm that advises them regarding any legal issues and that has developed the necessary paperwork to protect their brands (firm and products).

**Table 6.16 Summary of HC of the NVT when "FIRM G" was created in 2009**

NAME	JM	AS
CODE	F1	F2
Gender	M	M
Age	20s	20s
<b>Current Position</b>	CEO	ProdDir
<b>Formal Education</b>		
High school	Y	Y
Undergraduate	N	N
Postgraduate	N	N
Research group	N	N
<b>Previous Expertise (years)</b>		
Technical Expertise different to software development	0	0
Technical Expertise in software development	10	7
Managerial Expertise: Project director or department director	0	0
CEO Expertise	6	5
Entrepreneurial Expertise	6	5
Number of firms created	3	1(Freelance)

Both entrepreneurs have worked as software developers before. JM is the CEO and he managed the customers in the commercialisation stage and the marketing strategy of the company for entering into new markets. AS manages the customer in the development stage and the innovation strategy of the company, he has been the Product Director. They have differentiated roles in the company but they make decisions as a team. JM was mainly focused in the commercialisation of the products and organisational strategy and AS in the development of the products and customer strategy. “FIRM G” – Acceso Virtual – is composed of three departments: finance and accounting, marketing and sales, product

management and content. The manager director (C) is in charge of the finance and accounting department. JM, AS and C had mostly a business relationship; they were not friends before but the friendship emerged as a consequence of the business relationship.

#### PRODUCTS-SERVICES (Idea development and commercialisation)

As was presented at the beginning of this case, Acceso Virtual developed several types of product that were sold to different target markets. Acceso Virtual became a society called “FIRM G” once JM, the CEO, decided to group all the products whose target market was the education industry. Products such as Sara, Tomi (P1) and ECampus (P2), were developed mainly for improving the interaction of student-computer-teacher in classrooms. Since Sara was discontinued because of the problems with the shareholder, JM decided to include two new shareholders into the NVT, who were part of the team that identified the opportunity for P1 and P2.

The main source of information to develop P1 was a key competitor, the initial idea emerged while playing Wii, however the core improvements to the initial prototype were done based on the NVT participation in an event at which the competitor was launching the product.

Since this idea emerged from a team, they decided to work together in software to simulate start-up firms in Colombia. P2 emerged from the NVT expertise as self-employees and entrepreneurs. Having two products that were being developed together, JM offered a percentage of the company to one software developer (MA) and a web designer (AS). P2 was the main reason why they decided to work together. The second version of P2 was launched in 2011 as a complement to the concept “FIRM G”.

AS defined three basic aspects to consider when developing a new technology: low cost, portability and ease of use. These aspects are the base of “FIRM G” technologies and were identified while developing and commercialising P1.

P1 had had five different versions, version four was included in the “FIRM G” platform, however it was identified that it was better to have every product available to be used and sold without needing this platform. P1’s fifth version became a self-content product again. This improvement has been based mostly on customers’ feedback. Since 2011 they implemented a service that allows the user to comment and send feedback regarding the product. Any improvement from version 1 to 4 was based on the team ideas to make P1 better. AS

emphasises the importance of having a balance between what it is technically feasible, what can be sold and what users think.

Nintendo claimed the intellectual property of TOMI v1, this event motivated “FIRM G” to acquire new technical knowledge. They searched new suppliers that allowed them to adapt their idea to a different supplier. JM states that they were not aware of the legal issues but this event made them realise that there were other suppliers in China and more competitors in Colombia. They asked this new supplier to add some elements to their brand. This event also motivated an improvement in the quality of the product and addition of new specifications; these improvements were considered in the second version of P1.

The fourth version of P1 was created because one distributor identified that the users (teachers) may not use the product if they were not trained to use it. JM identified an opportunity in this need and decided to develop the concept of “FIRM G”. This concept included products for training teachers. Although the product cost was lower than the training, it is a fact that people pay more for technology than for training. This lesson allowed “FIRM G” to become one of the most innovative products in education in Colombia; “FIRM G” won several awards with its concept, one of them was Accenture.

JM describes the process of adaptation of improvements as an evolution. At the beginning, they took extra time to solve any problem, however they learned that changes in the product have to be approved and cannot be linked to any problem that is reported. They organised feedback into projects until this improvement became a need that was financially feasible and it was justifiable to allocate human capital for its development. Meanwhile, they found temporary solutions that can be implemented directly by the customer.

P1 has required different profiles to accomplish customer, distribution and developer aspirations. They have needed communicators, pedagogues, software developers, designers and engineers. P1 has been the starting point of “FIRM G”.

Most of the learning lessons of “FIRM G” have been based on learning by doing, and have had the flexibility to adapt new information into improvements of the product considering the overall performance of the firm. Mistakes have become opportunities to improve and deliver better service to customers.

A summary of the timescale of “FIRM G” is presented in the table below (Table 6.17).

**Table 6.17 Timescale of "FIRM G" since the entrepreneurial event in 2007 until 2013**

	2000–2003	2004–2007	2008–2011	2012–2013
Entrepreneurial event		2007		
Business Plan				
Legal creation			2009	
New Shareholders				
First innovative product commercialisation			2008	
First sales of the first product			2008	
- Change of roles			2009	
- Establishment of TMT			2009	
Incubation (Acceso Virtual unipersonal)		2005–2008		
Key decisions:				
- Funding				
- Awards or certifications				2012Inngenio,
- Memberships or alliances				2012&2013Accenture
- Spin-off(s)				

#### 6.2.1.8 "FIRM H"

THE FIRM (Running a newly established firm):

"FIRM H" was incubated in Acceso Virtual SAS. "FIRM H" is a spin-off of Acceso Virtual unipersonal. Although "FIRM H" was legally created in April 2012, one of the founders (JM) had been offering a similar product since 2005. "FIRM H" (fonomarketing SAS) is an application that automates phone calls, it has several functionalities such as surveys, following up debtors, invitations and confirmation of events, among others. "FIRM H" also offers the possibility to propose a new idea for the application, creating it and using it.

"FIRM H" was designed by a team of software developers who are part of the NVT, they are shareholders of the product. This firm had worked with the technological capabilities of its three software developers and one web designer. Fonomarketing SAS holds the patent for commercialising "FIRM H" and the trademark of its name.

Although "FIRM H" does not have any partnership, the CEO worked with Parque E – Opinno in designing the business model and developed eight different applications of the service. Their customers are local organisations that used the initial version of the service and are interested in the updated version. "FIRM H" aims to offer a platform of services to entrepreneurs interested in growing its businesses.



### THE NEW VENTURE TEAM (Organisation of the founding team):

“FIRM H” was initially created by VS and JM. JM’s background was presented in the previous section because KKatto is one of the spin-offs that were created by JM. A summary of JM’s and VS’s backgrounds before starting-up “FIRM H” are presented below, followed by how they decided to work together and how and when they decided to enter new members into the NVT. “FIRM H” evolved very fast because of several reasons, for instance, the level of development of the core product (it was sold before by the partner organisation, Acceso Virtual) and the level of involvement of the CEO and the several members that had a part in starting up and establishing the firm.

JM did not finish any undergraduate program; however he has been developing software since 1998. He taught some software development courses while he was at high school in 2001. That same year, he created his first firm. JM has created four firms in which he has been the CEO. His expertise as a software developer, a manager and an entrepreneur is very high; he has developed these roles for more than eight years. Moreover, his interest in starting up firms in the software industry began when he realised that people wanted to pay for technologies that he could develop.

VS holds a major in business from Universidad de Medellín. She did not have any expertise as a software developer or manager. She worked for JM developing material for one of “FIRM G”’s products (one of JM’s firms). She has been interested in becoming a manager since she was in the second year of her undergraduate degree. She always thought she wanted to become the CEO of a large company, however once she started her third year she did an internship and realised that she did not like having a boss because it tends to restrict her, *“then in the fifth semester I say, well I self analyse and ask myself if I’m willing to take orders all the time? (...) and that was for a particular situation and I went to do an internship at a company and when I received orders I felt embarrassed to be proactive and self-conscious of many things, then that definitely said I have to analyse well what I want to do”*.

VS started working for JM in a particular project of “FIRM G”. VS was working in media, developing material for educational videos. JM states that he observed that VS has the potential to reactivate “FIRM H” and invited her to become the leader of this process. At the same time, VS identified the opportunity to improve the product while having a director role.

JM had offered their employees the opportunity to become shareholders of the products if they become involved in their improvement. VS had the idea of transforming this product into the solution of many firms that needed to make campaigns using automatic phone calls.

Fonomarketing was a technology developed by JM eight years ago, but because its target market was different from education, this product was not included in the set of technologies particular to “FIRM G”.

JM identified the potential of this product, he knew that it could become a “Silicon Valley type of product”: social, viral and easy to commercialise. JM expresses *“That it (the product) would be viral, social, it was that sort of thing that did not live from institutional sales but one-dollar sales, then the main motivation was like making a model out of millions of dollars from many one-dollar sales, this is the origin of the whole idea”*. JM and VS have the intention of improving this software by adding more code, updating the platform and language and developing a new business model.

VS proposed a business plan with a business model that was easily scalable. Since AS was a shareholder of this product they presented him the business plan but AS decided to leave his shares because he believed it was not possible to make it work: *“at one point AS walked away saying he does not believe in “FIRM H”, and that he had no more money to risk”*.

Before legally creating “FIRM H”, VM started to search for talent to become part of this new firm. She had a vision that she described in the business plan, and it was approved by JM and AS. However, it was an idea for transforming an existing product into a new bigger product. This software needed to be updated and recreated; what she considers the starting point of “FIRM H”.

VS defined the profile of the people that they needed in the start-up. They developed the minimum feasible product and a preliminary campaign to launch it. This allowed them to validate that the product was useful and there were people interested in it. They contracted a firm for the testing, an accountant (contract by hours) and JM became a strategic mentor that helped to make decisions.

VS tried to obtain the support of the entrepreneurial department at her university but it was not possible because this department does not have an standardised process to support the students’ initiatives. She states that this university does not promote entrepreneurial behaviour: *“they never educate you, the methodology is not to become an entrepreneur, it is to become a manager or an employee in a large firm; they do not promote the potential entrepreneur”*.

VS did obtain the support of Parque E, however JM states that its support was incomplete because they contracted a firm to help “FIRM H” with an activity, but it was an hourly contract in which the task could not necessarily be completed, thus “FIRM H” would have to

pay for more hours to finish it. *“These supports are relative (...) for example they are going to help with the agreement with users, so what they do is they pay a firm to make the agreement, and the firm comes and begins writing something and leaves it in half and says they have ran out of hours, that the park did a contract for hours rather than results,(...) then the firm passes us an invoice of five million pesos to complete the process (...)”*.

VS participated in a programme coordinated by Parque E and INNPULSA in which they used CANVAS to develop the business model and the business plan. She also obtained some relevant legal information regarding property rights for commercialisation of the product and shares of a firm. She is grateful for the several types of support received from the park, *“but with them we have had very good things (...) we began to take advantage of all the entrepreneurial stages around them, then we started, we started to participate in conferences, started going to investment events with them, we started to improve many business processes thanks to them, as the legal and financial part”*.

“FIRM H” was created with four shareholders: JM, VM, VL and Web Programo. Web Programo is a start-up composed of three software developers (A1, A2, A3); all of them are Informatic Engineers from Politecnico Jaime Isaza. All of them have worked as freelancers for 10 years and one of them was an employee at “FIRM G” but he resigned. Each member of this start-up has 3% of the shares of fonomarketing. A1 met A2 and A3 at high school; A1 was a friend of A2’s brother.

Two of the software developers decided that they did not want to be employees. One of them expressed his interest in becoming an entrepreneur with around 20 to 25 employees. None of these software developers had any certification because when searching for a job or new customers they have been asked to show what they can do. *“Nobody asks for certifications, when developing they never ask certifications but what you can do, or you know, come and prove that you know to do something, you are never asked for certifications or study (formal education)”*. However, they all have finished an undergraduate degree in Systems Engineering and have worked as software developers for more than eight years. Webprogramo became part of “FIRM H”’s NVT when two previous software developers did not perform as expected and were fired.

VL is another member of fonomarketing NVT. At the begging VL had to work not only as a web designer but also as a software developer. VL holds two majors; one in Graph Design and the other in Business Management. He worked as a graph designer for 7 years (1989 to 1996), and he created his first firm in 1995. His dream was to become an entrepreneur to have more

time and be financially free: *“my dream, I understood in my life, was to be an entrepreneur, not to generate millions and millions and own Google and work there 20 hours a day, no, not because I have a very close example, I have never been money-oriented (...) but so what? I think it's a combination of a lot of things, and most do not even give money, most things that make one happy, then I wanted I said I want to start a business that generates me money and time, (...) then the marketing networks arrived (...) we did it and thank God that (being financially free) happens right now”*.

He has been a lecturer at several universities in Medellín at the same time that he has been an entrepreneur. His role in Fonomarketing was mostly in web design. He was not in charge of any managerial task. VL met JM when JM was starting up Parque Soft Antioquia in 2005. However, he decided to become part of this NVT because he knew JM and he liked the product and the idea. *“It really was that they were looking for people and JM placed the call on Facebook, and I've always admired JM because I find him very smart, enterprising, also a very good person, and I was already retired as serial entrepreneur, three years ago, (...) I was taking a break but I wanted to start again and ahh I did, when I saw the announcement I said I will speak to him, if he needs someone there and I can support him and do business together, let's do it, then I called him and I said ok let's do it (...)”*.

VL left “FIRM H” the same day that he was interviewed for this research. He said he needed a new stage, he is a salesmen of AMWAY; his family business which is very profitable. He is financially free because he had created firms that allow him to be an entrepreneur without having to worry about his family survival expenses. *“I create it and once it runs fine, once I have money well I can focus on undertaking lighter entrepreneurship without having to think how I am going to pay electricy bills, rent and the whole story, then I thank God for this moment of my live that I can do it, so that is why we entered “FIRM H”, it went fine, we did well thank God, we enjoyed the process but we need another stage”*.

The following table (6.18) presents a summary of the human capital of the NVT when they started “FIRM H”. Entrepreneurial knowledge and market knowledge were tacit and high because there were two serial entrepreneurs in the team. Technical knowledge was explicit and tacit because there were three systems engineers with high expertise developing software. Managerial knowledge was mainly explicit because the CEO has a bachelor in business but no expertise; however, both entrepreneurs (JM and VL) assumed the role of mentors which added a tacit component of entrepreneurial and managerial knowledge. It can be concluded that they had a multidisciplinary team with a complementary, related and specialised knowledge base.

**Table 6.18 Summary of HC of the NVT when "FIRM H" was legally created in 2012**

NAME	JM	VS	Webprogramo	VL
CODE	F1	F2	F3 (A1,2,3)	F4
Gender	M	F	M	M
Age	20s	20s	20s	30s
<b>Current Position</b>		CEO	None	None
<b>Formal Education</b>				
High school	Y	Y	Y	Y
Undergraduate	N	OnProgress	Y	Y (2)
Postgraduate	N	N	N	Y (x)
Research group	N	N	N	N
<b>Previous Expertise (years)</b>				
Technical Expertise different to software development	0	2	0	7
Technical Expertise in software development	13	0	10 (3)	17
Managerial Expertise: Project director or department director	0	0	0	0
CEO Expertise	9	0	0	17
Entrepreneurial Expertise	9	0	0.5	17
Number of firms created	4	0	OnProgress	8

VS is the CEO; she is the leader of "FIRM H", she assumed leadership roles with the customers, suppliers, entrepreneurial network and the team. JM is one shareholder and he assumed a mentor role. VS and JM make decisions. VL is the website master and Webprogramo the software developers. In 2013, they were analysing the possibility of entering two more shareholders that were not employees of the company thus they would not be enrolled in the operational activities of the firm. They were also starting to build the TMT. In August 2013, the founder team was changing, the shareholders were JM, VS (the CEO), VS and Webprogramo (a start-up of software developers) but they were bringing new investors and building the TMT.

#### PRODUCTS-SERVICES (Idea development and commercialisation)

As it was presented before, "FIRM H" emerged as an opportunity to improve an existing product. The improved version can be used online, have a broader target market (not only organisations but any person interested in the service), a different business model and a wider number of simultaneous phone calls for customers.

The main source of feedback in the development stage has been the NVT and one of the customers. They have used the preliminary versions to adjust it. This information is mainly tacit and related to how the product can become closer to the business idea and easier for the customer to use. They meet periodically with the customer, a preliminary customer of the initial version, and their feedback has been useful in the developing stage. VL considers that their feedback was very useful and pertinent: *“interaction with customers was invaluable to us because it helped us to envision a lot of things that we ourselves had not thought”*.

Technical knowledge needed to develop the software has been provided by the shareholders. It has been a result of teamwork since “FIRM H” could not afford to pay a software developer, thus A1 offered the service of webprogramo and this is the main reason why webprogramo, instead of one of the software developers, became part of the NVT (shareholders and employees). Sometimes they have needed more people to meet deadlines and webprogramo decided to involve all its team in the development of the software. *“When product development began, we needed a software developer, I told you that we launched the call, right?, then A1, who had contact with Acceso Virtual, told us that they were interested, when he said they were interested, we said ahh, but we cannot pay the software because it is more expensive than paying only one employee (...) then we saw that we needed to contract all of them because the process was very slow, then they as partners did not charge us more than if it was an employee but all were integrated in the project, then the three of them began to be part of the development process (...)”*.

A summary of the timescale of “FIRM H” is presented in the table below (Table 6.19).

**Table 6.19 Timescale of "FIRM G" since the entrepreneurial event in 2007 until 2013**

	2000–2003	2004–2007	2008–2011	2012–2013
Entrepreneurial event			2011	
Business Plan				2012
Legal creation				2012
New Shareholders				
First innovative product commercialisation				2013
First sales of the first product		2004		
- Change of roles				
- Establishment of TMT				
Incubation (Acceso Virtual unipersonal)		2005–2008		

## **6.3 Summary and Conclusions**

### **6.3.1 The regional system of entrepreneurship of Medellín**

The formal regional system of entrepreneurship for NTBFs in Medellín (Figure 6.1) represents a general model in which the key agents (Universities, Parque E and CREAME) have a specific task in the value chain of entrepreneurship (Figure 6.2). However, the narratives of the eight cases selected in the ICT cluster allow the conclusion that there are more local agents (Tecnoparque, Parque Soft Antioquia, Ruta N) playing important roles in the value chain of entrepreneurship. Figure 6.13 presents the regional system of entrepreneurship for NTBFs developing software in Medellín in 2013.

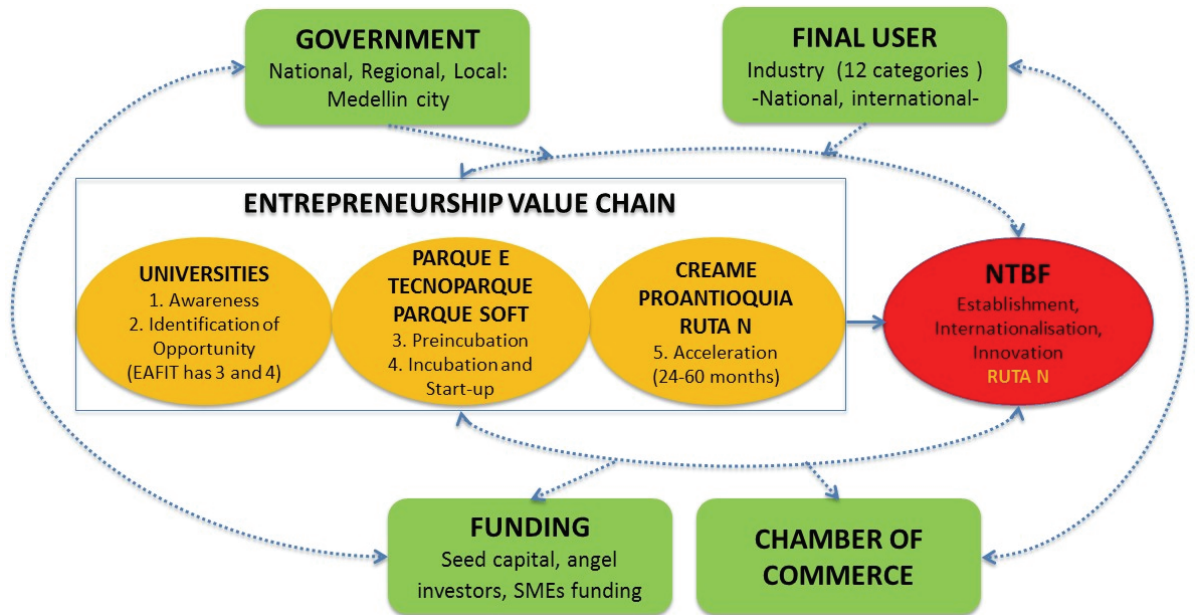
It can be also concluded that this system is dynamic and laws related to entrepreneurship have had an impact on the creation of intermediaries and NTBFs in this cluster. This can be evidenced because new products or new firms were influenced by the action of any of the agents. These agents (Ruta N, Colciencias, Parque E, CREAME, Tecnoparque, Parque Soft Antioquia) were created because of their policy of supporting entrepreneurship and competitiveness. As a consequence, it can be suggested that national, regional and local entrepreneurial policies have had an impact on NTBFs in the ICT cluster of Medellín.

It is important to notice that, although entrepreneurs come from four different universities in Medellín, only one of the universities (EAFIT) has an internal system of entrepreneurship in which entrepreneurs are supported in the preincubation stage and are strongly encouraged to start-up a new firm.

### **6.3.2 Value chain of entrepreneurship in Medellín and stage of the firms**

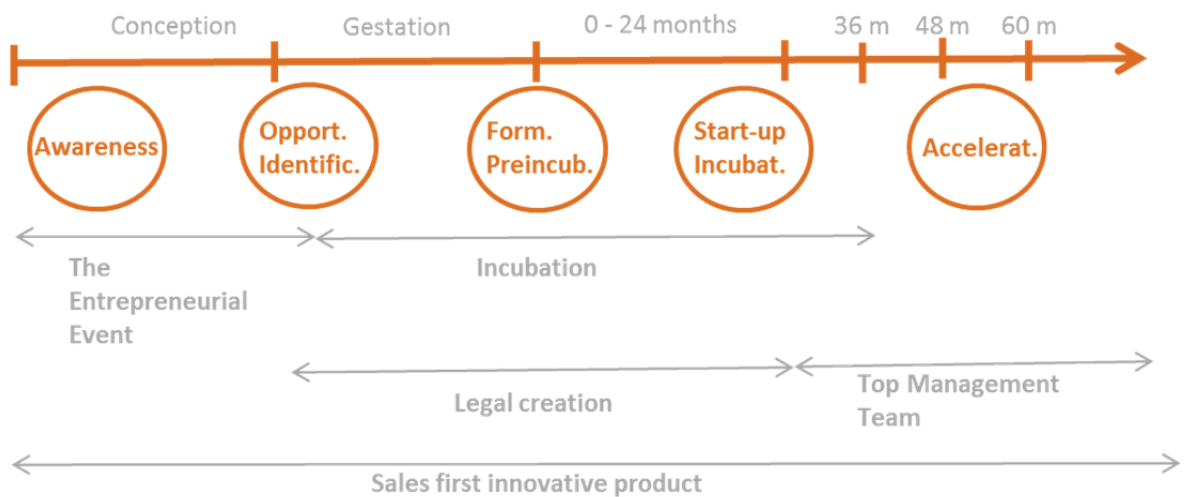
A list of key events in the emergence of NTBFs were identified: the entrepreneurial event, the business plan creation, legal creation, incubation, definition of the TMT. These events can be linked to the value chain of entrepreneurship (Figure 6.2). When comparing the eight cases, it can be seen that two of the oldest firms, “FIRM A” and “FIRM F”, have more than 20 employees. In particular, “FIRM G” has more than 20 employees, however, this firm was legally created in 2009 (five years old) and it was created with all the employees because it was created as a transformation of unipersonal firm into an S.A.S.

**Figure 6.1 Regional System of Entrepreneurship for NTBF in Medellín, ICT Cluster**



Source: Own elaboration.

**Figure 6.2 Key events identified in the value chain of entrepreneurship**



Source: Own elaboration



“FIRM G” is not the only case for which creation was based on a unipersonal firm, “FIRM C” and “FIRM H” were too. Therefore, it can be concluded that the creation of NTBFs in this cluster has benefited from the law in which the type of firm S.A.S. was created. This type of firm is ideal for teams of shareholders that want to be included in tax exemptions.

Regarding incubation, only two of the cases were not incubated; three were incubated in another firm and three were incubated in an incubator or a technological park. It can be suggested that when the entrepreneur has personal financial resources to start up a firm, they do not need to be incubated. It is interesting to notice the role of Parque Soft Antioquia in some of the cases. Four of the cases had relationships with this agent, however, in one of the cases the NVT decided to continue its incubation in TecnoParque Medellín because it did not have any cost associated.

Only two of the cases have not a TMT yet, this can be related to an early stage (before acceleration) or to the entrepreneur’s perception that the current team is skillful enough to make the firm grow. In three of the cases, TMTs were chosen once new shareholders became part of the firm (“FIRM A”, “FIRM C” and “FIRM H”). It is important to notice that the NVT is composed of founders that are employees and make decisions, in contrast, TMTs are not necessarily shareholders or founders.

The sales of the first innovative product can happen once the entrepreneurial event is identified, for instance the case of “FIRM D”. It can take years for a firm to develop the first innovative product and sell it. For example, “FIRM E” sold its first innovative product five years after the firm was created. The next chapter will present a comparative analysis to understand better how the first new innovative product is developed and sold.

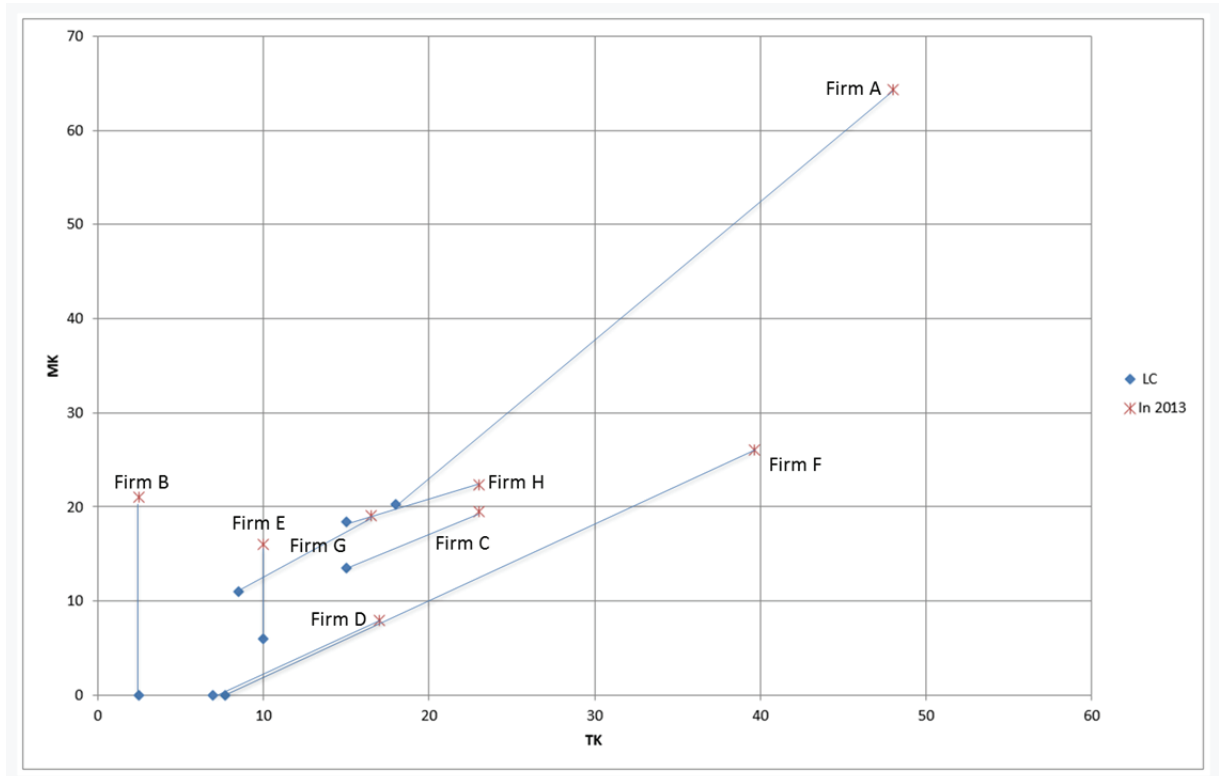
### **6.3.3 Similarities and differences between cases**

All eight cases selected (1) offer software, thus they are part of the ICT cluster; (2) were created in Medellín; (3) have sold (at least once) an innovative product; and (4) the opportunity driver to create the firm can be identified.

There was an attempt to utilise polar cases to consider a surrogate of technical and market knowledge (Section 4.6.2); nevertheless, after collecting detailed information and analysing it, a new surrogate was developed for both dimensions. Two cases can be categorised as the polar cases: “FIRM A” with the highest level of knowledge and “FIRM B” with the lowest

level of knowledge. Figure 6.3 presents the categorisation of the selected cases considering an improved surrogate (measurement scale) for technical and market knowledge (Section 4.6.2); in this figure the path for each NVT since the legal creation of the firm until 2013 is presented.

**Figure 6.3 NVT technical and market knowledge of the eight cases at legal creation (LG) and in 2013**



Expertise in developing software was identified as an important component of technical knowledge, as are formal education in management and expertise as a manager or as an entrepreneur key components of market knowledge. An improved surrogate of MK considers the expertise of the members of the NVT in managerial positions (including being a CEO, a director or a coordinator) and in an entrepreneurial position (in the case of serial and portfolio entrepreneurs).

From Figure 6.3 it can be seen that:

- (1) When firms were legally created the level of technical knowledge was different in all the cases but the level of market knowledge was the same for entrepreneurs that did not have formal education or expertise in business.

- (2) When firms did not have any new member of the NVT working in software development, the firm's level of technical knowledge was the same when the firm was created *and* in 2013. This is a path which was followed by two firms: "FIRM B" and "FIRM E".
- (3) Two firms showed a significant increase in the level of market and technical knowledge (more than 300%, see measurement scale in Section 4.6.2): "FIRM F" and "FIRM A".
- (4) Four firms have an increasing level of market and technical knowledge: "FIRM H", "FIRM G", "FIRM C" and "FIRM D".

When understanding what type of knowledge integration took place when creating the firm and developing and commercialising the first innovative product, it is relevant to consider how related, complementary and specific the knowledge base of the NVT was. A summary of the formal education of the NVT and a description of the knowledge base of the NVT are presented in Table 6.20. Chapter 7 will describe and analyse the different types of knowledge integration that took place in each case.

From Table 6.20 it can be seen that:

- (1) One case had a complementary knowledge base when creating the firm: "FIRM B".
- (2) One case cannot be categorised because there was not an NVT, the firm had only one founder: "FIRM E".
- (3) There are only two cases with related but complementary and specific knowledge bases in 2013: "FIRM A" and "FIRM F".
- (4) One case had a large NVT (seven members), in this case some of them have a related technical base, some of them have specific knowledge bases. In general, it can be said that the NVT had complementary and specialised knowledge bases: "FIRM H".
- (5) Three of the cases have related technical knowledge base: "FIRM C", "FIRM D" and "FIRM G".

It is important to remember that two firms ("FIRM A" and "FIRM F") were nine years old when data were collected, and that only "FIRM H" is less than two years old and the other firms are between three and seven years old. This has implications for the expertise of the NVTs between when the firm was created and 2013.

**Table 6.20 Summary of NVT knowledge base: how related, specific or complementary?**

Name	Entrepreneurs' formal and informal education: (1) When legally created (2) In 2013 (if there is new information)	Classification of NVT Knowledge base	
		When creating the firm	In 2013
<b>"FIRM A"</b>			
JW	(1) Technologist in Systems and undergraduate in Business management.	Related technical knowledge base. Specialised.	Related, but complementary and specific.
JJ	(1) Technologist in Systems with certifications in software development. (2) SCRUM Master.		
SC	(2) Informatics engineer with MBA. SCRUM Master.		
AC	(2) Systems and Informatics Engineer with specialisation in software development. SCRUM Master.		
<b>"FIRM B"</b>			
OM	(1) Industrial Engineer.	Complementary and explicit.	
GM	(1) Electronic Engineer.		
<b>"FIRM C"</b>			
CC	(1) Anthropologist and Informatics technician.	Related technical knowledge base.	Related and specialised technical knowledge base.
VC	(1) Informatics engineer. (2) Specialisation in software development.		
<b>"FIRM F"</b>			
P	(1) Systems Engineer. (2) MBA.	Related technical knowledge base.	Related, but complementary and specific.
JD	(1) Systems Engineer. (2) Master in Software Architecture.		
E	(1) Systems Engineer. (2) Master in Software Development.		
<b>"FIRM E"</b>			
F	(1) Systems Engineer.		
<b>"FIRM D"</b>			
AP	(1) Electronic Engineer.	Related technical knowledge base.	
JP	(1) Electronic Engineer. (2) Training in course in domotics.		
<b>"FIRM G"</b>			
JM	(1) High School.	Related and specialised knowledge base.	
AS	(1) High School (AS learned basic programming from JM).		
<b>"FIRM H"</b>			
JM	(1) High School.	Complementary and specialised.	
VS	(1) Undergraduate in Business Management (in progress) (2) Finishes undergraduate programme.		
Webpr	(1) Three Informatics Engineers.		
VL	(1) Graph Designer and undergraduate in Business Management.		

Findings suggest that all cases had different needs concerning knowledge when the firm was created and they have followed their own paths to develop and commercialise innovative products. The next chapter presents an analysis of what patterns they followed to manage new and prior knowledge while developing organisational capabilities.

## Chapter 7 COMPARATIVE CASE ANALYSIS AND PROPOSED THEORY

The objective of this chapter is to present data and a descriptive theory regarding how entrepreneurs manage knowledge in Medellín's entrepreneurial ecosystem. This chapter is organised in three sections. The first section is a comparative study about the nature of knowledge integration activities in NTBFs; this analysis is based on data from the second stage of this research and includes data illustrations of entrepreneurial activities that NVTs developed to process new knowledge. This section addresses the third research question: *What is the nature of knowledge integration activities (KI) in NTBFs created in the regional entrepreneurial ecosystem of Medellín?* The second section discusses the key findings of this research, this section includes the first and second stages of the data collection, and is organised in four subsections: the entrepreneurial process, the ecosystem and its networks, knowledge integration and NVT capabilities. The third section describes a theory of knowledge management in NTBFs in an entrepreneurial ecosystem.

### 7.1 Comparative study of knowledge integration activities

To overcome the liabilities of newness, the importance of two aspects has been identified: networks and teams. Networks are recognised as the most important source of resources for new ventures because the literature states that efficient networks enable access to resources by providing key new information (Hoang and Antoncic, 2003). However in particular, NTBFs' most important resource is knowledge (Yli-Renko, Autio and Sapienza, 2001) and most new ventures in technology sectors are created by teams rather than by individuals.

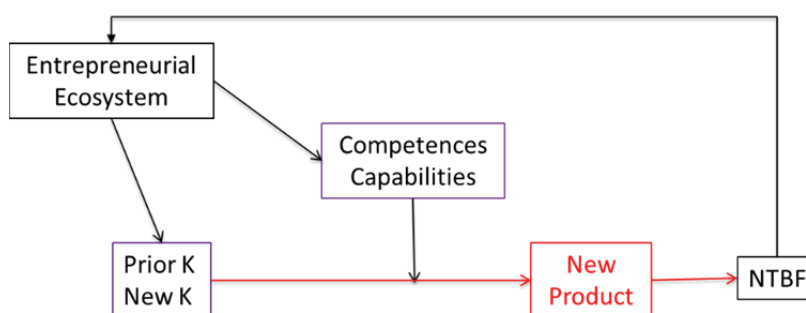
The review of existing literature relevant to an understanding of the role of knowledge and learning in NTBFs presented in Chapter 3, suggests two dimensions to consider: the external and the internal. As Adler and Kwon (2002:21) state, "the distinction between the external and internal views is, to a large extent, a matter of perspective and unit of analysis". Thus, for the

purpose of this research, external makes references to the relations that members of the new firm have with friends, colleagues, mentors and any person in the surrounding industries and markets (following Bourdieu's definition of external social capital); internal makes reference to the relations between the members of the new firm, entrepreneurs, shareholders and employees (following Fukuyama's definition of internal social capital).

The external dimension proposed in this research is composed of several broad groups: entrepreneurial systems, systems of innovation, business ecosystems, innovation ecosystems, global innovation ecosystems, entrepreneurial networks and knowledge networks. Entrepreneurial ecosystems are business and innovation ecosystems composed of dynamic and active networks of organisations supporting entrepreneurs. The entrepreneurial ecosystem is the external perspective used in this research.

The internal dimension proposed in this research is composed of three broad groups: knowledge, capabilities and competences. Each of them has different theoretical frameworks. However, they represent the set of attributes that entrepreneurs and their teams need during the entrepreneurial process. For the purpose of this research, the knowledge-based view is the theoretical lens from which it is more convenient to explore how entrepreneurs integrate their PK with new knowledge while developing and commercialising new products (NP) in NTBFs in early stage entrepreneurial ecosystems. Figure 7.1 presents an integrative model including the external and internal dimensions of effective learning in NTBFs, this model considers elements discussed in the literature review chapters and presented in models 3.3, 3.7 and 4.2.

**Figure 7.1 External and internal dimensions of effective learning in NTBFs**



Source: Developed by author (Black boxes: organisations, purple boxes: intangibles, red box: tangible outcome).

Knowledge management literature on new firms has not clarified the importance of knowledge heterogeneity when creating and establishing a firm. Moreover, it has not been clarified exactly what are the implications of knowledge heterogeneity and relatedness in NTBFs. To help contribute to the understanding of these variables and their relationship with knowledge management in NTBFs, this section is organised into four subsections. The first presents the external and internal sources of knowledge, the second presents the several types of knowledge acquisition and entrepreneurial learning, the third presents the several types of knowledge integration activities practised by firms and the last comprises a summary of the findings.

### **7.1.1 External and internal sources of new knowledge**

Regardless of the multiple efforts to understand how NTBFs are created, established and grow, there is still a lack of understanding of how NVTs manage their most important resource: knowledge. Entrepreneurs manage resources, but the most valuable resource they manage is their knowledge and also, by implication, their sources of knowledge. From this perspective, for the purpose of exploring how entrepreneurs learn it is assumed that knowledge includes information, capabilities, competences and abilities. To contribute to the description of the entrepreneurial process of NTBFs this section is organised into two subsections, market knowledge and technical knowledge (See Section 3.6).

#### ***7.1.1.1 Sources of new technical knowledge (TK)***

Some firms acquired new technical knowledge by outsourcing, gaining more employees, education, and by expertise gained while developing and commercialising new products. Table 7.1 presents evidence of the different activities that entrepreneurs do to supply their technological knowledge needs when developing and commercialising a new product.

“FIRM A” and “FIRM F” have increased the level of TK by hiring many software developers at the same time that their NVTs acquire new technical knowledge from informal and formal education, for instance, three of the members of the NVT in “FIRM A” became SCRUM Masters and two of the members of the NVT of “FIRM F” gained Masters related to software development. In contrast, members of the NVTs of “FIRM B” and “FIRM E” have focused their efforts on developing the firm’s networks and strategies and their roles have been mainly

managerial. They have hired software developers as employees (new TK) while the members of the NVT have focused on acquiring MK.

**Table 7.1 Sources of new TK in each case: data illustrations**

Case	Source of new TK	Quotes
“FIRM A”	New member (employees)	<i>It was because he had more needs and the people who were assigned at that time were not enough to meet them, then he allowed us to hire more people</i>
	New member (NVT)	<i>(...) I invited three people to become part of the company with a small participation in the shares, (...) I have 55% of the shares, they are people that bring technical know-how, (...)</i>
“FIRM B”	Outsourcing	<i>What was the strategy that we did? The software was outsourced, that is because to pay a systems engineer was very expensive for us, so what we did is, we hired a company to develop the software, a company that charged a low cost</i>
	New member (employees)	<i>Look Elizabeth what we have wanted when we developed a project is (...) to develop a product is not easy and additionally it is very expensive, so we've developed projects funded by the government to help us leverage wages for people, (...) then we develop our product, our software platform, we hired staff for this project(...)</i>
“FIRM C”	Formal education	<i>My partner and I, VM and I started a specialisation in developing applications for mobile devices, I did not the finish (the specialisation), he did, if then they have developed (...) because as a, as almost all of our firm has revolved around the entrepreneurs' technical capabilities</i>
“FIRM D”	New member (employees)	<i>Then new partners (product partners) entered, the web designers, G and C (all software developers)</i>
“FIRM E”	New member (directors)	<i>The clinical director has been more focused on all of the technology that we are trying to create for the management of cardio-stroke (...) he is, we also have a research director who has also been working on some projects (...) some research topics</i>
“FIRM F”	Formal education	<i>E was studying (a master in) software engineering, then let's say that I took mine on the side of human-computer interaction, it was slightly different from software engineering, I was also thinking to complement each other</i>
	New member (employees)	<i>Well, there are nine software developers, more or less</i>
“FIRM G”	(Only developed by the NVT and employees)	<i>Technical developments have depended on me, then my partner was developing the skills and abilities, today it depends a bit more on him, but let's say that all products have my code, but I still develop software, our development team grew for related products (...) then let's say that in the technical subject, my partner and I continue to be at the heart of developments and we hire engineers for specific tasks</i>
“FIRM H”	(Only developed by the NVT)	<i>VL, the designer, was responsible for making all the visual parts of the platform (...) Web Programmo program was responsible for developing and integrating all that design to development (...) I have been as I have always been at the head of the team and I'm like the one that gives vision</i>

Source: Developed by author



Other firms, such as “FIRM C”, “FIRM H” and “FIRM D”, are micro firms in which members of the NVT work as software developers. They are part of the technical team that develops the software for their companies. “FIRM G” is a particular case in which software developers have been hired (they represent a third of their employees) but it was not a micro firm when it was legally established because its entrepreneur was offering services for more than five years before the legal creation.

New technical knowledge was needed to satisfy customers` needs or to develop new business ideas. This new knowledge was used to create the new product and to modify the existing technology. In some cases this new technical knowledge was acquired from existing members of the NVT who had the expertise or who engaged in formal education to develop the skill. In other cases, new employees were hired or freelancers were contracted to supply the need. The selection of this human capital is mostly based on their ability to prove what they know, in some cases they have to present an exam or they are recognised for their previous developments. While most of the cases prefer to use their internal technical knowledge (employees including the NVT), one of the cases decided to contract a freelancer because it was less expensive than hiring a software developer.

### **7.1.1.2 Sources of new market knowledge (MK)**

Some firms acquired new market knowledge from customers, others from intermediaries, others from experience because of a failure or from customer feedback. Table 7.2 presents evidence of the several activities that entrepreneurs do to obtain the market knowledge they need.

**Table 7.2 Sources of MK in each case: data illustrations (Part A)**

<b>Case</b>	<b>Source of new MK</b>	<b>Quotes</b>
“FIRM A”	Experience	<i>One deep reason that I say that there was not (...) the process that we had defined, it was a process that does not allow to have that, to interact more directly with the customer, because the process was to some extent, was very waterfall, and from that point of view this issue was waterfall, I think that didn't allow a very direct channel of communication to exist, but it was that I always got all the documentation, did all the testing, then all the analysis, after I do all the analysis, I do all the design, and I was disconnected from the user then let's say that we interacted with each user only sometimes and those moments were distant, I think partly it was also a bit the process that we were taught to always make software (...) we were taught to do it that way and we thought that was the best way</i>

Source: Developed by author.

**Table 7.2.** Sources of new MK in each case: data illustrations (Part B)

Case	Source of new MK	Quotes
“FIRM A”	Feedback-Customer	<i>It is easier to say how many of the 180 (employees) did not interact with them (with the customers) (...) the methodology (SCUM) allows us to make and correct mistakes very soon because there is a daily interaction with the customer.</i>
“FIRM B”	Intermediaries	<i>Then they advised us about the private partnership agreement, with the constitution of the minutes, then let’s say that all started there (...) Then everything was like a chain, then Cultura E led us to Creame, Creame took us and introduced us to Sena, Sena introduced us to Coomeva, in Coomeva thanks to the events we got the third partner, and thanks to the third partner we met the fourth partner, thanks to fourth partner we’ve known potential clients with whom we are finishing to fix stuff to go international, then everything has been like a chain and a construction on the road, because one continues to grow steadily</i>
	Feedback (customer)	<i>We started ISO9001 – 2008 – many years ago, but when we came to use it, right now in April 2012</i>
	New member (partner, investor, no employee)	<i>And at that moment we met our first partner who is a distributor of Comcel (...) we saw him as very strategic because he had all the sales force and worked directly with Comcel, (...) then we saw it as a very good alternative, then he joined the company (...) he was the second investor who entered the company, once he enters he also gives us a sales force because he has his salespeople, (...) and let’s say that that also had good results</i>
	Experience (Failure)	<i>We did not make money, then the product slowed sharply, we couldn’t sell to other farmers’ customers, and we began to diversify, we said, good, if this sector does not respond we must seek other sectors, we started with health (...) fundamentally the health sector was like the next sector that helped to expand a little more, and then we started to open energy applications, public energy, monitoring industry (...)</i>
	Outsourcing	<i>We have never had a commercial area, we are just realising that there are four businesses within a company, all with high growth potential, but we created a trading scheme as do companies like Clear, as Movistar, with commercial agents, with distributors</i>
“FIRM C”	Experience (Failure)	<i>I started to visualise again, as everything was not as highly planned, or it was more my intuition telling me, well what do we do, and I was missing something, work, (...) we work more and earn less than X time</i>
	Feedback (customer)	<i>The market because customers will know, or by reference to other people who know what the company needs, and if we see that it (the suggestion of the customer) fits within what the product is, we include it (in the product)</i>
	Intermediaries	<i>In fact at Parque Soft, let’s say we were the largest (firm), (...) but we had a very local vision of the matter, that interaction with the people there (at Parque Soft) was very valuable to us, I think that was the most significant though the most painful thing</i>

Source: Developed by author.

**Table 7.2.** Sources of new MK in each case: data illustrations (Part C)

Case	Source of new MK	Quotes
"FIRM D"	Experience	<i>By the end of 2010 we had a break and we said no, we will not continue selling websites because that is not our core, then we said no to the companies that we were working with (...) we said we will not work on that anymore; on the other stuff, yes, we can still offer that, because we saw that, we say, we saw that in comparison with the year, we saw that the difference in returns on interactive products and web pages was very, very, very big</i>
	Feedback customer And experience	<i>(...) What is usually done is that the sales team are A and J, they met with the client, the client says its need (...) at the beginning, as the company did not have a large amount of games, every time a customer had a need we had to do a new development for this client who has a need, and over time we have tried to reuse what we have already done</i>
	Intermediaries	<i>And we saw other guys, very young people working on entrepreneurship, and that motivated us in Parque Soft, then let's say that the company start-up with that context of this park, then through Parque Soft began arriving as the first official customer (...)</i>
"FIRM E"	Feedback (Customer, CofP)	<i>What happens is that the director of research and clinical director are also people who have other activities that work hand in hand, (...) then we try to get the space to work together and advance the project when it is required of them, (...) Canada has an important team that is available to the development team, and we then, what we do is to represent that knowledge in software (...)</i>
"FIRM F"	New member (partner, investor, no employee)	<i>When this person became a member of us, he moved everything a lot, invigorated everything a lot, allowed us to gain new customers quickly, even got a physical space to keep us working (...) this new partner was also helping with the administrative part and accounting</i>
	Intermediaries (EAFIT)	<i>That was more because EAFIT arranged another (meeting with a potential customer) (...) then the idea of having that product was from the client, it was not that we sat down and said let's develop a product</i>
	Feedback (customer)	<i>Actually the product has always been created working hand in hand with customers, true, customers are asking us things and we annexed them to our product, some of them are only for a few customers, some are published for all, but that's how the product has been offered</i>
	Experience	<i>The customer buys the generic product, but we have to integrate the generic product to our servers, because we have all of the servers, we have to integrate our servers to client servers, right, to make that step of automatic information, then that part required much specific development</i>
	Formal education	<i>Precisely we were missing knowledge in the financial part, on the part of marketing, rather in all other areas (...) it was not the technique, then I always liked more sales, marketing, management, then I decided I would do an MBA and that matched with what we wanted in the company</i>
	Mentor	<i>Pro-Antioquia which helped a lot with some programs they have, it has been very beneficial for us (...) we were assigned to an executive (a mentor) (...) we started to produce information about our strategy and all that stuff, many things that we didn't have the academic background for (...)</i>

Source: Developed by author.

**Table 7.2.** Sources of new MK in each case: data illustrations (Part D)

Case	Source of new MK	Quotes
“FIRM G”	Feedback (customer)	<i>Our products come with constant metric mechanisms, then we realise where they are used (...) then there are feedback mechanisms after the product is delivered (...) say we begin to apply certain strategies to measure the market but that is only happening a year ago</i>
	Intermediaries	<i>SENA was key, Dario Montoya was key in this story, he gave us visibility, that's one of the things that promotes entrepreneurship</i>
“FIRM H”	Intermediaries	<i>(Parque E helped) with Opinno (using CANVAS) and in obtaining intellectual property (...) But that is only the rights of Software, because trademark registrations were done with another company</i>
	Feedback (customer)	<i>I think that, that interaction with customers for us was invaluable because it helped us to glimpse a lot of things that we ourselves had not thought of</i>

Source: Developed by author.

New market knowledge was obtained from (1) customers by different activities such as daily interaction, feedback mechanisms and teamwork, (2) experience by reflecting on profits and failure, (3) intermediaries by offering access to new customers, advice regarding vision, visibility, support for obtaining IP protection and a common space to interact with other entrepreneurs facing similar circumstances, (4) new members with experience and networks, (5) mentors with expertise, and (6) formal education related to sales, marketing and strategic management.

Some firms like “FIRM A” and “FIRM F” have focused on working collaboratively with customers in order to improve their products, services and strategies. ISO and customer satisfaction metrics have been pursued by the entrepreneurs in order to keep their customers satisfied. They learn from failure and from listening to the feedback from customers. *“There were happy projects and not so happy projects. What happens is that a customer, a customer gave us a project that we started and (...) 15 days before the deadline, we found many problems, we realised that all we did was garbage. We had misunderstood, there were all types of mistakes, we had to start the project again. We lost a year, then we invited the customer to see that we had to make it different”* (Firm A).

Some firms such as “FIRM D” and “FIRM B” identified that interactions with the first customers were key when deciding their focus of interest regarding the type of service they would be offering, the target market and the strategy to enter new markets or to increase their market size. By contrast, some entrepreneurs (“FIRM G”, “FIRM C”, “FIRM E” and “FIRM H”) were working on similar products or services before starting up these firms, thus they did

not perceive that the relationship with the first customer had some failure associated with it. Nevertheless, they stated that they made changes in their strategies and their new core product or service based on the understanding of the potential of their core competences while interacting with their customers. For instance, “FIRM C” identified its potential core competences in a new market by improving some of its strategies, and it decided to create a new firm and to develop and commercialise an innovative service.

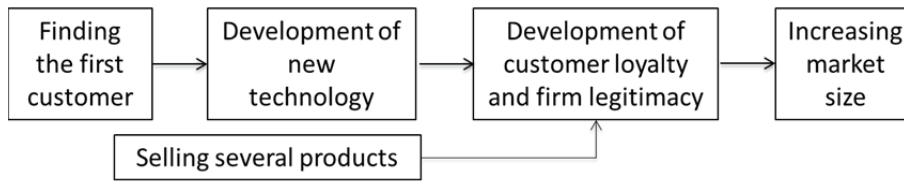
When the new product-service was completely new for all the entrepreneurs involved and there were no previous customers, entrepreneurs stated that the first two years had a particular failure associated with sales, and it was related to the lack of understanding of the needs of the target market. Thus, for four of these NTBFs (“FIRM A”, “FIRM F”, “FIRM D” and “FIRM B”), the relationship with the first customers was difficult.

In some circumstances, firms decided to make radical changes. For instance, two of the cases (“FIRM F” and “FIRM B”) changed their target market and adapted the technology to the new target market. Another case (“FIRM A”) decided to focus only on bespoke software and the other case (“FIRM D”) developed another new product because it identified that the target market of the first product had a particular cycle.

The relationship with the customer was key for firm establishment. In order to summarise, four stages could be identified in which learning from its customer, and, therefore, this relationship (customer-NVT), evolved (Figure 7.2):

- a. Finding the first customer. Different forms of finding the first customer emerged from the data. In the four cases in which the firm did not have a preliminary product-service that was sold before by any of the members of the entrepreneurial team, there were two forms of accessing the first customer, through previous contacts of any of the entrepreneurs or through contacts with the entrepreneurial ecosystem in which they were involved (an incubator, a university or an event in which they participated).
- b. Developing new technology (and improved versions of the initial technology) while working with the customer or observing customer behaviour. Almost all the firms were selling multiple products/services while developing the new technology (the first innovative product).
- c. Developing customer loyalty and firm reputation. “FIRM A” has followed a product development strategy (SCRUM) in which daily communication with the customer was prioritised, in order to supply their needs more efficiently and with efficacy.
- d. Increasing market size.

**Figure 7.2 Customer relationship and firm development**



Source: Developed by author.

Regarding the exploration of new knowledge from failure or critical moments, for instance, “FIRM D” was going into bankruptcy because it did not know that the publicity industry was inactive during the first semester of the year. They learned that because they could not sell any product during the first semester. *“After a while projects stopped coming, and then we discovered that the market also has cycles and that was in 2009, in 2008 we started to sell in the second half of 2008, we were not selling anything by the first half of 2009, or very little, then we collided with the reality of what the market was, and we discovered that advertising would not sell anything in the first half (of the year), but we knew nothing and we were ready to continue working and there was no work, and many things we discovered, that even if we do not have a very complex business plan, at least a basic study about where we were going, it would have been helpful”.*

It is interesting to notice that two of the cases have outsourced their sales to distributors, this is the situation for “FIRM G” and “FIRM B”. Both cases are composed of entrepreneurs who do not have any formal education directly related to the products or services they have been offering. Both cases have also decided to sell their software with hardware. Thus their core competences have come to be associated not only with the software they outsourced but also with the platform they used in their equipment, both are exporting hardware from China in order to decrease costs in their production. Moreover, both have subcontracted distributors which are not the end user. This decision has implications for the profitability of their business because they have to share their profits with their distributors. However, their prices allow them to stay in the market offering unique services and their differentiation is based not only on the software but also on the support they offer.

Commercialising new technologies is an important task for a firm because it can determine its survival. All firms were aware of the importance of selling and many of them were selling standard services in the beginning but they sold enough to survive and have cash flow. In business, selling products to customers is important, but pricing correctly and making profit is

also equally important. Before CC and VM created “FIRM C”, they were selling products but could not make profits. Therefore, market knowledge implies not only knowing about the target market but also knowing about what to sell and how much. This implies the importance of having a basic knowledge base to understand the language of business.

Institutions supporting entrepreneurship or innovation played important roles in helping entrepreneurs to price their technologies, to develop market studies and business models, and to have a level of understanding of finance and accounting. *“We create the branding but the billing was through Parque Soft, it also helped to get the first customers (...) then say you came through the park, much knowledge (...) mirrors that we had from other companies helped us, if you had any doubt about how to budget something or how you had to manage an accounting issue that was one thing that helped a lot as well as support among the companies”*.

Although only three of the cases did not have any member of the NVT that had any previous entrepreneurial expertise (“FIRM F”, “FIRM D” and “FIRM B”), it is important to state that all NVTs had at least one member who was fully committed to the success of the new firm. It implies that they see entrepreneurship as a life project instead of a temporal stage of their lives. Moreover, in many of the cases entrepreneurs benefited from sharing with other entrepreneurs the place where their firms were incubated. This implies the importance of being part of a community where others were engaged with starting up a firm.

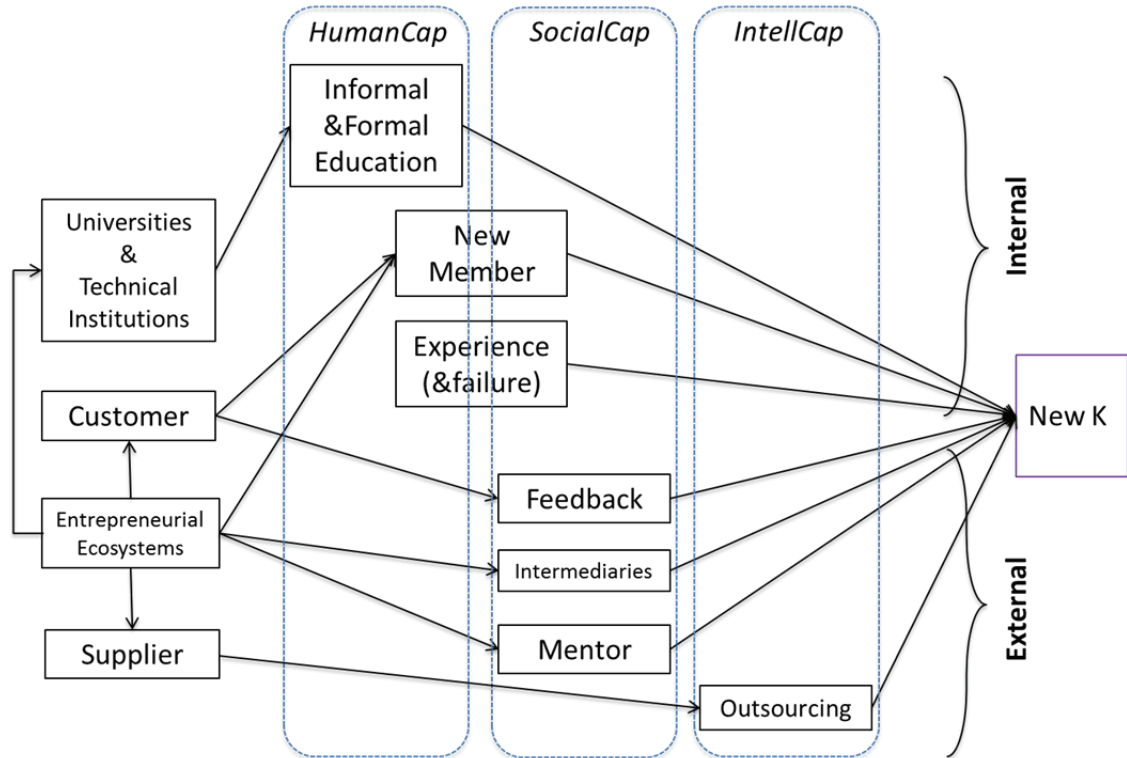
### ***7.1.1.3 Reflection on internal and external dimensions of knowledge management***

From the data, seven sources of new knowledge were identified. These can be categorised as internal and external when considering the firm as a unit of analysis; those inside the firm are classified as internal and those outside are classified as external. The four sources of external knowledge are: outsourcing, intermediaries, mentors and feedback from the customer. The three sources of internal knowledge are: experience, new members and formal education. Figure 7.3 presents these seven entrepreneurial activities that are source of new knowledge categorised in two dimensions: internal and external. It also presents the type of capital associated with each activity.

All activities were relevant for managing new market knowledge but some of them were not used to manage technical knowledge. Table 7.3 presents a summary of activities used for each

case considering the content of the knowledge. The next section will link these sources of new knowledge with the literature of knowledge acquisition and entrepreneurial learning.

**Figure 7.3 Sources of new knowledge in NTBFs created in Medellín**



Source: Developed by author.

As Mouritsen and Larsen (2005) state, there are two waves of knowledge management; one is focused on the creative individual and the second one on the network of knowledge resources. The first wave considers knowledge embedded in individuals and the second wave considers knowledge embedded in a practice, suggesting that there is set of knowledge resources involved in producing and creating value. This suggests the concern that intellectual capital is a field from which knowledge resources can be controlled by a management activity.

### 7.1.2 Knowledge acquisition and entrepreneurial learning

As presented in Chapter 3, Huber's model of knowledge acquisition has five forms: experiential, vicarious by observing other firms, vicarious by noticing or searching the organisation environment, grafting and congenital. These forms of knowledge acquisition can be linked with the several entrepreneurial activities that entrepreneurs from the eight NTBFs



performed to manage new knowledge. By doing so it is possible to link the several entrepreneurial activities in the cases with particular entrepreneurial learning types presented in Chapter 3. Key findings and relationships between theoretical categories of entrepreneurial learning and conceptual dimensions of Huber’s model are explained below.

**Table 7.3 Summary of data illustrations of internal and external sources of TK and MK**

<i>Entrepreneurial activities</i>	<i>New TK</i>	<i>New MK</i>
<i>Internal source of knowledge</i>		
New member	“FIRM A”, “FIRM F”, “FIRM D”, “FIRM E”, “FIRM B”	“FIRM F”, “FIRM B”
Formal education	“FIRM F”, “FIRM C”	“FIRM F”
Experience	All of them (Implicit)	“FIRM A”, “FIRM F”, “FIRM C”, “FIRM D”, “FIRM B”
<i>External source of knowledge</i>		
Customer feedback		All of them (Explicit)
Intermediaries		“FIRM F”, “FIRM C”, “FIRM D”, “FIRM H”, “FIRM G”, “FIRM B”
Mentor		“FIRM F”
Outsourcing	“FIRM B”	“FIRM B”

Source: Developed by author.

Outsourcing is not considered in Huber’s model of knowledge acquisition. None of the five categories of knowledge acquisition from Huber correspond to the acquisition of new knowledge by outsourcing. In this case, new knowledge is acquired by a freelancer who gives the property rights of software to the firm that contracted him/her.

Formal education is a form of grafting because when a member of the firm holds a new certification, this explicit knowledge becomes internal knowledge to the firm that is not possessed by the organisation yet. For instance, when the three founders of “FIRM F” finished their masters programmes while establishing the firm, they brought new knowledge to the organisation.

A new member is also a form of grafting because a new member is an internal source of knowledge. Although a new member can come from the entrepreneurial ecosystem or a customer, it is not considered a form of vicarious learning because the new member becomes part of the organisation and thus his/her knowledge comes too. For the firm, once a new member enters, this new member is internal to the firm and represents a stock of human capital (expertise and formal education), which is also part of an internal knowledge source for the firm that is not possessed by the organisation yet.

As presented in Chapter 3, the new firm has PK that corresponds to the knowledge-base of the NVT. This form of knowledge acquisition corresponds to the knowledge that was acquired at the organisation's birth (when the firm was legally created). This form of knowledge corresponds to congenital learning in Huber's model.

To summarise, Table 7.4 presents the several sources of knowledge, the theoretical dimensions of entrepreneurial learning and conceptual frameworks of Huber's model. As it was presented there is a source of new knowledge that is not included in Huber's model: outsourcing. It can also be stated that PK, experience and customer feedback require a mix of theoretical categories of entrepreneurial learning. PK implies considering Kolb's because this theoretical framework explains how individuals integrate knowledge and knowledge spillover because this theoretical framework explains how knowledge spills over the identification of opportunities to generate economic knowledge. Experience requires exploration because it implies experimentation, play, flexibility, discovery, and SLT; NVTs pursue the development and commercialisation of its products/services, they work in temporal communities of practice to achieve their goal. Feedback from the customer requires ACAP and external learning because the customer is an external agent that provides key information to improve the product/service, and exploration and situated learning theory (SLT) because the NVT with the employees of the NTBF have to assimilate this new information and use it, thus they experiment in order to solve a problem and improve the product.

**Table 7.4 Theoretical categories of entrepreneurial learning and conceptual dimensions of Huber's model**

<i>Sources of knowledge</i>	<i>Knowledge acquisition (Huber's model)</i>	<i>Type of knowledge (tacit or explicit)</i>	<i>Entrepreneurial Learning type(s)</i>
<i>Internal source of knowledge</i>			
PK	Congenital	Tacit and explicit	Kolb's
New member	Grafting	Tacit and explicit	Kolb's
Formal education	Grafting	Tacit and explicit	Kolb's
Experience	Experiential	Tacit (can be explicit too)	Exploration (March) SLT (Rae)
<i>External source of knowledge</i>			
Customer feedback	Experiential	Tacit	ACAP and ext. learning Exploration (March) SLT (Rae)
Intermediaries	Vicarious	Tacit	ACAP and ext. learning
Mentor	Vicarious	Tacit	ACAP and ext. learning
Outsourcing		Explicit	ACAP and ext. learning

Source: developed by author.

It can be seen that some of the sources of knowledge imply knowledge acquisition but some consider also other processes such as knowledge creation and exploitation, such as experience and outsourcing. This is why knowledge acquisition is not enough to explain the knowledge-related processes that NVTs execute. Additionally, NVTs use prior and new knowledge to achieve entrepreneurial growth, which is why all the sources of knowledge presented can be better linked with entrepreneurial activities that require knowledge integration capability, a particular type of learning that NVTs use when creating and establishing NTBFs.

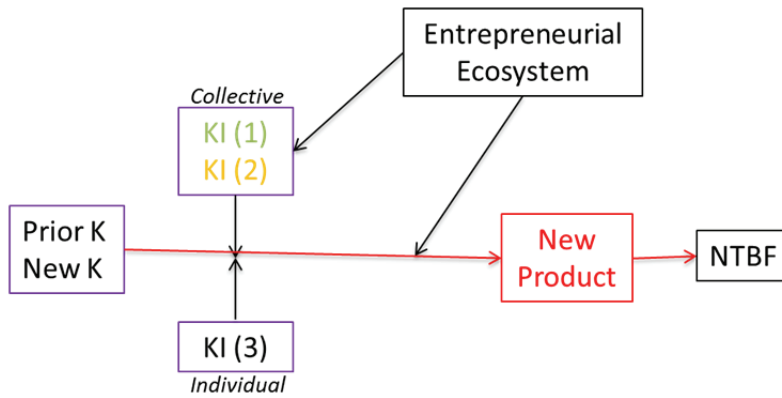
Although the literature review (Chapter 3) presented many different theoretical frameworks of entrepreneurial learning, only some of them are related to the different entrepreneurial activities used by the selected cases of NTBFs in Medellín. Given that data collection was related to technology sales, new knowledge was managed for product development (technical knowledge capability) and product commercialisation (market knowledge capability). This fact means that knowledge was integrated for developing and commercialising innovative products of the NTBFs. The next section presents the role of knowledge integration in the NTBFs of the ICT sector of Medellín.

### **7.1.3 Knowledge integration**

As was presented in Section 3.5.2, knowledge integration has three forms: external, internal and individual (Figure 7.4). The literature states that external knowledge integration (KI (1)) is mostly associated with ACAP, knowledge transfer and value generation. Internal knowledge integration (KI (2)) is associated with the ability to integrate knowledge within the members of the firm. Finally, individual knowledge integration is associated with an individual (or entrepreneur) assimilating knowledge that will then be exploited by the firm (KI (3)).

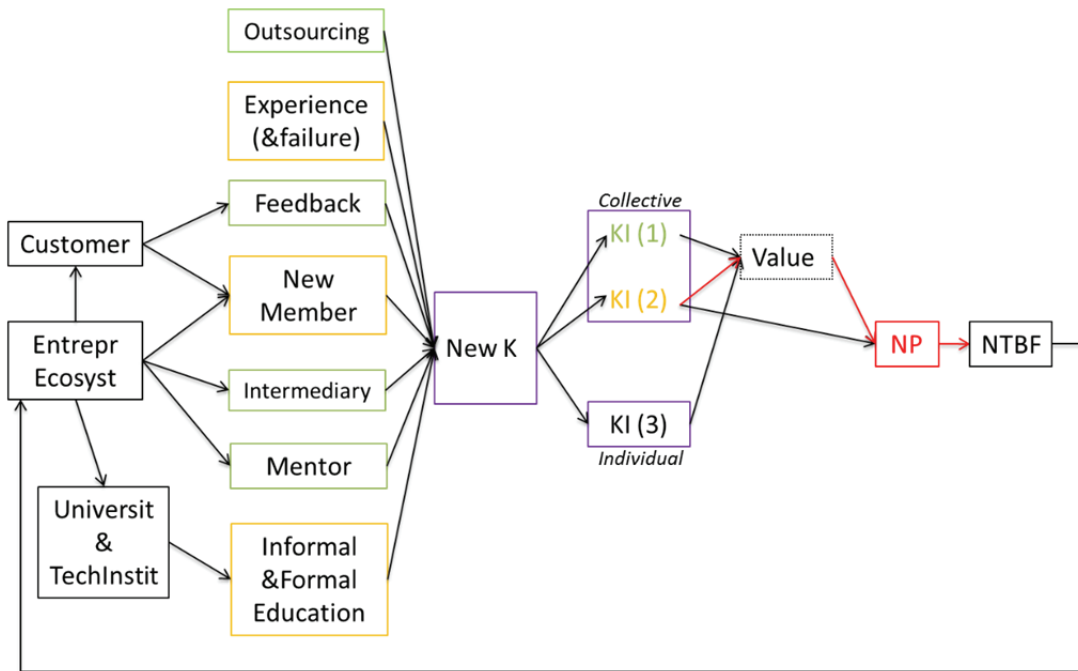
Figure 7.5 presents a comprehensive diagram including the several sources of new knowledge used when managing knowledge. Once knowledge is transferred to the firm by different entrepreneurial activities, this new knowledge is integrated to generate value and, therefore, support new product development and commercialisation. NTBFs survive when they are able to develop new products and commercialise them; knowledge integration allows the development of technical knowledge capability (TK) and market knowledge capability (MK).

**Figure 7.4 Knowledge integration types in NTBFs in entrepreneurial ecosystems**



Source: Developed by author.

**Figure 7.5 NTBF knowledge management in an early stage entrepreneurial ecosystem**



Source: Developed by author, based on an adaptation of Holcomb et al. (2009).

Each firm used both forms of KI (1 and 2). Table 7.5 presents four different types of knowledge integration used by the eight cases that represent the ICT sector in Medellín, an early stage entrepreneurial ecosystem. It is important to notice that if congenital learning is added to the framework, at least one of the members of “FIRM E”, “FIRM G” and “FIRM H”

had MK when the firm was created. Therefore, they integrated this PK with external and internal new knowledge (TK and MK) to develop and commercialise their products or services. Type A of KI corresponds to the integration of externally new MK, Type B of KI corresponds to the integration of internally new MK, Type C of KI corresponds to the integration of externally new TK, and Type D of KI corresponds to the integration of internally new TK.

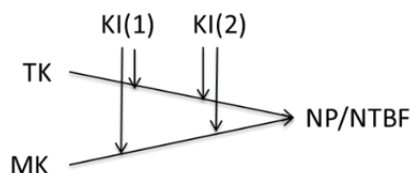
**Table 7.5 Different KI types used in NTBFs of the ICT sector in Medellín**

<i>Type of KI</i>	<i>MK</i>		<i>TK</i>	
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>CASE</i>	<i>KI (1)</i>	<i>KI (2)</i>	<i>KI (1)</i>	<i>KI (2)</i>
“FIRM A”	Yes	Yes	No	Yes
“FIRM B”	Yes	Yes	Yes	Yes
“FIRM C”	Yes	Yes	No	Yes
“FIRM F”	Yes	Yes	No	Yes
“FIRM D”	Yes	Yes	No	Yes
“FIRM E”	Yes	Yes	No	Yes
“FIRM G”	Yes	Yes	No	Yes
“FIRM H”	Yes	Yes	No	Yes

Source: Developed by author based on Table 7.4 and Chapter 6.

From Table 7.5, two patterns of KI are identified, one is composed by the four types of KI and corresponds to “FIRM B” (Figure 7.6). The other pattern corresponds to three of the four types of KI, all of them except external integration for technical knowledge (Figure 7.7). This is because “FIRM B” did not have related knowledge in the NVT and it had the lowest level of TK and MK when it was created (see Chapter 6). Moreover, none of the members of the NVT had any software development expertise when the firm was created. The NVT of “FIRM B” knows the importance of integrating new knowledge into the firm, thus it used all of the various types of knowledge (A, B, C and D), and acquired new TK and MK using external and internal sources of new knowledge.

**Figure 7.6 Pattern of knowledge integration used by "FIRM B"**

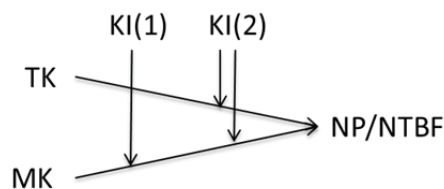


Source: Developed by author.

“FIRM G” and “FIRM H” are spin-offs from the same firm, whose entrepreneur is part of the NVT of both spin-offs. Regarding TK, “FIRM G” has hired software developers to increase its TK, five members of the NVT of “FIRM H” are software developers, three of them (a firm of software development) were invited to be part of the NVT to increase its TK. Regarding MK, both firms are aware that intermediaries and customers are good sources of information about their markets and about ideas to improve their products, enhancing their commercialisation. Moreover, these two firms and “FIRM E”, have used entrepreneurs’ prior MK to acquire customers and survive. Prior MK is an effective internal source of knowledge that has enabled these firms to develop and commercialise their products.

Firms like “FIRM A”, “FIRM F”, “FIRM C” and “FIRM D” have added new members to the firm in order to increase their TK, they have increased the human capital level of the firm. Moreover, they have used several sources of new knowledge (external and internal) to increase their MK. These firms developed TK using their internal technical capabilities (using only type D of knowledge integration) and using both types of knowledge integration (external and internal) to develop MK (using Types A and B of knowledge integration).

**Figure 7.7 Pattern of knowledge integration used by seven of the firms, apart from "FIRM B"**

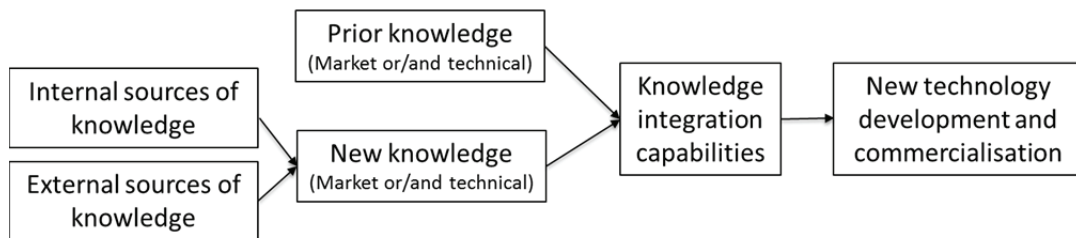


Source: Developed by author.

Regardless of the knowledge-base of the NVT, the specific content of knowledge that is required to create a specific type of firm and the origin of the opportunity, a new firm cannot exist without an entrepreneur or an NVT focused on creating and establishing the new firm by pursuing multiple goals such as performance, technology development and commercialisation, and competition and collaboration (Nambisan and Baron, 2012). A new firm cannot survive without acquiring, storing and using new knowledge that allows the firm to develop and commercialise its products. Learning processes allow firms to gain and maintain competitive advantage.

Figure 7.8 presents a model of effective entrepreneurial learning in NTBFs. NVTs use internal and external sources of knowledge and different types of knowledge integration capabilities to transform this knowledge into a new technology that is commercialised. Different levels and stocks of PK may influence the type of knowledge integration that the NVT uses.

**Figure 7.8 A model of effective entrepreneurial learning in NTBFs**



Source: Developed by author

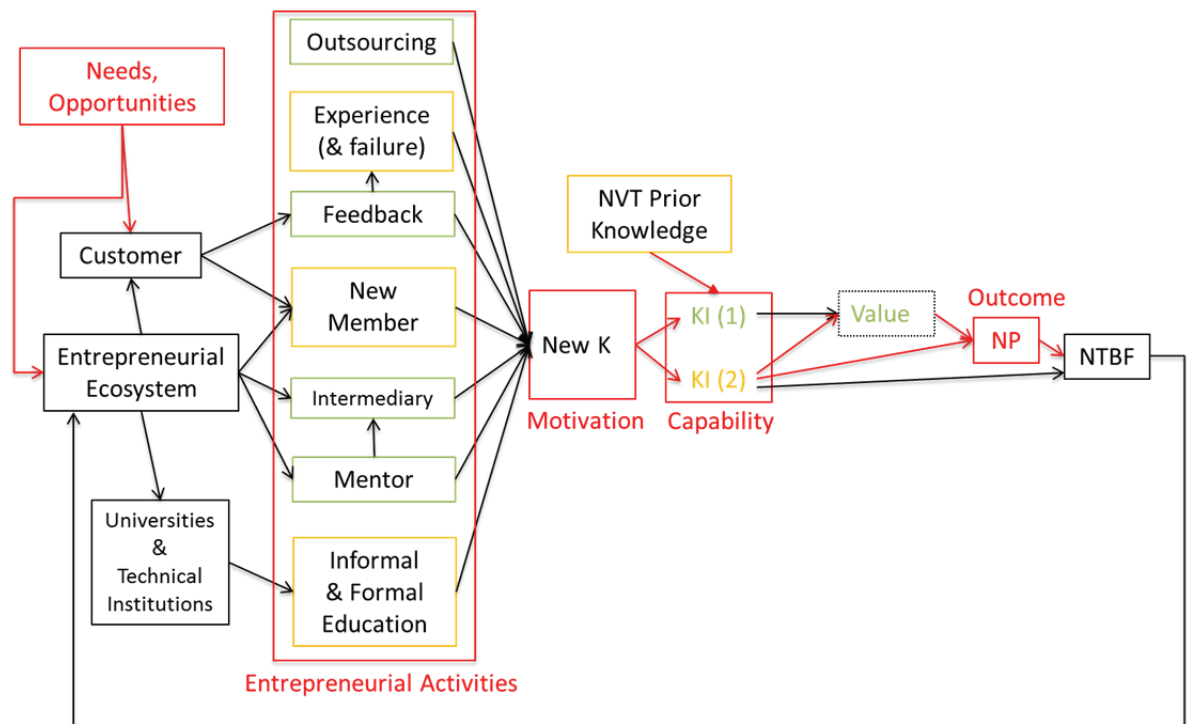
#### **7.1.4 Knowledge integration activities and firm substantive capabilities**

Needs and opportunities emerge from the customer and the entrepreneurial ecosystem. Entrepreneurs aimed to satisfy these needs and take these opportunities to acquire new knowledge (MK and TK) from external and/or internal sources and integrate it. NVTs are motivated to acquire new knowledge to develop and commercialise new products in order to help their NTBFs survive. This knowledge integration ability can be individual or collective, but even when there is only one member in the NVT, this entrepreneur uses external or internal sources of knowledge. This is why it is possible to simplify Figure 7.4 and consider only two of the forms of knowledge integration, external (1) and internal (2). Figure 7.9 presents a framework of NTBF knowledge management in an entrepreneurial ecosystem considering PK, needs, opportunities, motivation, ability and outcomes.

Entrepreneurs perform seven entrepreneurial activities to acquire and integrate new knowledge when developing and commercialising innovative products. They (1) outsource, (2) experiment and learn from failure, (3) listen to feedback from the customer, (4) add new members to the firm, (5) interact with intermediaries, (6) interact with mentors, (7) enrol in formal and informal education. Four of these activities are associated with external networks (suppliers, customers, intermediaries and mentors) and three of these activities are associated with internal networks (NVTs and employees).

Customers and other agents of the entrepreneurial ecosystem are sources of needs and opportunities. Entrepreneurs (aware of the need for technical or market knowledge) engage in different activities to improve their knowledge stock and develop and commercialise new products. Their prior knowledge helps them to assimilate new knowledge that is used to create and improve new products that are commercialised. Technology commercialisation is what enables NTBFs to be part of the value chain of their products and gain profits.

**Figure 7.9 Model of NTBF knowledge management in an early stage entrepreneurial ecosystem**



Source: developed by author.

When sources of new knowledge are external, knowledge integration is considered external and is associated with value generated by knowledge transfer and sharing. When sources of new knowledge are internal, knowledge integration is considered internal and it is associated with the generation of new knowledge by integrating its members' related and diverse knowledge bases. Regardless of the related or diverse PK of the NVT, all NTBFs used internal and external knowledge integration. However, only one of the cases used external knowledge integration to develop TK, the NVT of this case had a low TK related to the technology when

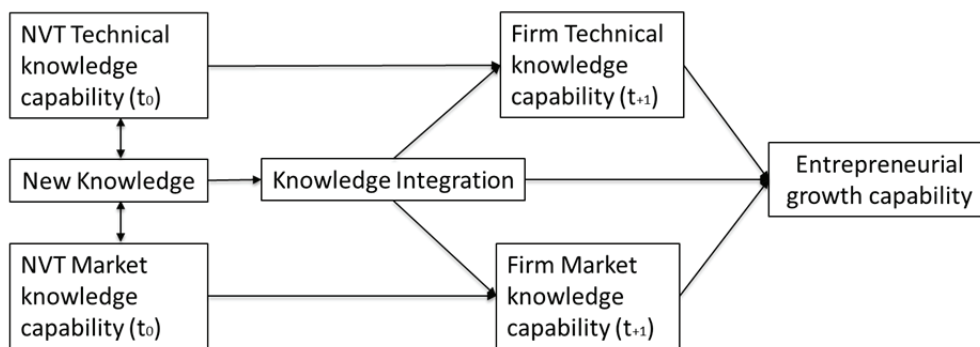


the firm was created. This case outsourced the software development and acquired the intellectual property of the software, this knowledge acquisition process had not been considered before in models of knowledge acquisition.

Four types of knowledge integration were identified that NTBFs use when developing and commercialising innovative products. NVTs knew that to achieve entrepreneurial growth they had to develop the MK and TK capabilities of the firm. The importance of knowledge integration in NTBFs was evidenced; this capability helps NVTs to create and establish their firms because they have to integrate new and PK to generate value and develop and commercialise new products.

Knowledge integration capability allows transformation of NVT substantive capabilities into firm substantive capabilities. Technical and market knowledge capabilities allow development and commercialisation of new products; NTBFs develop the capability for entrepreneurial growth by integrating their technical and market capabilities. Figure 7.10 presents the evolutionary process of entrepreneurial growth capability. Entrepreneurial growth capability allows the firm to survive and overcome the liabilities of newness while NVTs develop legitimacy, customer relationships and dynamic capabilities such as knowledge integration.

**Figure 7.10 Evolutionary process of entrepreneurial growth capability**



Source: Developed by author based on an adaptation of Zahra, Sapienza and Davidsson (2006)

In order to illustrate the several findings of this research, considering both stages of data collection and the findings presented in Chapters 5 and 6, the next section discusses four areas in which data contributed to understanding better how NVTs manage prior and new knowledge in NPD&C in NTBFs.

## **7.2 Key findings of this research**

The key finding for strategy management is the fact that not only the external conditions of the NTBF are important but also the internal ones; while some studies have stressed the importance of entrepreneurial ecosystems supporting entrepreneurs, others have stressed the importance of entrepreneurial behaviour and cognition to create and establish new firms. Both intra-organisational and inter-organisational relationships are important in NTBFs. This can be evidenced by the facts that (1) more NTBFs are being created in ecosystems in which entrepreneurship is highly supported and entrepreneurs have access to knowledge from external organisations (2) although the chosen firms have different initial levels of prior knowledge, NVTs are creating and establishing NTBFs.

Entrepreneurs and their entrepreneurial ecosystems are interrelated; it can be defined like a co-dependent system in which each needs the other to survive. Knowledge transfer and sharing are the two capabilities that members of the entrepreneurial ecosystem, regardless of the stage of evolution, use to support new ventures. It is the openness to share which makes the ecosystem dynamic, its dynamism works as a magnet for entrepreneurs to face the challenge of creating and, even more, establishing a new firm.

This section is organised in four subsections with the aim of discussing findings that emerged from analysing the data and answering the research questions.

### **7.2.1 The entrepreneurial process in NTBFs**

The findings of this research challenge the stream that suggests that the entrepreneurial process is a linear sequence of events, the entrepreneurial process consists of simultaneously operating sub-processes. During the preliminary start-up stage, the pre-entrepreneurial process, entrepreneurs had the intention of creating a business and they did, however, in some of the cases there was not a precipitating event but a deliberated and planned action to create it. In some cases the opportunity was being exploited before the business was created, but entrepreneurs decided to create a new firm to formalise the role of the several shareholders and improve the development and commercialisation of a product.

The process that entrepreneurs follow when creating and establishing a firm is chaotic in the sense that there is not a linear set of stages that all entrepreneurs follow. The entrepreneurial event can happen just by coincidence or be articulated with a strategic alignment of resources, or be an outcome of a permanent awareness of any opportunity to exploit. The sale of the first product can also emerge as an unexpected coincidence or as a result of active networking with potential customers, or indeed as an anticipated outcome of the marketing strategy. Incubation is a common route when the founders do not have enough financial resources and are pursuing initial cash flows to survive the valley of death. In some cases, legal creation was linked to the creation of policies regarding taxes and the need to build a team to start up the firm.

There is a quasi-random arrangement of the several events that occur when creating and establishing a firm. The researcher identified several common events in the firms of this study: (1) the entrepreneurial event, (2) legal creation, (3) incubation, (4) building of the TMT, (5) sales of the first innovative product. Although there is not a linear sequence between them, there is a quasi-random arrangement in which some events have to happen before others. The entrepreneurial event has to happen before the incubation and the legal creation. Sales of the first innovative product can happen at any time, even before the legal creation. Given that the entrepreneurial event is the manifested desire to create a firm, the legal creation cannot happen before it, or the incubation, however it is possible that a product is being sold before becoming the core product of a start-up. In some occasions, the legal creation occurs before or during the establishment of the TMT, although it is not common that the TMT is built before the legal creation, in the case of a spin-off it is possible that the TMT is already chosen and they start its roles once the firm is legally created.

It is also interesting to notice that entrepreneurs pursue several opportunities at the same time. While they were developing the first innovative product, they were also selling other products; they do so in order to maintain cash flow. This entrepreneurial behaviour is called entrepreneurial ambidexterity and refers to the ability of the entrepreneur to pursue several goals simultaneously. They work with the customer to satisfy new needs but also to improve existing products. They acquire new knowledge that can be used to detect an opportunity and also to commercialise a product. All of them are aware of the importance of offering quality in their products, thus they develop customer loyalty.

Some of the NVTs were not afraid of growing, thus they hired more employees and explored new markets, not only locally but internationally. Some cases were very conservative in their growth and adopted two opposite perspectives. One case outsourced software development, utilising external technical capabilities and contracting freelancers for specific products only

when they obtained financial resources from winning entrepreneurial competitions. In another case, entrepreneur expressed that he preferred to have control over the firm's technical capabilities, thus their products were offered only with the capabilities of their software developers. This case did not have any market strategy at the beginning and was working only to supply its customers' needs, and it was not aimed at growth.

### **7.2.2 The ecosystem and its networks**

Although the chosen entrepreneurial ecosystem represented a region of Colombia, Medellín, it was observed that some national and international organisations were also important sources of financial resources and legitimacy for NTBFs. Therefore, this ecosystem can be considered a global entrepreneurial ecosystem, compared to the global entrepreneurial ecosystem described in Zahra and Nambisan (2011), this ecosystem is not created by a central actor, it is the result of several types of organisations (governmental, academic and industrial) interacting with entrepreneurs.

The ecosystem surrounding entrepreneurs is a permanent source of opportunities in which needs arise from customers, more education can be obtained from universities and technical institutions, and intermediaries can provide mentors and key information for new members of the NVT or the board or for more employees. Regardless of the level of formal education of the entrepreneurs or the initial knowledge base of the NVT, they will seek new knowledge in the ecosystem.

The external environment is a source of opportunities and new knowledge for entrepreneurs. It is an open space in which NVTs can acquire new information that can be useful for exploring opportunities and commercialising new technologies. Therefore, entrepreneurs need to be wise enough to decide what opportunities to follow and how to fulfil their needs. They also need to be flexible enough to adapt to the external conditions of the ecosystem and the industries they want to enter. They also have to be strategic enough to choose their more convenient path to interact with the ecosystem.

Entrepreneurial ecosystems in which there are many organisations that support entrepreneurship can be encouraging for start-up firms. They provide knowledge in basic accountancy and legal issues that novice entrepreneurs do not know. Moreover, entrepreneurs can get financial resources by winning business plan competitions or being incubated because

they do not have to pay electricity bills and rent. Intermediaries can also help to gain access to new customers or to gain credibility.

Multilayers of networks in which organisations interact compose the entrepreneurial ecosystem – this implies that entrepreneurs can engage in multiple networks. In the case of NTBFs, organisations supporting innovation and entrepreneurship compose their ecosystems. Given that NTBFs are a form of technological transfer, innovation becomes one of the key activities that NVTs pursue, which is why organisations supporting innovation and technical clusters are also part of this entrepreneurial ecosystem.

The entrepreneurial ecosystem of this research is characterised in three ways: (1) Strong support from the local government that provides financial resources to boost the economic system by encouraging collaboration and support for firms interested in developing new products and to entrepreneurs interested in creating and establishing new firms. (2) A culture supporting entrepreneurship. (3) Multilayers of networks promoting and enhancing entrepreneurship, innovation, collaboration and competition.

### **7.2.3 Knowledge integration**

Regarding the debate as to whether knowledge integration is a process that teams develop after or during knowledge transfer (Berggren et al., 2013), findings from this research suggest that both forms of knowledge integration are used to achieve entrepreneurial growth. Members of the NVT in an NTBF can have related or complementary knowledge, nevertheless they are aware of the need for new knowledge and they acquire it using external and internal sources. They use external and internal knowledge integration regardless of the knowledge base of the NVT.

External knowledge integration is associated with ACAP, external learning, exploration and situated learning (Zahra and George, 2002, Cohen and Levinthal, 1990, March, 1991, Lave and Wenger, 1991, Theodorakopoulos and Figueira, 2012). All NVTs used external knowledge integration when developing market knowledge. Only one of the NTBFs used this form of knowledge integration when developing technical knowledge.

Internal knowledge integration is associated with Kolb's model, knowledge spillover, exploration and situated learning (Kolb, 1984, Kolb and Kolb, 2005, March, 1991, Lave and Wenger, 1991, Theodorakopoulos and Figueira, 2012). All NVTs used internal knowledge

integration when pursuing entrepreneurial growth. NVTs used their PK and expertise (and failure), some of them included a new member and some of them acquired more formal and informal education. This finding reinforces the literature regarding the importance of communities of practice, not only with external agents to the firm, but also within the members of the firm. It can be said that entrepreneurs organised temporal communities of practice and work within the NVT and/or the employees when pursuing commercialisation of new technologies and establishing the firm.

#### **7.2.4 NVT capabilities**

Regarding the debate about the role of PK (Section 3.4), no particular pattern of knowledge integration to each of the configurations of NVT PK was identified. NVT PK (or congenital learning) presented four different configurations in the cases of this study: (1) related technical knowledge base, (2) specific and complementary knowledge base, (3) related, specific and complementary knowledge base and, (4) complementary and specific knowledge base with some related technical knowledge base among the members of the NVT. Regardless of the NVT knowledge base at the point of legal creation, NVTs use external and internal knowledge integration.

It is important to notice that the NVT knowledge base corresponds to the level of human capital that was estimated for each of the cases. Thus in all NTBFs the level of human capital of the NVT (formal education plus experience) increased since its legal creation until 2013. This growth in human capital is directly related to the age of the firm and can be increased more if any of the members of the NVT gain individual knowledge through formal and informal education. If members of the NVT are engaged only with commercialising the product, the level of technical knowledge of the NVT remains constant. However, the level of technical knowledge of the firm can vary; it depends whether the employees are engaged with developing the technology.

When members of the NVT do not have a related knowledge base regarding the technology they want to develop, they used different types of knowledge integration for processing market and technical knowledge. They outsourced in order to pursue product development and they obtained the property rights for commercialising the business idea. This form of knowledge acquisition is a conceptual contribution to Huber's model of knowledge acquisition.

Members of NVTs work together and with others, they assign and assume roles in order to achieve multiple goals. They constantly use and develop their internal and external integration capabilities, and are aware of their lack of knowledge and manage external and internal sources of new knowledge wisely. They learn through reflection, flexibility and resilience; and although these three topics emerged during the analysis of the second stage of the methodology, they are not addressed because of the lack of relevance to the research questions pertaining to this research. Additionally, these behaviours are evident in the aims that all NVTs pursue: to establish the new firm and to commercialise new products. NVTs reflect when managing new and PK, adapt to external and internal conditions and recover fast from difficulties.

NVTs are in charge of the on-going daily operational activities that build the new firm (Klotz et al., 2014). They spend their time developing useful technologies to offer to selected markets that can change over time. It can be stated that when members of the NVT have not related knowledge base with the technology they want to develop, they use external knowledge integration when developing the technology. If they have a related knowledge base with the technology they want to commercialise, they only use internal knowledge integration for developing the technology. However, all the cases used internal and external knowledge integration for developing market knowledge. Market knowledge is acquired not only from external sources (not only ACAP) but also from internal ones.

As was presented in Section 3.6, market knowledge and technical knowledge capabilities include not only explicit knowledge about how to commercialise the new product and how to develop a technology, it also includes tacit knowledge that is created once the firm engages the pursuit of both activities. The successful outcome of both is a result of having used information, capabilities, competences and abilities. Since all of these were not observed or measured in this research, it is the successful development of a new technology that is sold which evidences that both substantive capabilities have been integrated and the new firm has developed substantive and dynamic capabilities that help the NTBF to survive.

Development of organisational capabilities requires making decisions and acting. Although there is not an explicit reference to decision-making and action in these findings, both components are embedded in the core capabilities of this study: knowledge integration, market knowledge and technical knowledge. NVTs need to make decisions and act when they are developing and commercialising a technology.

### **7.3 A descriptive theory of entrepreneurial learning in NTBFs**

This section presents a descriptive theory to explain how entrepreneurs manage prior and new knowledge when they are creating and establishing the new firm. Little is known about how early stage entrepreneurial ecosystems contribute into the acquisition and creation of new knowledge in NTBFs. Moreover, there is not a theory of knowledge management for NTBFs and a theory of such would help entrepreneurs and organisations supporting entrepreneurship to develop better mechanisms to acquire and integrate knowledge.

The theory of knowledge management presented here integrates the role of entrepreneurial ecosystems and NVTs in NTBFs. Entrepreneurs use a particular form of learning in which they manage external sources of knowledge such as intermediaries and internal sources of knowledge such as formal education. This particular form of learning is called knowledge integration and has different forms. It can be internal or external, and it can be associated with the integration of different substantive capabilities.

#### **7.3.1 The role of entrepreneurial ecosystems**

As was presented in Chapter 5, the entrepreneurial ecosystem of Colombia is composed of several regional entrepreneurial ecosystems that are at different stages. It was identified that the entrepreneurial ecosystem of Medellín was the most evolved in the country because several organisations were working together to define a formal value chain of entrepreneurship and they defined it in 2014.

Since none of the entrepreneurial ecosystems of Colombia had reached a stage in which the various organisations had a clear role in the entrepreneurial value chain, it was considered that none of the entrepreneurial networks was efficient when data were collected (2012–2013). This characteristic is considered a determinant aspect to categorise the entrepreneurial ecosystems of Colombia as being in an early stage of development. The national entrepreneurial ecosystem and the regional entrepreneurial ecosystems of Colombia were all in the early stages of development in 2013.

Four key factors were identified in the National Entrepreneurial Ecosystem: policies, entrepreneurial networks, talent pool and culture. The National Law of entrepreneurial culture created in 2006 was the mechanism that originated the creation of many organisations and programmes supporting entrepreneurship throughout the country. All these organisations are



expected to be part of the entrepreneurial networks that were proposed by the national law; however, there is a lack of coordination between the various agents. This lack of coordination is mainly due to a lack of trust and because organisations were competing for financial resources that have been offered by national and local governments (Section 5.1.2).

The interviewees stated that there is talent in Colombia to create NTBFs (Section 5.1.3), however, there are several challenges associated with this aspect, such as the lack of technological management capabilities in the entrepreneurial teams and the lack of commercial capabilities at the universities. Regarding culture, although a need was identified to change the mindset regarding entrepreneurs' vision and the public image of entrepreneurs, there are regional differences in the societal norms regarding entrepreneurship.

It was identified that Medellín has a supportive ecosystem for NTBFs in terms of (1) the several programmes offering support and financial resources to entrepreneurs because of the high level of local government support, (2) a culture that promotes entrepreneurship as a traditional path to engaging in the economic system, (3) the existence of multilayers of networks pursuing competitiveness, innovation and internationalisation. In Medellín, there is an institutional framework created by the local government in which entrepreneurs find a set of regulatory, social and cultural influences that promote survival and legitimacy. This ecosystem offers the possibility of engaging with several networks at the same time; therefore, the entrepreneur faces the challenge of choosing wisely which networks to engage with. This ecosystem meets the three characteristics of global innovation ecosystems presented by Zahra and Nambisan (2011): knowledge dispersion, diversity of knowledge and contextuality of knowledge.

Although interviewees in the first stage stated that none of the entrepreneurial networks were efficient, in one of the cases the entrepreneurs stated that it was the entrepreneurial network of the incubator that allowed them to find the first customer. In another of the cases, the university helped the entrepreneurs to reach the first two customers and to develop the first product, thus it was the network of the university that allowed them to start up the new firm. In several of the cases however, the relationship with the first customer was not maintained, instead this interaction gave the entrepreneurs new knowledge that was useful for further development of the technology and for reflecting about how to approach new customers or about the need to find new markets. In general, it was also identified that technological parks and partner organisations offered entrepreneurs the possibility of leveraging managerial knowledge that was basic for the operation of the NTBF.

It can be seen that even though several agents of the entrepreneurial networks expressed that the entrepreneurial networks were not efficient, findings from the second stage of this research allow the conclusion that organisations supporting entrepreneurship played important roles in the creation and development of new firms, particularly in the transfer of knowledge that was useful for commercialising the technology. The capability of some of the NTBFs to commercialise the technology (MK) was improved as a consequence of the interaction with the organisations supporting entrepreneurship in Medellín and Colombia. This benefit was mainly perceived by the NVT that did not have PK regarding management and did not have a network of potential customers when they started up the firm.

This finding suggests that NTBFs with low levels of market knowledge when created, benefit from the entrepreneurial networks of the organisations that they approach. The NVT has to have the ability to absorb the knowledge that the organisation can transfer to them. In fact, in all the cases NVTs absorbed new knowledge from the external environment to develop the existent market knowledge capability. Even in cases in which this capability was high when the firm was created, NVTs absorbed new knowledge from the customer. “Paradoxically, new ventures’ continuing participation in ecosystems depends largely on their ability to create and share new knowledge while taking advantage of the knowledge that exists in their networks” (Zahra and Nambisan, 2011:8).

The customer is an important agent of the entrepreneurial ecosystem. In all the cases, customers provided information to leverage the market knowledge capability. The relationship with the customer varies between the several cases studied in this research. For instance, in the two cases that presented the highest increase in the market knowledge of the NVT, the members of the NTBF have engaged in permanent interaction with the customer. This permanent interaction represented a permanent source of new market knowledge.

Firms with high market knowledge when the firm was created expressed that the information that the customer provided was essential for the improvement of the product. This improvement was reflected in the development of the technology because it allowed software developers to modify the product. New information about the customer’s needs was used to meet them; thus, this feedback was absorbed and used to improve the technology. This provides evidence of the role of knowledge integration capability in integrating market and technological capabilities.

Only in one of the cases has the technological knowledge capability been developed with the customer. It happened because the customer provided software developers, thus they were also

involved in the development of the technology. These practices might have impact on the development of the technological capability of the firm because the uniqueness of the technology is developed using the technological capability of the customer too. However, this is the firm which has grown the most of all the cases, which suggests that it has developed capabilities that allow it to grow. This firm has integrated knowledge from customers that have contributed to the development of the firm's market and technical knowledge capabilities, and has therefore integrated the technical competence of its employees with the technical competence of the customer. Moreover, they have integrated market information that is embedded in customers' need to improve their products/services. By doing so they have met the needs of the customer, which has in turn brought more new customers, more sales and the need for more employees.

The other case that demonstrated high levels of growth also developed a close relationship with the customer; however, this case has developed its technical capability inside the firm. Its market and technical knowledge capabilities have emerged as a result of permanent interaction with the customer at the same time that it has increased its number of employees and market size. This firm has international customers that have bought the company's core product.

It is necessary to mention that only one of the cases developed the technical knowledge capability with a supplier. They outsourced part of the development of the technology. These practices might have an impact on the development of the technological capability of the firm because the uniqueness of the technology is developed using the technological capability of the supplier too. They absorbed the knowledge and acquired the intellectual property rights over the technology, therefore the supplier cannot use the developed technical capability to compete with the NTBF. This form of integration can be compared with an external acquisition in which freelancers develop the software but the buyer commercialises it. There might be some risk associated with this form of knowledge integration, for instance, the NTBF might not have the core capabilities to adapt the technology to changes that are demanded by the market, or the supplier can decide to develop an improved version of the technology and compete.

To conclude, the market and technical knowledge capabilities of the firms of this study have been developed collaboratively with the customer, with the supplier and with the organisations supporting entrepreneurship. In doing so, the NTBFs have absorbed new knowledge regarding the needs and expectations of the customers and the several sectors that they entered. The entrepreneurial ecosystems have provided an environment to work collaboratively and compete with other NTBFs. "Being an integral part of the ecosystem has several important

advantages; overcoming gaps in knowledge/skills; gaining access to critical resources, including financial capital; and building important relationships, or social capital, that firms can use in allying to commercialize new technologies” (Zahra and Nambisan, 2012:228)

### **7.3.2 The role of the NVT**

In ecosystems that are in their early stages, NVTs perform entrepreneurial activities to increase their knowledge-base and the knowledge-base of the NTBF. Findings of this research evidence that NVTs not only use external knowledge integration (absorptive capacity) but also use internal knowledge integration. They also acquire new knowledge from internal sources such as training, formal education and expertise. This new knowledge is used for obtaining and developing capabilities. Wise searching and use of sources of new knowledge is crucial in NTBFs. Members of the NVT have the ability to think and act using knowledge, experience, understanding, common sense and insight.

A firm is a collective scenario where individuals interact to produce something different, something that could not have been produced by only one of the members. A new firm starts without organisational capabilities; it is the sum of individual capabilities that determines the initial stock of knowledge of a new firm. The NVTs have to have the capability to explore and acquire new knowledge, assimilate, transform and exploit it in tangible outcomes such as a new product to be sold. Without sales there is no real entrance into new markets and there is no financial turnover to allow the firm to survive. A successful NVT creates new knowledge by integrating new knowledge from a different type of source to their initial knowledge-base.

New knowledge that is created must be exploited in the form of new product commercialisation in order to represent a form of growth. This assumption leads us into the problem of the mutual knowledge gap which argues that technology commercialisation failure is due to “the inability to synchronize joint efforts, either because of inadequate mutual knowledge or difficulty in creating such knowledge” (Kotha, George and Srikanth, 2013:498).

Different levels of PK have different impacts on the need, use and development of individual and organisational capabilities. For instance, when prior levels are low, the ability to acquire and explore new knowledge is very much needed. Moreover, the motivation for exploiting the opportunity has to be high too because it has been stated that the lack of common language has a negative impact on knowledge assimilation and transfer.

Only under conditions where there is a positive disposition to sharing and creating knowledge, the lack of a common language might not become an obstacle to effective transfer and exchange of knowledge because efforts will be made to help the person, team or firm in need. High goal orientation within an NVT, with the confidence that the new firm can survive, will increase the team's effectiveness and access to sources of new knowledge. In the case of an NVT with low prior market and technical knowledge, a goal-oriented team with the confidence that the new firm can survive will be more disposed to find a common language.

When the NVT has high levels of PK, the heterogeneity of the specific knowledge base will have an influence on the likelihood of producing new knowledge. Studies in disruptive innovation have demonstrated the importance of knowledge diversity for generating new knowledge; however, some studies have not found any relationship between knowledge diversity and performance in firms.

From all the cases of this research, it can be assumed that regardless of the knowledge diversity of the PK of the NVT, new knowledge is acquired by adding new members to the firm – and by experience. These two entrepreneurial activities increase the level of internal knowledge of the firm. When adding new members, NVTs are validating the need to have new individual capabilities that will benefit the development and commercialisation of new products/services. The decision to increase the workforce of the NTBF reflects the importance of increasing the human capital of the firm. This is also reflected when members of the NVT decide to enrol in formal and informal training to learn more and contribute to the development of their firm's capabilities by increasing their own capabilities.

All the cases in this research learned by experience, they applied their capabilities to the development and commercialisation of their products. This echoes the importance of learning by doing in innovation, and the importance of action in entrepreneurship. NTBFs' capabilities are developed when NVTs exploit new knowledge while pursuing their goals. NVTs create an organisational climate where they feel free to act and share the learning lessons for the benefit of the new firm and for building organisational capabilities.

It can be seen that time became a very important dimension: the sooner a firm can integrate new knowledge into its knowledge-base to develop the new technology, the sooner new knowledge can be exploited. Prototypes can be improved and different versions of products can be produced. It is a cycle that repeats constantly, from identification to commercialisation of opportunities; and although sometimes commercialisation is not successful, learning from

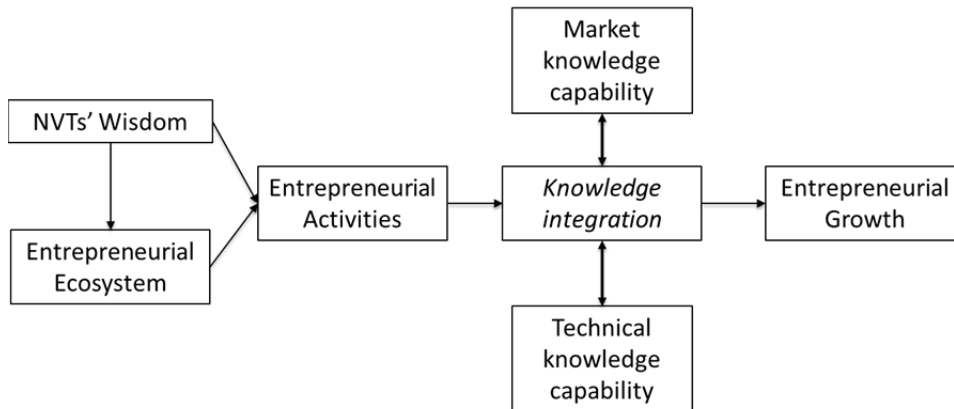
failure becomes a source of new knowledge that is assimilated, transformed and exploited with the aim of surviving and overcoming the liabilities of newness and adolescence.

Regardless of the level and content of PK, an NVT has an initial stock of individual knowledge (tacit and explicit) that can potentially be transformed into organisational capabilities. When a new venture team identifies an opportunity and there is an awareness of PK in the team, an NVT with high goal orientation and the confidence that the new firm can survive, will increase the team's effectiveness to produce new knowledge and to access sources of new knowledge. This exploitation of an opportunity will require individual and collective abilities to integrate new knowledge into the existent base of knowledge of the team and the firm.

With the assumption that any new knowledge and value generated by the team has to be transformed into a tangible asset which represents the entrance to the market, new product commercialisation becomes the outcome of effective entrepreneurial learning. Even when failure occurs, NVTs need to capitalise on their learning, improve the firm TK and MK capabilities, launch new products and sell them. Regardless of the type of market (local, regional, national or international), new firms can survive only when they sell their products and have financial support while they develop their organisational capabilities.

NVTs in NTBFs have to develop technical and market knowledge capabilities and must integrate them to achieve entrepreneurial growth (Figure 7.10). To do so, they perform entrepreneurial activities that involve external and internal sources of new knowledge (Figure 7.9). NVTs integrate new knowledge that can be technical or market with prior knowledge that can be market or technical too (Figure 7.8). This integration of knowledge is what generates organisational capabilities such as market knowledge capability and technical knowledge capability; they use their wisdom (reflective and selective thinking) and the entrepreneurial ecosystem to manage prior and new knowledge. NVTs embedded in dynamic entrepreneurial ecosystems such as Medellín have many networks available to search for new knowledge. They decide what activities to do to obtain new market and technical knowledge (they act wisely); in some cases they preferred to engage in formal and informal education rather than acquiring new knowledge from external networks or contracting suppliers to help develop and commercialise their new products. NVTs enter new markets with their new products, and by doing so they can achieve entrepreneurial growth. Figure 7.11 presents a model of knowledge management in NTBFs.

**Figure 7.11 A model of knowledge management in NTBFs**



Source: Developed by author, based on an adaptation of Zahra, Sapienza and Davidsson (2006).

## 7.4 Summary

NTBFs are being created in the Medellin Entrepreneurial Ecosystems where entrepreneurial networks are in early stage of development. Their NVTs manage prior knowledge and sources of new knowledge to create new knowledge and gain and maintain competitive advantage. They identify opportunities in the ecosystem and use the ecosystem as external source or new knowledge.

The identification and commercialisation of opportunities is carried out by NVTs when they are pursuing a tangible outcome: the sale of a new product. “Entrepreneurial opportunities are situations where new goods or services can be introduced and sold at a price greater than their cost. Opportunity identification involves two cognitive processes: active search and knowledge integration” (Foo, Uy and Murnieks, 2013). Entrepreneurial opportunities emerge from entrepreneurial ecosystems like Medellin’s and Colombia’s.

Market opportunities are available for discovery and exploitation, but it has been stated that opportunities can be exploited only by those entrepreneurs who possess the knowledge necessary to act. However, networks are considered a source of knowledge and entrepreneurs in this research have identified that networks are an important source of new knowledge. It implies that entrepreneurs aiming to exploit an opportunity do not necessarily need to have the knowledge but internal and external knowledge networks help them acquire the knowledge they need. NVTs in Medellin used external and internal knowledge integration to develop and

commercialise new products.

NVTs developed the capability of managing knowledge when pursuing uniqueness to be competitive, but, to do so, they knew what knowledge they have and what they lack. They identified what new knowledge is required and what new knowledge is available within the team, the firm and the ecosystem. This level of comprehension of what they lack when pursuing uniqueness enables them to seek sources of information (knowledge) about where to find the resources they need to achieve multiple goals, such as networking, commercialisation of new products and establishment of the new firm.

Given the fact that some NVTs may have a broader and deeper knowledge base, it can be assumed that regardless of the knowledge base, entrepreneurs need to have the capability to manage their PK and new knowledge they wish to acquire or explore, in order to create the new firm. New knowledge has to be integrated with the PK of the NVT in order to be exploited.

Several theories of learning make reference to outcomes such as competitive advantage (ACAP), internationalisation and value creation (Networks). A new firm enters a market and begins to participate actively in the economy system once it commercialises its products. The assimilation and transformation of new knowledge has to evolve into the exploitation of new knowledge for the development and commercialisation of new products. Regardless of the PK, the mode of learning and the nature of knowledge integration, a firm has to sell products to survive; it has to develop entrepreneurial growth capability (capability to develop and commercialise new products). NTBFs in Medellin develop their capability to develop and commercialise new products by integrating external and internal knowledge that can market or technical.

NVTs' members decide to work together in order to transform an idea into an NTBF. Sometimes the origin of the idea is an opportunity in the market but sometimes it is stimulated by the identification of a new product-service that can be potentially commercialised in a market. Regardless of the origin of the idea and the PK of the NVT, NVTs leverage the resources they control, which initially are their own knowledge and the relationships they have (internal and external networks). These two resources enable an NVT to pursue the exploitation of an opportunity in an entrepreneurial ecosystem. The NVT's wisdom enables it to perform entrepreneurial activities to achieve entrepreneurial growth by integrating market and technical knowledge capabilities.



Opportunities emerge from the entrepreneurial ecosystems in which several institutions such as customers and universities coexist. Regardless of the use of knowledge for developing the technology (TK) or for commercialising it (MK), NVTs integrate knowledge by internal and external mechanisms. Nevertheless, for marketing the technology (MK) all the firms used external sources and for developing the product (TK) only one of the firms used external sources of knowledge. This particular case used outsourcing to acquire new technical knowledge, an activity which implies that new knowledge can be created outside the firm to be exploited within the firm.

The proposed theory is a result of understanding the nature of knowledge integration activities in NTBFs and how NVTs manage prior and new knowledge (answering the second and third research questions). Regardless of whether knowledge integration activities are external or internal and individual or collective, NTBFs in Medellin remain different and competitive even though their NVTs have access to the same resources because they are embedded in the same ecosystems. Each of the NVTs develops internal capabilities that are used to develop differentiated products. It is in the interaction of the members of the firm that differentiation is pursued and competitive advantage is gained and maintained. However, it is the interaction with the external ecosystem and particularly with the customers and intermediaries that enriches the possibilities to improve their products and services and to remain synchronised with the market needs. The entrepreneurial ecosystems are the external sources of knowledge; entrepreneurial ecosystems with multilayers of networks, entrepreneurial culture and entrepreneurial policies like Medellin have an influence in the creation and establishment of NTBFs.

## Chapter 8 CONCLUSIONS

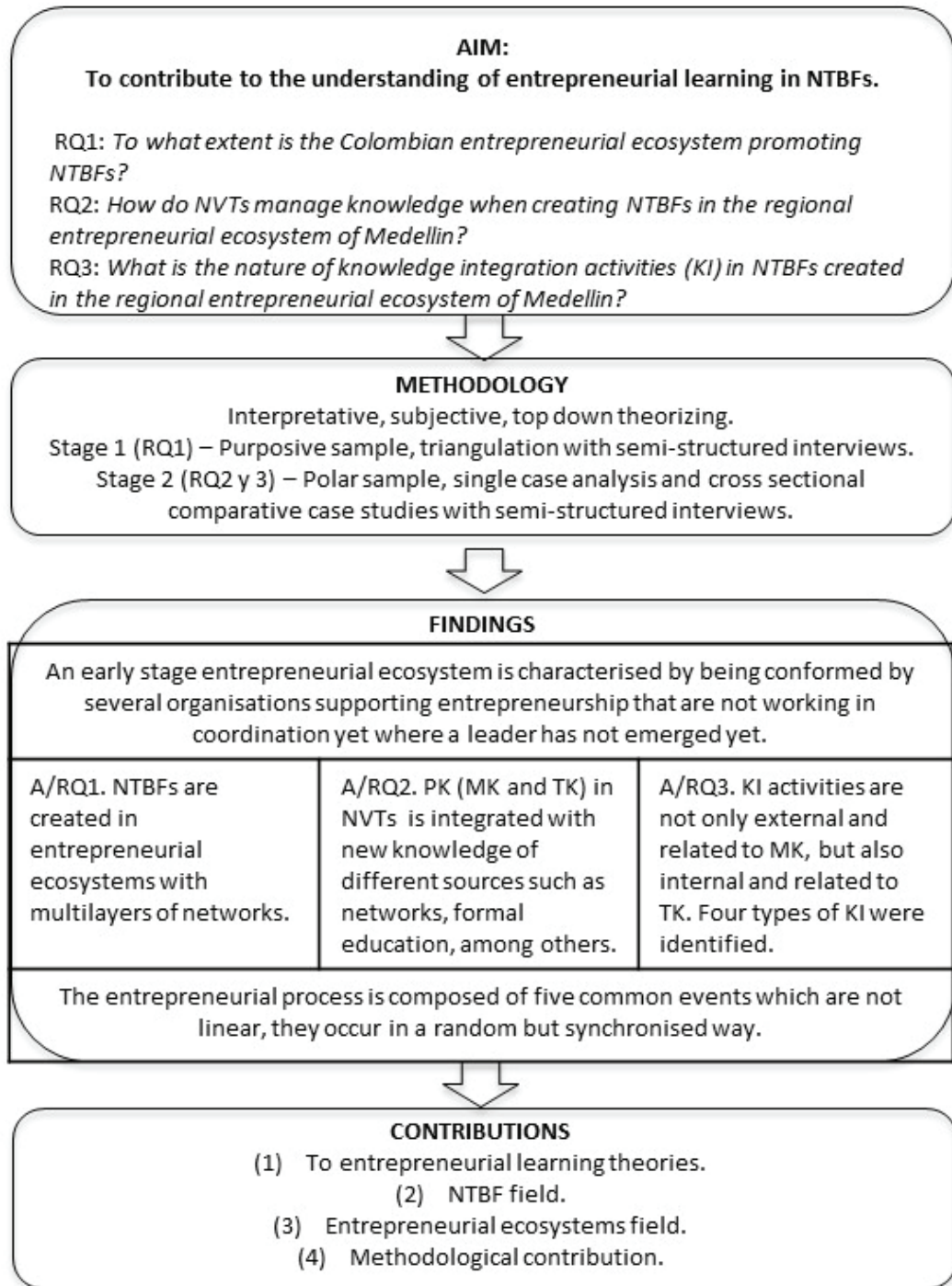
The purpose of this chapter is to present the contributions of this research. From a KBV of entrepreneurial learning, entrepreneurial learning is considered a set of knowledge-related processes; it is the ability to develop different capabilities when creating and establishing the NTBF, for instance, knowledge acquisition, knowledge integration, development of a technology (technical knowledge capability) and commercialisation of a new product (market knowledge capability). Findings presented in this research elaborated upon knowledge of NVTs in NTBFs, the entrepreneurial process of NTBF and the characteristics of the surrounding entrepreneurial ecosystems. These three components: the process, the external environment and NVT knowledge, play an important role in learning during the creation and establishment of an NTBF. The thesis overview can be seen in Figure 8.1.

The study addressed gaps in the existing entrepreneurial learning research, and integrates concepts from organisational learning, knowledge management, entrepreneurship and innovation to contribute to the understanding of how entrepreneurs learn by analysing how NVTs manage knowledge. It also extends the literature on the entrepreneurial process, networks, knowledge, knowledge integration and entrepreneurial ecosystems and NTBFs. The study sought to address these three research questions:

- *To what extent is the Colombian entrepreneurial ecosystem promoting NTBFs?*
- *How do NVTs manage knowledge when creating NTBFs in the regional entrepreneurial ecosystem of Medellín?*
- *What is the nature of knowledge integration activities (KI) in NTBFs created in the regional entrepreneurial ecosystem of Medellín?*

This chapter is organised in three sections. The first presents key insights, findings and contributions, theoretical and methodological contributions. The second presents implications for policy and practice. The third identifies opportunities for further research.

**Figure 8.1 Thesis overview**



## 8.1 Contributions

This research enriches the entrepreneurial learning literature by developing understanding of how NVTs manage knowledge in NTBFs in an early stage entrepreneurial ecosystem. Section

8.1.1 synthesises the empirical key findings and presents a summary of key insights, findings and contributions. Section 8.1.2 presents the theoretical contribution; it discusses the contributions to the literature and proposes a theoretical model of entrepreneurial learning from a knowledge based view perspective. Finally, Section 8.1.3 presents the methodological contribution.

### **8.1.1 Key insights, findings and contributions**

The main empirical findings are chapter specific and were summarised in the respective empirical chapters (The Colombian entrepreneurial ecosystem, Eight NTBFs in Medellín: Single case analysis, Comparative case analysis and proposed theory). This section synthesises the empirical key findings to answer the research questions and summarises key insights, findings and contributions.

*To what extent is the Colombian entrepreneurial ecosystem promoting NTBFs?*

Colombia governmental efforts to support entrepreneurship have helped new firms to overcome the liabilities of newness, moreover Medellín governmental efforts have helped new firms to survive. Even in a developed country like Colombia, NTBFs are being created. Although there are not statistics about NTBFs created in Colombia, NTBFs are more likely to be found in Colombian regions (like Medellín) that have developed entrepreneurial ecosystems which policies, culture and networks support entrepreneurs.

*How do NVTs manage knowledge when creating NTBFs in the regional entrepreneurial ecosystem of Medellín?*

NVTs integrate prior and new knowledge when developing and commercialising the first innovative product. Although each case followed a unique timescale when pursuing new product development and commercialisation, all cases managed human and social capital when creating the firm. In general, regardless of how related, specific and complementary the PK of the NVT was at legal creation, all firms integrated new technical and market knowledge when pursuing new technology commercialisation while creating the NTBF in Medellín.

*What is the nature of knowledge integration activities (KI) in NTBFs created in the regional entrepreneurial ecosystem of Medellín?*

NVTs acquire knowledge from external sources, such as mentors, intermediaries and customers. This finding echoes the importance of absorptive capacity in NTBF creation and survival. Moreover, NVTs acquire knowledge from internal sources of knowledge, such as new members, experience and formal education. All cases use external and internal knowledge integration activities to develop firm market and technical knowledge capabilities when commercialising innovative technologies.

The following table (8.1) summarises the key insights, findings and contributions of this research.

**Table 8.1 Key insights, findings and contributions (Part A)**

Topic	Key Insights, Findings and Contributions
<i>Knowledge and learning in NTBFs</i>	
Technical knowledge capability	Proposes new definition of technical knowledge capability in NTBFs
Market knowledge capability	Proposes new definition of market knowledge capability in NTBFs
Knowledge management in NTBFs	Simultaneous use of theories of entrepreneurial learning, knowledge networks and knowledge management
Knowledge integration	Proposes four types of knowledge integration organised in two forms of knowledge integration (external and internal) adding to the understanding of literature in knowledge integration
External sources of knowledge	Identified outsourcing as an external source of new knowledge
Internal sources of knowledge	Identified formal and informal education as internal sources of new knowledge
Effective learning	Proposes a new model of effective learning in new ventures which introduces a tangible outcome: new product development and commercialisation
Technical and market knowledge integration capability	NTBFs integrate market and technical knowledge to gain entrepreneurial growth
Models	Proposes new model of knowledge management in NTBFs
	Proposes new model of arrangement of key events in the entrepreneurial process of NTBFs
	Proposes new model of customer relationship in NTBFs
PK	Identifies that regardless of the relatedness and diversity of PK of the NVT, all NTBFs in the ICT sector of Medellín use internal and external sources of new knowledge
Role of PK	Identifies that different stocks and levels of PK have an impact on the selection of sources of new knowledge
Development of social capital	Identifies that NVTs are constantly developing social capital to develop and commercialise its technologies

Table 8.2 Key insights, findings and contributions (Part B)

<b><i>Entrepreneurial ecosystems</i></b>	
Early stage entrepreneurial ecosystem	Proposes new definition of an early stage entrepreneurial ecosystem
Role of entrepreneurial ecosystems	Identified factors related to NTBF creation in early stage entrepreneurial ecosystems
Role of entrepreneurial networks	Identified that even in inefficient entrepreneurial networks, organisations supporting entrepreneurship support NTBFs
Role of government	Identified as key element in the creation of entrepreneurial ecosystems
Role of entrepreneurs	Identified as key element in the co-creation of entrepreneurial ecosystems
Technological districts and clusters	Proposed differences with entrepreneurial ecosystems
<b><i>Methodological contribution</i></b>	
Multilevel perspective	Proposes a two-stage methodology considering macro and micro levels
Metacognition	Proposes the use of mindmaps to validate findings and co-create new knowledge with the entrepreneur
Technical and market knowledge capability	Proposes a surrogate to measure technical and market knowledge capability in NVTs

## **8.1.2 Theoretical contribution**

### ***8.1.2.1 Contribution to literature***

This thesis contributes to the field by extending the literature on learning in NTBFs in different themes:

#### **- Knowledge and learning in NTBFs:**

Given that all the cases acquired new knowledge from feedback from the customer and experience (including failure), the role of internal knowledge integration is stressed. NTBFs in the ICT sector of Medellín not only use ACAP but also internal knowledge integration, the ability to develop and commercialise new products. This implies integrating aspects of the literature of learning in innovation with the literature of ACAP in strategic entrepreneurship (Kuratko and Audretsch, 2009) and social entrepreneurship (Short, Moss and Lumpkin 2009).

Following Zahra, Sapienza and Davidsson's (2006) research agenda for entrepreneurship and dynamic capabilities, the inclusion of substantive capabilities (competences) such as developing technology and commercialising a new product, with the dynamic capability ACAP and the ability to integrate internal knowledge, represents a contribution to the NTBF

field. This framework is a contribution because the literature is highly fragmented, although in reality all the capabilities are path-dependent and interrelated.

This research is linked with an important contribution to the place of cognition in NTBFs (Rae, 2000). Findings of this research echo his findings regarding the role of communities of practice for learning (situated learning theory, Leve and Wenger, 1991). In the case that is using SCRUM methodology, it brings back the Takeuchi and Nonaka (1986)'s study in which they found that software is developed by agile teams that are autonomous, reflective and multidisciplinary.

This research makes a contribution to the NTBF field because it has been identified previously that the lack of market knowledge is one of the causes why NTBFs may not pass through the valley of death (Barr et al., 2009). Most literature on market knowledge is based on international opportunities and most of the literature on innovation stresses the importance of technological capability as a dynamic capability that is developed when pursuing innovation. However, there is no literature focusing on the integration of technical and market knowledge when pursuing technological innovation by NTBFs. This study highlights the importance of four different types of knowledge integration in NTBFs of the ICT sector of Medellín: integration of externally new MK, integration of internally new MK, integration of externally new TK and integration of internally new MK (Section 7.1.3).

As it was presented in Section 3.6.1, market knowledge is conceptualised as the set of data, information, abilities, competences and capabilities required to commercialise a new product. From the cases, it was identified that market knowledge in NVT of NTBFs is a combination of knowing management, entrepreneurship and marketing. Data from this research demonstrated that it was important to: (1) understand the fundamentals of accounting, to develop a business model in which the firm makes profits because only NTBFs that sell their technologies (making profits) survive, (2) be persistent and resilient, all the entrepreneurs of this study were aimed at commercialising their products and making the firm survive the challenges and difficulties they faced, (3) build reputation, have a brand that is recognised by offering the customers what they needed, but being wise in understanding when to change the vision and when to set boundaries around the mission of the firm. Therefore, while existent literature of MK conceptualise it as knowledge about the market, this research highlights the importance of additional dimensions such as basic accounting, business strategy and adaptability.

The literature regarding entrepreneurial teams in NTBFs stresses the importance of a well-balanced and skilled team (Section 2.3). However, some of the cases of this research did not

have a well-balanced skilled team when the firm was created. Teams were mainly technical and only half of them had at least one member with managerial expertise.

**- Technology commercialisation:**

Another contribution is the quasi-random arrangement of several events in the entrepreneurial process of NTBF creation and establishment. As was presented in Section 2.2, and echoing Moroz and Hindle (2012) there is not a model of the entrepreneurial process that covers the complexity of entrepreneurship. This can be due to the difficulty of standardising the sequence of key events that drives new venture creation and establishment. The identification of five common events (Figure 6.2) in all cases helps to project a flexible time-sequence of events when commercialising technologies by creating a new firm.

Previous studies in NTBFs have identified NTBFs' tendency to operate in several industry clusters in small open economies (Autio and Yli-Renko, 1998) and the voice of the consumer as a unique resource that leads to a sustainable competitive advantage (Basil et al, 2010). This study extends these findings in NTBFs of the ICT sector in an emerging economy. It also presents a model of customer relationship development for survival (Figure 7.2).

Moreover, this study echoes findings of Presutti et al. (2011) and Yli-Renko, Autio and Sapienza (2001) regarding the importance of proximity between the new firms and the customers. This finding has implications in the literature because the prominent role of an active relationship with the customer is not broadly addressed in the literature of new ventures.

The role of human capital was also identified as a key factor because it is necessary to have educational institutions training potential entrepreneurs and to have entrepreneurs willing to create and establish new firms. Although this study considers cases in which the NVT had different stocks and levels of PK, all NVTs have the capability to integrate prior and new knowledge and transform it in a commercialisable technology; they learned effectively. They were also capable of interacting wisely with different types of sources of new knowledge, managing both knowledge and sources of new knowledge. Without their action to transform business ideas into business, the entrepreneurial ecosystem would lack sense because no firms would be created and/or technologies would not be commercialised. This study shows that entrepreneurs creating NTBFs in early stage entrepreneurial ecosystems interact with their contexts (Autio et al., 2014) and create new knowledge that is exploited in a new firm.



### **- Entrepreneurial ecosystems:**

Given that the literature on entrepreneurial ecosystems is emerging (Section 2.5), this thesis contributes by extending the literature on entrepreneurial ecosystems, providing empirical evidence about the role of entrepreneurial networks, governments and entrepreneurs in NTBF creation and establishment in an early stage entrepreneurial ecosystem. This research highlights the importance of three factors in entrepreneurial ecosystems encouraging NTBFs: multilayers of networks, entrepreneurial culture and policies boosting entrepreneurship.

Literature states that initial teamwork capabilities are not as important as initial social capital of the NTV (Klotz et al., 2014). Findings of this research allow the conclusion that NVTs without initial social capital benefit from the social capital of the organisations supporting entrepreneurship and innovation even when entrepreneurial networks are in the early stages of development. NVTs also develop social capital by developing a good relationship with their customers, as satisfied customers brought new customers and therefore new opportunities to exploit.

Given that all the cases developed new technologies to commercialise, the teamwork capabilities were as important as the development of social capital. Their absorptive capability allowed them to integrate external knowledge based on the interaction with external networks, but the members of the firm also interacted to integrate new internal knowledge, they had an internal knowledge network in which teamwork capabilities were needed and used to develop the technology. Members of the NVT engaged in internal and external entrepreneurial activities when managing knowledge, for instance, they enrolled in training programmes and they got access to entrepreneurial networks in the universities, local and national entrepreneurial ecosystems.

The concept early stage entrepreneurial ecosystems emerged as a need to differentiate between entrepreneurial ecosystems in which entrepreneurial networks are efficient and entrepreneurial ecosystems in which entrepreneurial networks are not efficient. Medellín's entrepreneurial ecosystem is one of the most evolved in Latin America. Colombia is also recognised for having a high rate of nascent entrepreneurs (Gomez et al., 2010) and good GEDI index (Acs, Aution and Szerb, 2014). However, Moore (1993) defined the stages of business ecosystems and early stages are those in which "co-evolving companies must do more to satisfy customers; a leader must also emerge to initiate a process of rapid, ongoing improvement that draws the entire community toward a grander future" (79). Considering entrepreneurship as an

industry and Moore's categorisation, when data were collected (2012–2013), Medellín and Colombia were early-stage entrepreneurial ecosystems. Moreover, none of the entrepreneurial networks of Colombia were efficient; therefore, it was considered that all entrepreneurial ecosystems in Colombia were in an early stage of development. Additionally, it was identified that Medellín had the most evolved entrepreneurial ecosystem supporting NTBFs of the country (Colombia) because of the several organisations supporting entrepreneurship working together to organise the value chain of entrepreneurship, and because it was identified as the region in which more NTBFs could be found. This conceptualisation allows concluding that a more evolved early stage entrepreneurial ecosystem is an ideal context that enables not only competition but also collaboration.

Contrary to the literature on entrepreneurial networks (Hoang and Antoncic, 2003, Birley, 1986), NTBFs are being created in early stage entrepreneurial ecosystems in which formal entrepreneurial networks are not efficient – but in which organisations supporting entrepreneurship have efficient networks.

Even though organisations supporting entrepreneurship were not found to be working in articulation when data were collected, some entrepreneurs of the cases of this study received support from organisations such as incubators, technological parks and governmental programmes. It was found that entrepreneurial ecosystems, in which governmental, educational and private institutions support entrepreneurship and innovation, are potential and effective sources of knowledge for entrepreneurs.

The inefficiency of the entrepreneurial network implies a bigger challenge for the entrepreneurs because they need to identify which organisations can provide the knowledge needed, but all NVTs of this study engaged in an active search of the knowledge they lacked. In particular, NTBFs in which NVTs have financial resources did not interact with incubators, technological parks or investors. NTBFs which did not have NVT members with entrepreneurial expertise benefitted from market knowledge from the entrepreneurial network of technological parks (such as Parque E, Parque Soft and Technoparque). Throughout the region, only one university had an entrepreneurial network that provided market knowledge to NVTs. Organisations supporting entrepreneurship and innovation are sources of financial capital and market knowledge, additionally when they have an efficient network, they also provide social capital. This study highlights the importance of entrepreneurs in entrepreneurial ecosystems, their compensating, adaptive, selective and proactive behaviour shape the surrounding entrepreneurial ecosystems and its networks.

This research brings evidence that NTBFs in the ICT sector of Medellín have been created and established regardless of the level of PK in the NVT and their initial access to networks. In all the cases, NVTs searched for the knowledge they lacked and to acquire it they used internal and external sources of new knowledge. In particular, NVTs lacking of legitimacy were benefited of existent local and organisational entrepreneurial networks in the surrounding entrepreneurial ecosystems.

The literature on entrepreneurial ecosystems is still emerging despite the broad understanding of the importance of technological districts and clusters for boosting NTBF creation and establishment. In comparison with technological districts and clusters (Keeble and Wilkinson, 2000, Lecuyer, 2006) and systems of innovation (Lundvall, 2010, Malerba, 2002), entrepreneurial ecosystems are also defined by (1) the presence of several entrepreneurial networks at organisational, local, regional, national and international levels supporting entrepreneurs while creating and establishing the new firm, and (2) entrepreneurs engaged in the challenge of starting up new firms. This study highlights the role of intermediaries, entrepreneurs, universities, governments, industry and networks in knowledge and learning in NTBFs.

#### ***8.1.2.2 Model of entrepreneurial learning in NTBFs: A knowledge-based view perspective.***

Literature on entrepreneurial learning is fragmented and lacking a single framework to explain how entrepreneurs learn (Wang and Chugh, 2014). Moreover, there is very little literature regarding knowledge management in new ventures because the literature has focused on established firms (Nonaka and Takeuchi, 1995) and there is a need to understand how entrepreneurs construct knowledge (Campos and Hormiga, 2012). Echoing Easterby-Smith and Prieto's (2008) call, this research makes a contribution to the integrative role of learning among dynamic capabilities and knowledge management with a model supported by data. It proposes a theoretical model regarding how NVTs learn in NTBFs in an entrepreneurial ecosystem (Figure 3.7) that is further enriched with findings and discussions describing the evolutionary process of capability development in NTBFs (Section 7.3.1, Figure 7.10) and knowledge management in NTBFs (Section, 7.3.2, Figure 7.11) in early stage entrepreneurial ecosystems.

This research contributes into the KBV by exploring the nature of knowledge integration activities in NTBFs during new product development and commercialisation in an early stage

entrepreneurial ecosystem. NVTs perform different types of activities when managing prior and new knowledge for commercialising their technologies. NVTs acquire new knowledge from different sources (internal and external), and integrate it into their PK to develop and commercialise new technologies while they are creating and establishing the NTBF. Although the model presented was supported with empirical data from the ICT industry in an early stage entrepreneurial ecosystem, the model may be used to explore NTBFs in other industries, regions and countries.

Regarding intra-organisational learning, external sources of knowledge are those that are outside the firm such as intermediaries, mentors, feedback from the customer and outsourcing. West and Noel (2009) found that networking is a strong predictor of new venture performance and that business relatedness is positively associated with new venture performance. “Start-ups have been thought to be the most affected by external networks during their knowledge process” (Presutti, Boari and Majocchi, 2011:361). Huber (1991) establishes that searching is the subprocess by which objective knowledge is acquired in external sources; he also ascertains that the acquisition of experiential knowledge in external sources can be done through indirect experience, vicarious learning, and grafting. It can be seen that all the external sources of knowledge imply the interaction of at least two individuals, thus the role of relationships is crucial, through knowledge is transferred and shared within relationships. Outsourcing represents a contribution to the forms of knowledge acquisition presented by Huber.

Regarding inter-organisational learning, internal sources of knowledge are those ones that are inside the organisation such as new members, formal education and experience. Shane (2000) explains that PK developed from work, experience, education or other means allows entrepreneurs to recognise certain opportunities, but not others. People who learn about new knowledge before others may be more likely to discover opportunities to make use of that new knowledge. Huber (1991) affirms that objective knowledge is acquired from internal sources using latent information, and for acquiring experiential knowledge the subprocess implied is direct experience. These three sources of internal knowledge are different in the sense that although all of them can be individual, a new member brings tacit knowledge. As noted earlier, formal education is a form of explicit knowledge and experience is an action that creates experiential knowledge. The role of experiential knowledge in entrepreneurial learning has been broadly studied, in fact all the case studies learned by doing when commercialising their technology.

Additionally, the introduction of a tangible outcome (new product/service commercialisation) represents a contribution to the models of entrepreneurial learning. The inclusion of entrepreneurial growth, growth through the launch of new products/services (Naldi and Davidsson, 2014, Clarysse, Bruneel and Wright, 2011, Davidsson and Henrekson, 2002), in the model of entrepreneurial learning links the literature of growth to the literature of entrepreneurial learning.

As presented in the critical literature review of entrepreneurial learning (Chapter 3), ACAP is considered the theoretical model to study entrepreneurial learning from a KBV. This research introduces the concepts of outsourcing and informal and formal education as forms of learning in the model of ACAP (Zahra and George, 2002) and in the model of Holcomb et al. (2009). The introduction of these two forms of acquiring new knowledge represents a contribution to both theories for the case of new ventures.

### **8.1.3 Methodological contribution**

Traditional research in entrepreneurship cannot fully capture the essence of a multidimensional and context-specific concept such as entrepreneurial learning. The methodology designed for this research considers the macro and micro dimensions of entrepreneurial learning in NTBFs. It also considers the nature of entrepreneurs' cognition by asking entrepreneurs twice about the history of the firm and proposing a surrogate to estimate market and technical knowledge capabilities.

This research addresses the call of Autio et al. (2014:1106): "we would need a shift in the content and methods of entrepreneurship research to understand the multiple dimensions of entrepreneurial innovation processes and activities". Given that networks are considered in the literature as the most important source of knowledge in NTBFs, studying entrepreneurial learning has to consider not only the micro dimension (NVT's capabilities), but also the macro dimension (networks and the entrepreneurial ecosystem). By doing so, this methodology recognises that "entrepreneurship is a multifaceted, complex social construct" (Leitch et al., 2009:79). The methodology of this study is comprised of two stages, the first one analyses the macro dimension (the ecosystems) and the second one the micro dimension (the firms). This methodology allows understanding the role of internal and external social capital in knowledge and learning in NTBFs.

### **- Considering entrepreneurs' cognition:**

Mind maps were created to summarise what external and internal sources of resources were used while the firm was being created. These mind maps were revisited with the entrepreneurs to confirm previous information and to reflect with them in the role of the external and internal sources of knowledge, which is the focus of this research. This also minimised recall bias.

The use of mind maps with information that was collected in the first interview and revisited with the entrepreneurs is an application of the conceptual model of Cope presented by Pittaway and Thorpe (2012) because it considers the two basic forms of learning (reflecting and situated learning) by asking the entrepreneurs to reflect on the timeline of their NTBFs, regarding their key sources of capital when developing and commercialising the first innovative product.

Additionally, the use of a mind map creates a situation in which entrepreneurs need to use their metacognitive ability (Haynie et al., 2012, Haynie et al., 2010). By asking them twice and showing them a summary of the information they provided (mind map), entrepreneurs were invited to reflect upon the impact of several sources of resources and their actions. This methodology increases the awareness of the entrepreneurs regarding the evolution of the firm and their innovative products. "Organizational learning literature has alluded to the importance of mental models in organizational activities, such as problem solving, decision making, employee training, employee or group learning, idea generation and apprenticeship(...)" (Goel et al., 2010:219). Introducing mind maps to collect data is also a strategy for promoting learning in the NVTs.

### **- Market and technical knowledge:**

An easy-to-measure surrogate was also proposed for the level of market and technical knowledge in NTBFs (Section 4.6.2). Although researchers have used other surrogates to estimate technical knowledge, most of them are based on patents. Patents evidence the degree of newness and potential for commercialisation but do not include the individual technical knowledge of the members of the NVT.

The surrogate presented for technical knowledge in this research is based on human capital levels (education and expertise) and allows clarity when regarding the degree of knowledge related to the technology being developed. The surrogate presented for market knowledge in this research is based on human capital levels (education and expertise) and allows clarity regarding the degree of knowledge related to the market and business that is being developed in the NTBF. Although both surrogates were measured for NVTs in NTBFs in the ICT sector, they can also be measured in NTBFs from other sectors.

## **8.2 Implications of the findings**

### **8.2.1 Implications for policy**

This study illustrates the value of Colombia's and Medellín's institutional policies in helping support the creation and establishment of NTBFs. Many organisations provide support for entrepreneurship because the Entrepreneurship National Law and the local entrepreneurship law in Medellín created a setting in which these organisations were created and established. Other regions and countries should investigate implementing similar policies as a method of contributing to their own economic development.

Regarding entrepreneurship in Medellín, an entrepreneurial ecosystem in which local government engages in strategic alliances provides extensive advice and financial support for new firms. The level of engagement from the local government of Medellín in entrepreneurship, innovation and competitiveness has had a positive impact on the rates of survival for new firms. Other regions should investigate implementing similar policies (for instance, the creation of intermediaries based on strategic alliances, taxes exemptions for NVTs and funding programmes) as a method of contributing to regional and national economic development.

This study has important implications for the local government of Medellín beyond continuing to invest in the implementation of entrepreneurial and innovation policies. By considering the role of the entrepreneurial ecosystems as external sources of knowledge, this study has empirically examined the role of non-efficient entrepreneurial networks in knowledge transfer. This finding confirms that governments supporting innovation and entrepreneurship contribute indirectly to the creation and establishment of new firms. This study also suggests that the

local government of Medellin should also focus its efforts on improving NVTs-customer relationships, efficient entrepreneurial networks and team building. It is important to leverage these findings with regards to what has occurred in other technology sectors.

### **8.2.2 Implications for practice**

The findings of this study have implications for practitioners of the entrepreneurship industry, the software industry and for entrepreneurs (potential, nascent and actual entrepreneurs).

The findings of this study have implications for organisations supporting entrepreneurship and NTBFs in practice. Organisations supporting entrepreneurship should consider using their own networks to improve access to knowledge for the entrepreneurs that they support. In doing so, they may also gain value in terms of the services they offer because they can improve their support to their entrepreneurs. Identification of key events (Figure 6.2) in the entrepreneurial process of NTBFs can also be useful for organisations that promote innovation and entrepreneurship because it will help them to identify the new firm's stage of development and thus the NVT can be redirected to what it needs. To do so, organisations that promote innovation and entrepreneurship can generate timescales of the NTBFs (as presented in Section 6.2 for each of the firms of this study) and identify their stage of development.

The findings of this study also have implications for the Colombian Software industry. Software developers (freelance and new firms) have to identify what are their positions in the value chain of this industry. When the property rights of the software belong to organisations that do not belong to the Colombian industry, they are losing the opportunity to commercialise this technology and the Colombian economic system will not benefit from this development – another country will benefit more.

This study also illustrates the importance for NTBFs to connect with organisations that support entrepreneurship in order to access key market knowledge, be integrated with technical knowledge and achieve entrepreneurial growth. NTBFs can increase their knowledge base by interacting with several of the institutions supporting entrepreneurship and innovation, even if they are not connected themselves. This generates attention to the role of the entrepreneur to have wisdom to select where to seek information and what to assimilate for the better development and commercialisation of new products while creating and establishing a new firm. NVTs that are aware of their strengths and weakness make better decisions about how to acquire, assimilate and exploit the knowledge needed. NVTs assign roles but make



decisions together; their interactions give room for reflection and construction of interpretations of their realities, based on how they decide to pursue their missions. Entrepreneurs reflect upon the outcomes of their actions and learn.

Regarding NTBFs, NVTs with low levels of technical knowledge can outsource the development of the technology and gain the commercialisation rights. When the entrepreneurs have a lower technical-related knowledge base, they do not necessarily have to develop the technical capability to develop the product, but they need to be able to assimilate their new technical knowledge in such a way that they can exploit it. NVTs with low levels of market knowledge can also outsource the commercialisation of the technology. Entrepreneurs should be aware that useful market and technical knowledge can be found not only in external sources of knowledge but also in internal ones such as new members and formal education.

NVTs need to be flexible, resilient and dynamic: (1) Flexible enough to adjust to external conditions in environments with potential sources of resources, (2) resilient enough to learn from mistakes and failure and keep trying to develop and commercialise innovative products, and (3) dynamic enough to interact externally and internally, developing the knowledge integration dynamic capability.

To finish, cases explored in this research suggest that part of the success of growing is related to willingness to grow. The cases of this research stressed that when entrepreneurs are not aimed to grow they maintain an organic dynamism in which they develop customer relationships and stay competitive. In this research, growth was achieved by NVTs which aimed to do so, they hired employees and were disposed to hire more if needed. Nevertheless, most of the cases were more aimed to survive than to grow. This presents an interesting characteristic of NVTs, in most of the cases of this research they were pursuing mostly a lifestyle approach to their businesses rather than a focus on becoming rich.

This study has implications for training programmes for entrepreneurs. Training programmes for managers and entrepreneurs should promote not only absorptive capacity and leadership but also teamwork in communities of practice. Formal and informal educational programmes educating entrepreneurs should now consider the contributions of this research for teaching entrepreneurship and innovation.

### 8.3 Opportunities for further research

Several areas were identified in entrepreneurship that can be explored in further research. They are listed below.

- This research presents an innovative approach to exploring knowledge integration activities that entrepreneurs undertake in order to acquire new knowledge when developing and commercialising new products while creating and establishing NTBFs. To do so the researcher collected data using interviews, however, further research should engage in ethnographic studies to capture the routines and capabilities of NVTs. Studying internal knowledge integration as a set of routines would be useful to develop time-dependent patterns and will help bring light into a deeper understanding of the interactions within teams that allow more effective outcomes.
- Although this study presents a preliminary categorisation of the knowledge base of the entrepreneurs at the legal creation and in 2013, it could have been interesting to see whether the knowledge base of the entrepreneurs changed since the entrepreneurial event. This might have implications for the decisions about when to create the firm or may have been linked to the several types of team heterogeneity used in other papers. Given that a pattern associated with a subgroup of the firms was not identified and most of them (7 of 8 cases) used almost all forms of knowledge integration, it would be interesting to explore other aspects such as how fast and efficient was the decision process of the entrepreneurs, or what type of leader each team has. Those explorations will help to explore further what moderates the relationship between NVT heterogeneity and NTBF performance.
- Given that it is difficult to access retrospective perceptions, this case study involved interviews with members of the NVTs. Following the decision-making process of the entrepreneurs and what heuristics they used when deciding would involve using observations in a longitudinal study. The method of research was consequent with the time limitations of the entrepreneurs and the researcher.
- Further research can also involve similar studies in entrepreneurial ecosystems at different stages of development to compare whether, and if so how, entrepreneurs also use both forms of knowledge integration, external and internal, and to identify whether different external factors have direct implications on the development and commercialisation of new products in NTBF.

- Other sectors different from ICT could also be explored with the methodology and doing the respective adaptations for technical knowledge. This could also help to enhance our understanding of how important the studied team capabilities are in all types of NTBFs.
- This research suggested how organisational capabilities are developed in NTBFs. This understanding could be used to establish future studies of NTBFs' survival and growth by exploring how technical and market knowledge capabilities are developed and how technological clusters in entrepreneurial ecosystems can better support survival and growth.

## REFERENCES

- Abatecola, G., Cafferata, R. and Poggesi, S. 2012. Arthur Stinchcombe's "liability of newness": contribution and impact of the construct. *Journal of Management History*, 18, 402-418.
- Acs, Z. J., Braunerhjelm, P., Audretsch, D. B. and Carlsson, B. 2009. The knowledge spillover theory of entrepreneurship. *Small Business Economics*, 32, 15-30.
- Acs, Z. J. and Sanders, M. W. 2013. Knowledge spillover entrepreneurship in an endogenous growth model. *Small Business Economics*, 41, 775-795.
- Acs, Z. J., Autio, E and Szerb, L. 2014. National Systems of Entrepreneurship: Measurement issues and policy implications. *Research Policy*, 43, 476-494.
- Acs, Z. J., and Szerb, L. 2007. Entrepreneurship, economic growth and public policy. *Small Business Economics*, 28(2-3), 109-122.
- Acs, Z. J., and Audretsch, D. B. 1988. Innovation and firm size in manufacturing. *Technovation*, 7(3), 197-210.
- Acs, Z. J., Desai, S., and Hessels, J. 2008. Entrepreneurship, economic development and institutions. *Small Business Economics*, 31(3), 219-234.
- Adler, P. S. and Kwon, S.-W. 2002. Social capital: Prospects for a new concept. *Academy of Management Review*, 27, 17-40.
- Aldrich, H. E. 1990. Using an ecological perspective to study organizational founding rates. *Entrepreneurship Theory and Practice*, 14(3), 7-24.
- Aldrich, H. E. and Martinez, M. A. 2007. Many are called, but few are chosen: An evolutionary perspective for the study of entrepreneurship. *Entrepreneurship*. Springer.
- Aldrich, H. E. and Yang, T. 2014. How do entrepreneurs know what to do? learning and organizing in new ventures. *Journal of Evolutionary Economics*, 24, 59-82.
- Alvarez, S. A. and Busenitz, L. W. 2001. The entrepreneurship of resource-based theory. *Journal of Management*, 27, 755-775.
- Amabile, T. M. 1983. The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, 45, 357.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J. and Herron, M. 1996. Assessing the work environment for creativity. *Academy of Management Journal*, 39, 1154-1184.
- Amit, R., Glosten, L. and Muller, E. 1993. Challenges to theory development in entrepreneurship research. *Journal of Management Studies*, 30, 815-834.

- Argote, L. and Ingram, P. 2000. Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82, 150-169.
- Argyris, C. 1977. Organizational learning and management information systems. *Accounting, Organizations and Society*, 2, 113-123.
- Arrow, K. J. 1962. The economic implications of learning by doing. *The Review of Economic Studies*, 29(3), 155-173.
- Audretsch, D. and Keilbach, M. 2004. Entrepreneurship capital and economic performance. *Regional Studies*, 38, 949-959.
- Audretsch, D. B. and Belitski, M. 2013. The missing pillar: the creativity theory of knowledge spillover entrepreneurship. *Small Business Economics*, 41, 819-836.
- Autio, E. 1994. New, technology-based firms as agents of RandD and innovation: an empirical study. *Technovation*, 14(4), 259-273.
- Autio, E., Kenney, M., Mustar, P., Siegel, D., and Wright, M. 2014. Entrepreneurial innovation: The importance of context. *Research Policy*, 43(7), 1097-1108.
- Autio, E., Sapienza, H. J. and Almeida, J. G. 2000. Effects of age at entry, knowledge intensity, and imitability on international growth. *Academy of Management Journal*, 43, 909-924.
- Ayres, R. U. 2004. On the life cycle metaphor: where ecology and economics diverge. *Ecological Economics*, 48(4), 425-438.
- Baker, T., Miner, A. S. and Eesley, D. T. 2003. Improvising firms: bricolage, account giving and improvisational competencies in the founding process. *Research Policy*, 32, 255-276.
- Baker, T. and Nelson, R. E. 2005. Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative Science Quarterly*, 50, 329-366.
- Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120.
- Barney, J. B. 1986. Strategic Factor Markets: Expectations, Luck, and Business Strategy. *Management Science*, 32, 1231-1241.
- Barney, J. B. 2001. Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27, 643-650.
- Barney, J. B., and Hansen, M. H. 1994. Trustworthiness as a source of competitive advantage. *Strategic Management Journal*, 15(S1), 175-190.
- Baron, R. A. 2007. Behavioral and cognitive factors in entrepreneurship: Entrepreneurs as the active element in new venture creation. *Strategic Entrepreneurship Journal*, 1(1□2), 167-182.
- Baron, R. and Shane, S. 2007. *Entrepreneurship: A process perspective*, Cengage Learning.

- Baron, R. A. and Markman, G. D. 2000. Beyond social capital: How social skills can enhance entrepreneurs' success. *The Academy of Management Executive*, 14, 106-116.
- Baron, R. A. and Markman, G. D. 2003. Beyond social capital: the role of entrepreneurs' social competence in their financial success. *Journal of Business Venturing*, 18, 41-60.
- Barr, S. H., Baker, T., Markham, S. K. and Kingon, A. I. 2009. Bridging the valley of death: Lessons learned from 14 years of commercialization of technology education. *Academy of Management Learning and Education*, 8, 370-388.
- Basadur, M. 2004. Leading others to think innovatively together: Creative leadership. *The Leadership Quarterly*, 15, 103-121.
- Bates, T. 1997. Financing small business creation: the case of Chinese and Korean immigrant entrepreneurs. *Journal of Business Venturing*, 12, 109-124.
- Bathelt, H., Kogler, D. F. and Munro, A. K. 2010. A knowledge-based typology of university spin-offs in the context of regional economic development. *Technovation*, 30, 519-532.
- Baumol, W. J. 2002. *The free-market innovation machine: Analyzing the growth miracle of capitalism*. Princeton University Press.
- Berggren, C., Bergek, A., Bengtsson, L., Hobday, M. and Söderlund, J. 2013. *Knowledge integration and innovation: Critical challenges facing international technology-based firms*, Oxford University Press.
- Bessant, J. and Tidd, J. 2007. *Innovation and entrepreneurship*, John Wiley and Sons.
- Bhave, M. P. 1994. A process model of entrepreneurial venture creation. *Journal of Business Venturing*, 9, 223-242.
- Bhide, A. 1994. How Entrepreneurs Craft Strategies That Work. *Harvard Business Review*, 72, 150-61.
- Bhide, A. 2000. *The origin and evolution of new businesses*, Oxford University Press.
- Bhide, A. and Stevenson, H. 1992. Trust, uncertainty, and profit. *The Journal of Socio-Economics*, 21, 191-208.
- Bird, B. 1988. Implementing entrepreneurial ideas: The case for intention. *Academy of Management Review*, 13, 442-453.
- Bird, B. and Jelinek, M. 1988. The operation of entrepreneurial intentions. *Entrepreneurship Theory and Practice*, 13, 21-29.
- Birley, S. 1986. The role of networks in the entrepreneurial process. *Journal of Business Venturing*, 1, 107-117.
- Blaikie, N. 2010. *Designing social research*, Polity.
- Blanchflower, D. G., Oswald, A. and Stutzer, A. 2001. Latent entrepreneurship across nations. *European Economic Review*, 45, 680-691.

- Bourdieu, P. 1985. The social space and the genesis of groups. *Theory and Society*, 14(6), 723-744.
- Bourdieu, P. and Wacquant, L. J. 1992. *An invitation to reflexive sociology*, University of Chicago Press.
- Boyd, N. G. and Vozikis, G. S. 1994. The influence of self-efficacy on the development of entrepreneurial intentions and actions. *Entrepreneurship Theory and Practice*, 18, 63-63.
- Breschi, S., Lissoni, F. and Malerba, F. 2003. Knowledge-relatedness in firm technological diversification. *Research Policy*, 32, 69-87.
- Brush, C. G., Greene, P. G., and Hart, M. M. 2001. From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base. *The Academy of Management Executive*, 15(1), 64-78.
- Bruyat, C. and Julien, P.-A. 2001. Defining the field of research in entrepreneurship. *Journal of Business Venturing*, 16, 165-180.
- Bryman, A., and Bell, E. 2015. *Business research methods*, Oxford University Press.
- Busenitz, L. W. and Lau, C.-M. 1996. A cross-cultural cognitive model of new venture creation. *Entrepreneurship Theory and Practice*, 20, 25-40.
- Bygrave, W. D. 1989. The entrepreneurship paradigm (I): a philosophical look at its research methodologies. *Entrepreneurship Theory and Practice*, 14, 7-26.
- Campos, A. and Hormiga, E. (eds.) 2012. The state of art of knowledge research in entrepreneurship: a ten-year literature review. *Entrepreneurial Processes in a Changing Economy*, 177-208.
- Carlsson, B., and Jacobsson, S. 1997. Diversity creation and technological systems: a technology policy perspective. *Systems of innovation: Technologies, institutions and organizations*, Pinter Publishers, 7.
- Carlsson, B., and Stankiewicz, R. 1991. On the nature, function and composition of technological systems. *Journal of Evolutionary Economics*, 1(2), 93-118.
- Carter, C., Clegg, S. R. and Kornberger, M. 2008. Strategy as practice. *Strategic Organization*, 6, 83-99.
- Carter, N. M., Gartner, W. B. and Reynolds, P. D. 1996. Exploring start-up event sequences. *Journal of Business Venturing*, 11, 151-166.
- Cassar, G. 2004. The financing of business start-ups. *Journal of Business Venturing*, 19, 261-283.
- Casson, M. 1982. *The entrepreneur: An economic theory*, Rowman and Littlefield.
- Chandler, G. N. and Jansen, E. 1992. The founder's self-assessed competence and venture performance. *Journal of Business Venturing*, 7, 223-236.

- Chorev, S. and Anderson, A. R. 2006. Success in Israeli high-tech start-ups; Critical factors and process. *Technovation*, 26, 162-174.
- Chun, H. and Mun, S.-B. 2012. Determinants of RandD cooperation in small and medium-sized enterprises. *Small Business Economics*, 39, 419-436.
- Clarysse, B., Wright, M., Lockett, A., Mustar, P., and Knockaert, M. 2007. Academic spin-offs, formal technology transfer and capital raising. *Industrial and Corporate Change*, 16(4), 609-640.
- Clarysse, B., Wright, M. and Van de Velde, E. 2011. Entrepreneurial Origin, Technological Knowledge, and the Growth of Spin-Off Companies. *Journal of Management Studies*, 48, 1420-1442.
- Clarysse, B., Bruneel, J., and Wright, M. 2011. Explaining growth paths of young technology-based firms: structuring resource portfolios in different competitive environments. *Strategic Entrepreneurship Journal*, 5(2), 137-157.
- Clercq, D. D. and Sapienza, H. J. 2005. When do venture capital firms learn from their portfolio companies? *Entrepreneurship Theory and Practice*, 29, 517-535.
- Cohen, B. 2006. Sustainable valley entrepreneurial ecosystems. *Business Strategy and the Environment*, 15(1), 1-14.
- Cohen, W. M. and Levinthal, D. A. 1990. Absorptive capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35, 128-152.
- Coleman, S. and Cohn, R. 2000. Small firms' use of financial leverage: evidence from the 1993 national survey of small business finances. *Journal of Business and Entrepreneurship*, 12, 81.
- Collinson, S. and Gregson, G. 2003. Knowledge networks for new technology-based firms: an international comparison of local entrepreneurship promotion. *RandD Management*, 33, 189-208.
- Colovic, A. 2012. Territorial systems and relocation: Insights from eight cases in Japan. *Entrepreneurship and Regional Development*, 24, 589-617.
- Conner, K. R. 1991. A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of the firm? *Journal of Management*, 17, 121-154.
- Conner, K. R. and Prahalad, C. K. 1996. A resource-based theory of the firm: Knowledge versus opportunism. *Organization Science*, 7, 477-501.
- Cooke, P., and Leydesdorff, L. 2006. Regional development in the knowledge-based economy: The construction of advantage. *The Journal of Technology Transfer*, 31(1), 5-15.
- Cooper, A. C. and Artz, K. W. 1995. Determinants of satisfaction for entrepreneurs. *Journal of Business Venturing*, 10, 439-457.
- Cooper, A. C., Folta, T. B. and Woo, C. 1995. Entrepreneurial information search. *Journal of Business Venturing*, 10, 107-120.



- Cooper, A. C., Gimeno-Gascon, F. J. and Woo, C. Y. 1994. Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing*, 9, 371-395.
- Cooper, R. G. 2006. Managing technology development projects. *Research-Technology Management*, 49, 23-31.
- Cooper, R. G. and Kleinschmidt, E. J. 1986. An investigation into the new product process: steps, deficiencies, and impact. *Journal of Product Innovation Management*, 3, 71-85.
- Cooper, R. G. and Kleinschmidt, E. J. 1995. Benchmarking the Firm's Critical Success Factors in New Product Development. *Journal of Product Innovation Management*, 12, 374-391.
- Cope, J. 2003. Entrepreneurial Learning and Critical Reflection Discontinuous Events as Triggers for 'Higher-level' Learning. *Management Learning*, 34, 429-450.
- Cope, J. 2005. Toward a dynamic learning perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 29, 373-397.
- Cope, J. 2011. Entrepreneurial learning from failure: An interpretative phenomenological analysis. *Journal of Business Venturing*, 26, 604-623.
- Cope, J. and Watts, G. 2000. Learning by doing – an exploration of experience, critical incidents and reflection in entrepreneurial learning. *International Journal of Entrepreneurial Behaviour and Research*, 6, 104-124.
- Corbett, A. C. 2005. Experiential learning within the process of opportunity identification and exploitation. *Entrepreneurship Theory and Practice*, 29, 473-491.
- Corbett, A. C. 2007. Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of Business Venturing*, 22, 97-118.
- Cramer, J. S., Hartog, J., Jonker, N. and Van Praag, C. M. 2002. Low risk aversion encourages the choice for entrepreneurship: an empirical test of a truism. *Journal of Economic Behavior and Organization*, 48, 29-36.
- Creswell, J. 2008. W. (1994) *Research design: Qualitative and quantitative approaches*, Thousand Oaks.
- Cuevas, J. G. 1994. Towards a taxonomy of entrepreneurial theories. *International Small Business Journal*, 12, 77-88.
- Curran, J. and Blackburn, R. 1994. *Small firms and local economic networks: The death of the local economy?*, Paul Chapman.
- Davidsson, P. 2005. *Researching entrepreneurship*, Springer Science and Business Media.
- Davidsson, P. and Henrekson, M. 2002. Determinants of the prevalence of start-ups and high-growth firms. *Small Business Economics*, 19, 81-104.
- De Clercq, D., Dimov, D. and Thongpapanl, N. 2013a. Organizational Social Capital, Formalization, and Internal Knowledge Sharing in Entrepreneurial Orientation Formation. *Entrepreneurship Theory and Practice*, 37, 505-537.

- Dencker, J. C., Gruber, M. and Shah, S. K. 2009. Pre-entry knowledge, learning, and the survival of new firms. *Organization Science*, 20, 516-537.
- Di Gregorio, D., and Shane, S. 2003. Why do some universities generate more start-ups than others? *Research policy*, 32(2), 209-227.
- Drennan, J. 2003. Cognitive interviewing: verbal data in the design and pretesting of questionnaires. *Journal of Advanced Nursing*, 42, 57-63.
- Dutta, D. K. and Crossan, M. M. 2005. The nature of entrepreneurial opportunities: understanding the process using the 4I organizational learning framework. *Entrepreneurship Theory and Practice*, 29, 425-449.
- Easterby-Smith, M. 1997. Disciplines of organizational learning: contributions and critiques. *Human Relations*, 50, 1085-1113.
- Easterby-Smith, M., Thorpe, R. and Jackson, P. 2012. *Management Research*, Sage.
- Easterby-Smith, M. and Prieto, I. M. 2008. Dynamic Capabilities and Knowledge Management: an Integrative Role for Learning?. *British Journal of Management*, 19, 235-249.
- Eisenhardt, K. M. 1988. Agency- and Institutional-Theory Explanations: The Case of Retail Sales Compensation. *The Academy of Management Journal*, 31, 488-511.
- Eisenhardt, K. M. 1989. Building theories from case study research. *Academy of Management Review*, 14, 532-550.
- Eisenhardt, K. M. 1991. Better stories and better constructs: The case for rigor and comparative logic. *Academy of Management Review*, 16, 620-627.
- Eisenhardt, K. M. and Graebner, M. E. 2007. Theory building from cases: opportunities and challenges. *Academy of Management Journal*, 50, 25-32.
- Eisenhardt, K. M., and Martin, J. A. 2000. Dynamic capabilities: what are they? *Strategic Management Journal*, 21(10-11), 1105-1121.
- Eisenhardt, K. M. and Schoonhoven, C. B. 1990. Organizational growth: Linking founding team, strategy, environment, and growth among US semiconductor ventures, 1978-1988. *Administrative Science Quarterly*, 35(3), 504-529.
- Elfring, T. and Volberda, H. W. 2001. Schools of thought in strategic management: Fragmentation, integration or synthesis. In: *Rethinking strategy*, Volberda and Elfring, Sage.
- Ensley, M. D. and Hmieleski, K. M. 2005. A comparative study of new venture top management team composition, dynamics and performance between university-based and independent start-ups. *Research Policy*, 34, 1091-1105.
- Erramilli, M. K., and Rao, C. P. 1990. Choice of foreign market entry modes by service firms: role of market knowledge. *MIR: Management International Review*, 135-150.

- Fang, S.-C., Tsai, F.-S. and Lin, J. L. 2010. Leveraging tenant-incubator social capital for organizational learning and performance in incubation programme. *International Small Business Journal*, 28, 90-113.
- Faulkner, W. 1994. Conceptualizing knowledge used in innovation: a second look at the science-technology distinction and industrial innovation. *Science, Technology and Human Values*, 19(4), 425-458.
- Feldman, M. P. 2001. The entrepreneurial event revisited: firm formation in a regional context. *Industrial and Corporate Change*, 10, 861-891.
- Fernhaber, S. A. and Li, D. 2013. International exposure through network relationships: Implications for new venture internationalization. *Journal of Business Venturing*, 28, 316-334.
- Fischer, E. M., Reuber, A. R. and Dyke, L. S. 1993. A theoretical overview and extension of research on sex, gender, and entrepreneurship. *Journal of Business Venturing*, 8, 151-168.
- Fisher, G. 2012. Effectuation, causation, and bricolage: A behavioral comparison of emerging theories in entrepreneurship research. *Entrepreneurship Theory and Practice*, 36, 1019-1051.
- Fletcher, M. and Harris, S. 2012. Knowledge acquisition for the internationalization of the smaller firm: content and sources. *International Business Review*, 21, 631-647.
- Foo, M.-D., Uy, M. A. and Murnieks, C. 2015. Beyond Affective Valence: Untangling Valence and Activation Influences on Opportunity Identification. *Entrepreneurship Theory and Practice*, 39(2), 407-431.
- Forbes, D. P., Borchert, P. S., Zellmer-Bruhn, M. E. and Sapienza, H. J. 2006. Entrepreneurial team formation: An exploration of new member addition. *Entrepreneurship Theory and Practice*, 30, 225-248.
- Frankish, J. S., Roberts, R. G., Coad, A., Spears, T. C. and Storey, D. J. 2012. Do entrepreneurs really learn? Or do they just tell us that they do? *Industrial and Corporate Change*, 22(1), 73-106.
- Franklin, S. J., Wright, M. and Lockett, A. 2001. Academic and surrogate entrepreneurs in university spin-out companies. *The Journal of Technology Transfer*, 26, 127-141.
- Freiling, J., Gersch, M. and Goeke, C. 2008. On the path towards a competence-based theory of the firm. *Organization Studies*, 29, 1143-1164.
- Gardner, H. K., Gino, F. and Staats, B. R. 2012. Dynamically integrating knowledge in teams: Transforming resources into performance. *Academy of Management Journal*, 55, 998-1022.
- Gartner, W. B. 1985. A conceptual framework for describing the phenomenon of new venture creation. *Academy of Management Review*, 10, 696-706.
- Gartner, W. B. 1988. Who is an entrepreneur? is the wrong question. *American Journal of Small Business*, 12(4), 1-32.

- Gartner, W. B. 1990. What are we talking about when we talk about entrepreneurship? *Journal of Business Venturing*, 5, 15-28.
- Gatewood, E. J., Shaver, K. G. and Gartner, W. B. 1995. A longitudinal study of cognitive factors influencing start-up behaviors and success at venture creation. *Journal of Business Venturing*, 10, 371-391.
- Gibb, A. A. 1997. Small firms' training and competitiveness. Building upon the small business as a learning organisation. *International Small Business Journal*, 15, 13-29.
- Goel, L., Johnson, N., Junglas, I., and Ives, B. 2010. Situated learning: Conceptualization and measurement. *Decision Sciences Journal of Innovative Education*, 8(1), 215-240.
- Granovetter, M. 1983. The strength of weak ties: A network theory revisited. *Sociological Theory*, 1(1), 201-233.
- Grant, R. M. 1991. The resource-based theory of competitive advantage: implications for strategy formulation. *Knowledge and Strategy*, 3-23.
- Grant, R. M. 1996a. Prospering in Dynamically-competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, 7, 375-387.
- Grant, R. M. 1996b. Toward a Knowledge-Based Theory of the firm. *Strategic Management Journal*, 17, 109-122.
- Greve, A. 1995. Networks and entrepreneurship – an analysis of social relations, occupational background, and use of contacts during the establishment process. *Scandinavian Journal of Management*, 11, 1-24.
- Greve, A. and Salaff, J. W. 2003. Social networks and entrepreneurship. *Entrepreneurship Theory and Practice*, 28, 1-22.
- Guba, E. G. and Lincoln, Y. S. 1994. Competing paradigms in qualitative research. *Handbook of qualitative research*, 2.
- Hambrick, D. C. 2007. Upper echelons theory: An update. *Academy of Management Review*, 32(2), 334-343.
- Hansen, E. L. 1995. Entrepreneurial networks and new organization growth. *Entrepreneurship Theory and Practice*, 19, 7-20.
- Hansen, E. L. and Wortman, M. S. 1989. Entrepreneurial Networks: The Organization in Vitro. *Academy of Management Proceedings*, 69-73.
- Hansen, M. T. 2002. Knowledge networks: Explaining effective knowledge sharing in multiunit companies. *Organization Science*, 13, 232-248.
- Hansen, M. T., Mors, M. L. and Løvås, B. 2005. Knowledge sharing in organizations: Multiple networks, multiple phases. *Academy of Management Journal*, 48, 776-793.
- Harper, D. A. 2008. Towards a theory of entrepreneurial teams. *Journal of Business Venturing*, 23, 613-626.

- Harrison, R. T., Cooper, S. Y., and Mason, C. M. 2004. Entrepreneurial activity and the dynamics of technology-based cluster development: the case of Ottawa. *Urban Studies*, 41(5-6), 1045-1070.
- Harrison, R. T. and Leitch, C. M. 2005. Entrepreneurial Learning: Researching the Interface Between Learning and the Entrepreneurial Context. *Entrepreneurship Theory and Practice*, 29, 351-371.
- Harrison, R. T. and Leitch, C. M. 2008. *Entrepreneurial learning: conceptual frameworks and applications*, Routledge.
- Harrison, R. T., and Leitch, C. 2010. Voodoo institution or entrepreneurial university? Spin-off companies, the entrepreneurial system and regional development in the UK. *Regional Studies*, 44(9), 1241-1262.
- Haynie, J. M., Shepherd, D. A. and Patzelt, H. 2012. Cognitive adaptability and an entrepreneurial task: The role of metacognitive ability and feedback. *Entrepreneurship Theory and Practice*, 36, 237-265.
- Heinonen, J. 2007. An entrepreneurial-directed approach to teaching corporate entrepreneurship at university level. *Education+ Training*, 49, 310-324.
- Henry, C., Hill, F. and Leitch, C. 2005a. Entrepreneurship education and training: can entrepreneurship be taught? Part I. *Education+ Training*, 47, 98-111.
- Henry, C., Hill, F. and Leitch, C. 2005b. Entrepreneurship education and training: can entrepreneurship be taught? Part II. *Education+ Training*, 47, 158-169.
- Herron, L. and Robinson Jr, R. B. 1993. A structural model of the effects of entrepreneurial characteristics on venture performance. *Journal of Business Venturing*, 8, 281-294.
- Hoang, H. and Antoncic, B. 2003. Network-based research in entrepreneurship: A critical review. *Journal of Business Venturing*, 18, 165-187.
- Holcomb, T. R., Ireland, R. D., Holmes Jr, R. M. and Hitt, M. A. 2009. Architecture of entrepreneurial learning: exploring the link among heuristics, knowledge, and action. *Entrepreneurship Theory and Practice*, 33, 167-192.
- Honig, B., and Karlsson, T. 2004. Institutional forces and the written business plan. *Journal of Management*, 30(1), 29-48.
- Hoskisson, R. E., Hitt, M. A., Wan, W. P. and Yiu, D. 1999. Theory and research in strategic management: Swings of a pendulum. *Journal of Management*, 25, 417-456.
- Howells, J. 2006. Intermediation and the role of intermediaries in innovation. *Research policy*, 35(5), 715-728.
- Huber, G. P. 1991. Organizational learning: The contributing processes and the literatures. *Organization Science*, 2, 88-115.
- Hyytinen, A., & Pajarinen, M. (2005). Financing of technology-intensive small businesses: some evidence on the uniqueness of the ICT sector. *Information Economics and Policy*, 17(1), 115-132.

- Inkpen, A. C. and Tsang, E. W. 2005. Social capital, networks, and knowledge transfer. *Academy of Management Review*, 30, 146-165.
- Isenberg, D. 2011. The entrepreneurship ecosystem strategy as a new paradigm for economic policy: Principles for cultivating entrepreneurship. *Institute of International European Affairs*, Dublin, Ireland.
- Isenberg, D. J. 2010. How to start an entrepreneurial revolution. *Harvard Business Review*, 88, 40-50.
- Jansen, J. J., Van Den Bosch, F. A. and Volberda, H. W. 2005. Managing potential and realized absorptive capacity: how do organizational antecedents matter? *Academy of Management Journal*, 48, 999-1015.
- Jarillo, J. C. 1989. Entrepreneurship and growth: The strategic use of external resources. *Journal of Business Venturing*, 4(2), 133-147.
- Jenssen, J. I. 2001. Social networks, resources and entrepreneurship. *The International Journal of Entrepreneurship and Innovation*, 2(2), 103-109.
- Jo, H. and Lee, J. 1996. The relationship between an entrepreneur's background and performance in a new venture. *Technovation*, 16, 161-211.
- Johannisson, B. 1991. University training for entrepreneurship: Swedish approaches. *Entrepreneurship and Regional Development*, 3, 67-82.
- Johanson, J. and Vahlne, J.-E. 1977. The internationalization process of the firm—a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies*, 23-32.
- Jonsson, S. and Lindbergh, J. 2013. The Development of Social Capital and Financing of Entrepreneurial Firms: From Financial Bootstrapping to Bank Funding. *Entrepreneurship Theory and Practice*, 37, 661-686.
- Jovanovic, B. 1994. Firm formation with heterogeneous management and labor skills. *Small Business Economics*, 6, 185-191.
- Kamm, J. B., Shuman, J. C., Seeger, J. A. and Nurick, A. J. 1990. Entrepreneurial teams in new venture creation: A research agenda. *Entrepreneurship Theory and Practice*, 14, 7-17.
- Kan, K. and Tsai, W.-D. 2006. Entrepreneurship and risk aversion. *Small Business Economics*, 26, 465-474.
- Katz, J. and Gartner, W. B. 1988. Properties of emerging organizations. *Academy of Management Review*, 13, 429-441.
- Kazanjian, R. K. 1988. Relation of dominant problems to stages of growth in technology-based new ventures. *Academy of Management Journal*, 31, 257-279.
- Keeble, D., and Wilkinson, F. (Eds.). 2000. *High-technology clusters, networking and collective learning in Europe*, Ashgate Publishing.

- Kempster, S. and Cope, J. 2010. Learning to lead in the entrepreneurial context. *International Journal of Entrepreneurial Behaviour and Research*, 16, 5-34.
- Kets de Vries, M. F. 1985. The dark side of entrepreneurship. *Harvard Business Review*, 63, 160-167.
- Kim, L. 1999. *Learning and innovation in economic development*. Edward Elgar Publishing.
- Kirzner, I. M. 1997. Entrepreneurial discovery and the competitive market process: An Austrian approach. *Journal of Economic Literature*, 60-85.
- Klofsten, M. 1994. Technology-based firms: critical aspects of their early development. *Journal of Enterprising Culture*, 2, 535-557.
- Klofsten, M. 2000. Training entrepreneurship at universities: a Swedish case. *Journal of European Industrial Training*, 24, 337-344.
- Klotz, A. C., Hmieleski, K. M., Bradley, B. H. and Busenitz, L. W. 2014. New Venture Teams: A Review of the Literature and Roadmap for Future Research. *Journal of Management*, 40, 226-255.
- Knight, F. H. 2012. *Risk, uncertainty and profit*, Courier Dover Publications.
- Knockaert, M., Spithoven, A. and Clarysse, B. 2010. The knowledge paradox explored: what is impeding the creation of ICT spin-offs? *Technology Analysis and Strategic Management*, 22, 479-493.
- Knockaert, M., Ucbasaran, D., Wright, M. and Clarysse, B. 2011. The relationship between knowledge management team composition, and performance: The case of Science-based entrepreneurial firms. *Entrepreneurship, Theory and Practice*, July.
- Kogut, B. and Zander, U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3, 383-397.
- Kogut, B. and Zander, U. 1996. What firms do? Coordination, identity, and learning. *Organization Science*, 7, 502-518.
- Kohli, A. K., and Jaworski, B. J. 1990. Market orientation: the construct, research propositions, and managerial implications. *The Journal of Marketing*, 1-18.
- Kolb, A. Y. and Kolb, D. A. 2005. Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education*, 4, 193-212.
- Kolb, D. A. 1984. *Experiential learning: Experience as the source of learning and development*, Prentice-Hall Englewood Cliffs, NJ.
- Kollmann, T. and Kuckertz, A. 2006. Venture archetypes and the entrepreneurial event: cross-cultural empirical evidence. *Journal of Enterprising Culture*, 14, 27-48.
- Koryak, O., Mole, K. F., Lockett, A., Hayton, J. C., Ucbasaran, D., and Hodgkinson, G. P. 2015. Entrepreneurial leadership, capabilities and firm growth. *International Small Business Journal*, 33(1), 89-105.

- Kreiser, P. M. 2011. Entrepreneurial Orientation and Organizational Learning: The Impact of Network Range and Network Closure. *Entrepreneurship Theory and Practice*, 35, 1025-1050.
- Krueger, N. F. and Brazeal, D. V. 1994. Entrepreneurial potential and potential entrepreneurs. *Entrepreneurship Theory and Practice*, 18, 91-91.
- Krueger, N. F., Reilly, M. D. and Carsrud, A. L. 2000. Competing models of entrepreneurial intentions. *Journal of Business Venturing*, 15, 411-432.
- Kuratko, D. F. and Audretsch, D. B. 2009. Strategic entrepreneurship: exploring different perspectives of an emerging concept. *Entrepreneurship Theory and Practice*, 33, 1-17.
- Landstrom, H. 2007. *Pioneers in entrepreneurship and small business research*, springer.
- Lang, J. 2002. *The High-Tech Entrepreneur's Handbook*, Prentice Hall.
- Langley, A. 1999. Strategies for theorizing from process data. *Academy of Management Review*, 24, 691-710.
- Larson, A. and Starr, J. A. 1993. A network model of organization formation. *Entrepreneurship Theory and Practice*, 17, 5-5.
- Lazear, E. P. 2004. Balanced skills and entrepreneurship. *American Economic Review*, 208-211.
- Lawson, C. 2000. Collective learning, system competences and epistemically significant moments. *High-Technology Clusters, Networking and Collective Learning*, Ashgate, Aldershot, 182-198.
- Learned, K. E. 1992. What happened before the organization? A model of organization formation. *Entrepreneurship Theory and Practice*, 17, 39-39.
- Lechler, T. 2001. Social interaction: a determinant of entrepreneurial team venture success. *Small Business Economics*, 16, 263-278.
- Lechner, C., Dowling, M. and Welpe, I. 2006. Firm networks and firm development: The role of the relational mix. *Journal of Business Venturing*, 21, 514-540.
- Lécuyer, C. 2006. *Making Silicon Valley: Innovation and the growth of high tech, 1930-1970*, MIT Press.
- Lee, S. M. and Peterson, S. J. 2001. Culture, entrepreneurial orientation, and global competitiveness. *Journal of World Business*, 35, 401-416.
- Leitch, C. M., Hill, F. M. and Harrison, R. T. 2009. The philosophy and practice of interpretivist research in entrepreneurship: Quality, validation, and trust. *Organizational Research Methods*, 31(1), 67-84.
- Leitch, C. M., McMullan, C., and Harrison, R. T. 2013. The development of entrepreneurial leadership: The role of human, social and institutional capital. *British Journal of Management*, 24(3), 347-366.



- Lave, J., and Wenger, E. 1991. *Situated learning: Legitimate peripheral participation*. Cambridge university press.
- Li, T. and Calantone, R. J. 1998. The Impact of Market Knowledge Competence on New Product Advantage: Conceptualization and Empirical Examination. *The Journal of Marketing*, 62, 13-29.
- Lim, S. S., Platts, K. and Minshall, T. 2012. An Exploratory Study of the Manufacturing Strategy in Start-up Companies. *New Technology-Based Firms in the New Millenium*, 9, 151-172.
- Liu, X., Wright, M., Filatotchev, I., Dai, O. and Lu, J. 2010. Human mobility and international knowledge spillovers: evidence from high-tech small and medium enterprises in an emerging market. *Strategic Entrepreneurship Journal*, 4, 340-355.
- Lubik, S. and Garnsey, E. 2014. Entrepreneurial innovation in science-based firms: the need for an ecosystem perspective. *Handbook of Research on Small Business and Entrepreneurship*, 315-332.
- Lucas, W. A. and Cooper, S. Y. 2005. *Enhancing self-efficacy to enable entrepreneurship: The case of CMI's connections*. MIT Sloan school of management working paper, 4489-04.
- Lumpkin, G. T. and Lichtenstein, B. B. 2005. The role of organizational learning in the Opportunity Recognition process. *Entrepreneurship Theory and Practice*, 29, 451-472.
- Lundvall, B. Å. (Ed.). 2010. *National systems of innovation: Toward a theory of innovation and interactive learning* (Vol. 2), Anthem Press.
- MacMillan, I. C., Siegel, R. and Narasimha, P. 1986. Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*, 1, 119-128.
- Maes, J. and Sels, L. 2014. SMEs' Radical Product Innovation: The Role of Internally and Externally Oriented Knowledge Capabilities. *Journal of Small Business Management*, 52, 141-163.
- Makri, M., Hitt, M. A. and Lane, P. J. 2010. Complementary technologies, knowledge relatedness, and invention outcomes in high technology mergers and acquisitions. *Strategic Management Journal*, 31, 602-628.
- Malerba, F. 2002. Sectoral systems of innovation and production. *Research policy*, 31(2), 247-264.
- March, J. G. 1991. Exploration and exploitation in Organizational Learning. *Organization Science*, 2, 71-87.
- Markman, G. D., Siegel, D. S., and Wright, M. 2008. Research and technology commercialization. *Journal of Management Studies*, 45(8), 1401-1423.
- Martinez, M. A. and Aldrich, H. E. 2011. Networking strategies for entrepreneurs: balancing cohesion and diversity. *International Journal of Entrepreneurial Behaviour and Research*, 17, 7-38.

- Maskell, P. 2001. Towards a knowledge-based theory of the geographical cluster. *Industrial and corporate change*, 10(4), 921-943.
- Mason, J. 2002. *Qualitative researching*, Sage.
- Maxwell, J. A. 1992. Understanding and validity in qualitative research. *Harvard Educational Review*, 62, 279-301.
- McEvily, S. K., and Chakravarthy, B. 2002. The persistence of knowledge-based advantage: an empirical test for product performance and technological knowledge. *Strategic Management Journal*, 23(4), 285-305.
- Milanov, H. and Fernhaber, S. A. 2014. When do domestic alliances help ventures abroad? Direct and moderating effects from a learning perspective. *Journal of Business Venturing*, 29, 377-391.
- Miles, M. B., and Huberman, A. M. 1994. *Qualitative data analysis: An expanded sourcebook*, Sage.
- Miles, M. B., Huberman, A. M. and Saldaña, J. 2014. *Qualitative data analysis: A methods sourcebook*, Sage.
- Minniti, M. and Bygrave, W. 2001. A dynamic model of entrepreneurial learning. *Entrepreneurship Theory and Practice*, 25, 5-14.
- Moore, J. F. 1993. Predators and prey: a new ecology of competition. *Harvard Business Review*, 71, 75-83.
- Moorman, C. and Miner, A. S. 1998. The convergence of planning and execution: improvisation in new product development. *The Journal of Marketing*, 1-20.
- Morgan, G. and Smircich, L. 1980. The case for qualitative research. *Academy of Management Review*, 5, 491-500.
- Morgan, K. 2007. The learning region: institutions, innovation and regional renewal. *Regional Studies*, 41, S147-S159.
- Moroz, P. W. and Hindle, K. 2012. Entrepreneurship as a process: Toward harmonizing multiple perspectives. *Entrepreneurship Theory and Practice*, 36, 781-818.
- Morrison, A., Pietrobelli, C. and Rabelotti, R. 2008. Global value chains and technological capabilities: a framework to study learning and innovation in developing countries. *Oxford Development Studies*, 36, 39-58.
- Mouritsen, J. and Larsen, H. T. 2005. The 2nd wave of knowledge management: the management control of knowledge resources through intellectual capital information. *Management Accounting Research*, 16, 371-394.
- 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.
- Naffziger, D. W., Hornsby, J. S. and Kuratko, D. F. 1994. A proposed research model of entrepreneurial motivation. *Entrepreneurship: Theory and Practice*, 18, 29.

- Nahapiet, J. and Ghoshal, S. 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23, 242-266.
- Nambisan, S., and Baron, R. A. 2013. Entrepreneurship in Innovation Ecosystems: Entrepreneurs' Self-Regulatory Processes and Their Implications for New Venture Success. *Entrepreneurship Theory and Practice*, 37(5), 1071-1097.
- Naldi, L. and Davidsson, P. 2014. Entrepreneurial growth: the role of international knowledge acquisition as moderated by firm age. *Journal of Business Venturing*, 29, 687-703.
- Ndonzuau, F. N., Pirnay, F. and Surlemont, B. 2002. A stage model of academic spin-off creation. *Technovation*, 22, 281-289.
- Neck, H. M., Meyer, G. D., Cohen, B., and Corbett, A. C. 2004. An entrepreneurial system view of new venture creation. *Journal of Small Business Management*, 42(2), 190-208.
- Nerkar, A. 2003. Old is gold? The value of temporal exploration in the creation of new knowledge. *Management Science*, 49, 211-229.
- Nonaka, I. and Takeuchi, H. 1995. *The knowledge-creating company: How Japanese companies create the dynamics of innovation*, Oxford University Press.
- Nonaka, I., Toyama, R. and Nagata, A. 2000. A firm as a knowledge-creating entity: a new perspective on the theory of the firm. *Industrial and Corporate Change*, 9, 1-20.
- Norton Jr, W. I. and Moore, W. T. 2006. The influence of entrepreneurial risk assessment on venture launch or growth decisions. *Small Business Economics*, 26, 215-226.
- Nooteboom, B., Van Haverbeke, W., Duysters, G., Gilsing, V., and Van den Oord, A. 2007. Optimal cognitive distance and absorptive capacity. *Research Policy*, 36(7), 1016-1034.
- Nooteboom, B. 2000. *Learning and innovation in organizations and economies*, Oxford University Press.
- O'Donnell, A. 2014. The contribution of networking to small firm marketing. *Journal of Small Business Management*, 52, 164-187.
- Oakey, R. P. and Cooper, S. 1991. The relationship between product technology and innovation performance in high technology small firms. *Technovation*, 11, 79-92.
- Owen-Smith, J. and Powell, W. W. 2004. Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community. *Organization Science*, 15, 5-21.
- Palich, L. E. and Bagby, D. R. 1995. Using cognitive theory to explain entrepreneurial risk-taking: Challenging conventional wisdom. *Journal of Business Venturing*, 10, 425-438.
- Park, S. and Bae, Z.-T. 2004. New venture strategies in a developing country: Identifying a typology and examining growth patterns through case studies. *Journal of Business Venturing*, 19, 81-105.

- Parker, S. C. 1997. The effects of risk on self-employment. *Small Business Economics*, 9, 515-522.
- Parker, S. C. 2004. *The economics of self-employment and entrepreneurship*, Cambridge University Press.
- Parker, S. C. 2009. *The economics of entrepreneurship*, Cambridge University Press.
- Parker, S. C. 2013. Do serial entrepreneurs run successively better-performing businesses? *Journal of Business Venturing*, 28, 652-666.
- Partington, D. 2000. Building grounded theories of management action. *British Journal of Management*, 11, 91-102.
- Penrose, E. 2009. *The Theory of the Growth of the Firm*, Oxford University Press.
- Peterman, N. E. and Kennedy, J. 2003. Enterprise education: Influencing students' perceptions of entrepreneurship. *Entrepreneurship Theory and Practice*, 28, 129-144.
- Pisano, G. P. 1997. *The development factory: unlocking the potential of process innovation*, Harvard Business Press.
- Pitelis, C. 2012. Clusters, entrepreneurial ecosystem co-creation, and appropriability: a conceptual framework. *Industrial and Corporate Change*, 21(6), 1359-1388..
- Pittaway, L. and Cope, J. 2007. Simulating entrepreneurial learning integrating experiential and collaborative approaches to learning. *Management Learning*, 38, 211-233.
- Pittaway, L. and Thorpe, R. 2012. A framework for entrepreneurial learning: A tribute to Jason Cope. *Entrepreneurship and Regional Development*, 24, 837-859.
- Plummer, L. A. and Acs, Z. J. 2014. Localized competition in the knowledge spillover theory of entrepreneurship. *Journal of Business Venturing*, 29, 121-136.
- Politis, D. 2005. The process of entrepreneurial learning: a conceptual framework. *Entrepreneurship Theory and Practice*, 29, 399-424.
- Porter, M. E. 1980. *Competitive Strategy Techniques for Analyzing Industries and Competitors*, The Free Press, NY.
- Porter, M. E. 2008. *Competitive advantage: Creating and sustaining superior performance*. Simon and Schuster.
- Prashantham, S. and Young, S. 2011. Post-entry speed of international new ventures. *Entrepreneurship Theory and Practice*, 35, 275-292.
- Presutti, M., Boari, C. and Fratocchi, L. 2007. Knowledge acquisition and the foreign development of high-tech start-ups: A social capital approach. *International Business Review*, 16, 23-46.
- Presutti, M., Boari, C. and Majocchi, A. 2011. The Importance of Proximity for the Start-Ups' Knowledge Acquisition and Exploitation. *Journal of Small Business Management*, 49, 361-389.

- Priem, R. L., and Butler, J. E. 2001. Is the resource-based “view” a useful perspective for strategic management research? *Academy of Management Review*, 26(1), 22-40.
- Qian, H. and Acs, Z. J. 2013. An absorptive capacity theory of knowledge spillover entrepreneurship. *Small Business Economics*, 40, 185-197.
- Quinn, R. E. and Cameron, K. 1983. Organizational life cycles and shifting criteria of effectiveness: Some preliminary evidence. *Management Science*, 29, 33-51.
- Rae, D. 2000. Understanding entrepreneurial learning: a question of how? *International Journal of Entrepreneurial Behaviour and Research*, 6, 145-159.
- Rae, D. 2006. Entrepreneurial learning: a conceptual framework for technology-based enterprise. *Technology Analysis and Strategic Management*, 18, 39-56.
- Rae, D. and Carswell, M. 2000. Using a life-story approach in researching entrepreneurial learning: the development of a conceptual model and its implications in the design of learning experiences. *Education+ Training*, 42, 220-228.
- Rae, D. and Carswell, M. 2001. Towards a conceptual understanding of entrepreneurial learning. *Journal of Small Business and Enterprise Development*, 8, 150-158.
- Ravasi, D. and Turati, C. 2005. Exploring entrepreneurial learning: a comparative study of technology development projects. *Journal of Business Venturing*, 20, 137-164.
- Reuber, A. R. and Fischer, E. M. 1994. Entrepreneurs' experience, expertise, and the performance of technology-based firms. *Engineering Management*, 41, 365-374.
- Roberts, N., Galluch, P. S., Dinger, M. and Grover, V. 2012. Absorptive Capacity and Information Systems Research: Review, Synthesis, and Directions for Future Research. *MIS quarterly*, 36, 625-648.
- Rossiter, J. R. 2001. What is marketing knowledge? Stage I: forms of marketing knowledge. *Marketing Theory*, 1(1), 9-26.
- Saarenketo, S., Puumalainen, K., Kyläheiko, K., & Kuivalainen, O. 2008. Linking knowledge and internationalization in small and medium-sized enterprises in the ICT sector. *Technovation*, 28(9), 591-601.
- Sábato, J. and Botana, N. 1968. La ciencia y la tecnología en el desarrollo futuro de América Latina. *Revista de la Integración*, 1, 15-36.
- Salazar, M. R., Lant, T. K., Fiore, S. M., and Salas, E. 2012. Facilitating innovation in diverse science teams through integrative capacity. *Small Group Research*, 43(5), 527-558
- Sandberg, W. R. and Hofer, C. W. 1988. Improving new venture performance: The role of strategy, industry structure, and the entrepreneur. *Journal of Business Venturing*, 2, 5-28.
- Sapienza, H. J., Parhankangas, A. and Autio, E. 2004. Knowledge relatedness and post-spin-off growth. *Journal of Business Venturing*, 19, 809-829.

- Sarasvathy, S. D. 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26, 243-263.
- Saunders, M. N., Saunders, M., Lewis, P., and Thornhill, A. 2011. Research methods for business students, 5/e, Pearson Education India.
- Sawyer, O. O., & Gilsdorf, J. W. (2008). An exploration of knowledge management processes in start-up firms in the high-technology sector. *Entrepreneurial Learning: Conceptual Frameworks and Applications*, 141.
- Schildt, H. A., Maula, M. V. and Keil, T. 2005. Explorative and exploitative learning from external corporate ventures. *Entrepreneurship Theory and Practice*, 29, 493-515.
- Schumpeter, J. A. 1934. *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*, Transaction publishers.
- Semrau, T. and Werner, A. 2014. How Exactly Do Network Relationships Pay Off? The Effects of Network Size and Relationship Quality on Access to Start-Up Resources. *Entrepreneurship Theory and Practice*, 38, 501-525.
- Shane, S. 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11, 448-469.
- Shane, S. 2003. *A general theory of entrepreneurship: The individual-opportunity nexus*, Edward Elgar Publishing.
- Shane, S. 2004. *Academic entrepreneurship*, Edward Elgar Publishing.
- Shane, S. 2005. *Economic Development Through Entrepreneurship: Government, University And Business Linkages (New Horizons in Entrepreneurship)*, Edward Elgar Publishing.
- Shane, S. and Venkataraman, S. 2000. The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25, 217-226.
- Shapiro, A. and Sokol, L. 1982. The social dimensions of entrepreneurship. *Encyclopedia of entrepreneurship*, 72-90.
- Shepherd, D. A. 2003. Learning from business failure: Propositions of grief recovery for the self-employed. *Academy of Management Review*, 28(2), 318-328.
- Shepherd, D. A. and Sutcliffe, K. M. 2011. Inductive top-down theorizing: A source of new theories of organization. *Academy of Management Review*, 36, 361-380.
- Sitkin, S. B., Sutcliffe, K. M. and Schroeder, R. G. 1994. Distinguishing control from learning in total quality management: a contingency perspective. *Academy of Management Review*, 19, 537-564.
- Smith, J. A. 1996. Beyond the divide between cognition and discourse: Using interpretative phenomenological analysis in health psychology. *Psychology and Health*, 11(2), 261-271

- Smith, J. A., Flowers, P., and Larkin, M. 2009. *Interpretative phenomenological analysis: Theory, method and research*, Sage.
- Spender, J. 2012. Nonaka and KM's Past, Present and Future. *Towards organizational knowledge: The pionering work of Ikujiro Nonaka*, Palgrave Macmillan.
- Spender, J.-C. 1996. Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17, 45-62.
- Spilling, O. R. 1996. Regional variation of new firm formation: the Norwegian case. *Entrepreneurship and Regional Development*, 8, 217-244.
- Srivastava, A., Bartol, K. M. and Locke, E. A. 2006. Empowering leadership in management teams: Effects on knowledge sharing, efficacy, and performance. *Academy of Management Journal*, 49, 1239-1251.
- Stake, R. E. 2000. Case Studies. In *Handbook of Qualitative Research*, N. K. Denzin, Lincoln, Yvonna S. (Eds.), 2nd edition, 134-164, 435-454.
- Stevenson, H. H. 1983. *A perspective on entrepreneurship*, Harvard Business School.
- Stevenson, H. H. 2000. *Why entrepreneurship has won*, Coleman White Paper.
- Stevenson, H. H. and Jarillo, J. C. 1990. A paradigm of entrepreneurship: entrepreneurial management. *Strategic Management Journal*, 11, 17-27.
- Stewart Jr, W. H. and Roth, P. L. 2001. Risk propensity differences between entrepreneurs and managers: a meta-analytic review. *Journal of Applied Psychology*, 86, 145.
- Stinchcombe, A. L. 1965. Social structure and organizations. *Handbook of Organizations*, Routledge, 142-193.
- Strauss, A. and Corbin, J. 1994. Grounded theory methodology. *Handbook of qualitative research*, Sage, 273-285.
- Stuart, R. W. and Abetti, P. A. 1990. Impact of entrepreneurial and management experience on early performance. *Journal of Business Venturing*, 5, 151-162.
- Suddaby, R. 2006. From the editors: What grounded theory is not. *Academy of Management Journal*, 49, 633-642.
- Szulanski, G. 2000. The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational behavior and human decision processes*, 82, 9-27.
- Takeuchi, H. and Nonaka, I. 1986. The new new product development game. *Harvard Business Review*, 64, 137-146.
- Tan, J., Shao, Y. and Li, W. 2013. To be different, or to be the same? An exploratory study of isomorphism in the cluster. *Journal of Business Venturing*, 28, 83-97.
- Tanriverdi, H. 2005. Information technology relatedness, knowledge management capability, and performance of multibusiness firms. *MIS quarterly*, 311-334.

- Teece, D. 1997. Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18, 509-533.
- Teece, D. J. 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28, 1319-1350.
- Teece, D. J. 2009. *Dynamic capabilities and strategic management: organizing for innovation and growth*. Oxford University Press.
- Teece, D. J., Pisano, G. and Shuen, A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- Thakur, S. P. 1999. Size of investment, opportunity choice and human resources in new venture growth: some typologies. *Journal of Business Venturing*, 14, 283-309.
- Theodorakopoulos, N. and Figueira, C. 2012. What Can Situated Learning Theory Tell Us About Leading to Develop Organizational Learning Capabilities for Entrepreneurial Performance? Lessons from a Knowledge-Intensive Small Firm. *Thunderbird International Business Review*, 54, 859-873.
- Thompson, J. L. 2004. The facets of the entrepreneur: identifying entrepreneurial potential. *Management Decision*, 42, 243-258.
- Tidd, J., Bessant, J. and Pavitt, K. 2011. *Managing innovation: integrating technological, market and organizational change*, Wiley.
- Timmons, J. A. 1989. *The Entrepreneurial Mind*, ERIC.
- Timmons, J. A. and Spinelli, S. 1999. *New venture creation: Entrepreneurship for the 21st century*, Mc Graw-Hill.
- Tsai, W. 2001. Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44, 996-1004.
- Ucbasaran, D., Lockett, A., Wright, M. and Westhead, P. 2003. Entrepreneurial founder teams: Factors associated with member entry and exit. *Entrepreneurship Theory and Practice*, 28, 107-128.
- Ucbasaran, D., Westhead, P. and Wright, M. 2001. The focus of entrepreneurial research: contextual and process issues. *Entrepreneurship Theory and Practice*, 25, 57-80.
- Van Burg, E., Romme, A. G. L., Gilsing, V. A. and Reymen, I. M. 2008. Creating University Spin-Offs: A Science-Based Design Perspective. *Journal of Product Innovation Management*, 25, 114-128.
- Van de Ven, H. 1993. The development of an infrastructure for entrepreneurship. *Journal of Business Venturing*, 8, 211-230.
- Van Den Bosch, F. A., Volberda, H. W. and De Boer, M. 1999. Coevolution of firm absorptive capacity and knowledge environment: Organizational forms and combinative capabilities. *Organization Science*, 10, 551-568.



- Vanaelst, I., Clarysse, B., Wright, M., Lockett, A., Moray, N. and S'Jegers, R. 2006. Entrepreneurial team development in academic spinouts: An examination of team heterogeneity. *Entrepreneurship Theory and Practice*, 30, 249-271.
- Veciana, J. M. 2007. Entrepreneurship as a Scientific Research Programme. *Entrepreneurship*, Springer.
- Vendrell-Herrero, F., González-Pernía, J. L. and Peña-Legazkue, I. 2011. Do incentives matter to promote high technology-driven entrepreneurial activity? *International Entrepreneurship and Management Journal*, 1-24.
- Venkataraman, S. 1997. The distinctive domain of entrepreneurship research. *Advances in entrepreneurship, firm emergence and growth*, 3, 119-138.
- Vohora, A., Wright, M. and Lockett, A. 2004. Critical junctures in the development of university high-tech spinout companies. *Research Policy*, 33, 147-175.
- Voudouris, I., Dimitratos, P. and Salavou, H. 2011. Entrepreneurial learning in the international new high-technology venture. *International Small Business Journal*, 29, 238-258.
- Watkins, A., Papaioannou, T., Mugwagwa, J. and Kale, D. 2015. National innovation systems and the intermediary role of industry associations in building institutional capacities for innovation in developing countries: A critical review of the literature. *Research Policy*, 44(8), 1407-1418
- Wang, C. L. and Chugh, H. 2014. Entrepreneurial learning: Past research and future challenges. *International Journal of Management Reviews*, 16, 24-61.
- Wernerfelt, B. 1984. A resource-based view of the firm. *Strategic Management Journal*, 5, 171-180.
- West, G. P. and Noel, T. W. 2009. The impact of knowledge resources on new venture performance. *Journal of Small Business Management*, 47, 1-22.
- Westhead, P., Ucbasaran, D. and Wright, M. 2005a. Decisions, Actions, and Performance: Do Novice, Serial, and Portfolio Entrepreneurs Differ?. *Journal of Small Business Management*, 43, 393-417.
- Westhead, P., Ucbasaran, D. and Wright, M. 2005b. Experience and Cognition: Do Novice, Serial and Portfolio Entrepreneurs Differ? *International Small Business Journal*, 23, 72-98.
- Westhead, P., Wright, M. and McElwee, G. 2011. *Entrepreneurship: Perspectives and cases*, Pearson.
- Wilken, P. H. 1979. *Entrepreneurship: A comparative and historical study*, Ablex Pub.
- Wincent, J., Thorgren, S. and Anokhin, S. 2014. Entrepreneurial orientation and network board diversity in network organizations. *Journal of Business Venturing*, 29, 327-344.
- Winter, S. G. 2003. Understanding dynamic capabilities. *Strategic Management Journal*, 24, 991-995.

- Wood, M. S., McKelvie, A. and Haynie, J. M. 2014. Making it personal: Opportunity individuation and the shaping of opportunity beliefs. *Journal of Business Venturing*, 29, 252-272.
- Wright, M., Robbie, K. and Ennew, C. 1997. Serial entrepreneurs. *British Journal of Management*, 8, 251-268.
- Wuyts, S., Colombo, M. G., Dutta, S. and Nooteboom, B. 2005. Empirical tests of optimal cognitive distance. *Journal of Economic Behavior and Organization*, 58, 277-302.
- Yin, R. K. 1994. *Case study research: Design and methods*, Sage publications.
- Yin, R. K. 2014. *Case study research: Design and methods*, Sage publications.
- Yli-Renko, H. and Janakiraman, R. 2008. How customer portfolio affects new product development in technology-based entrepreneurial firms. *Journal of Marketing*, 72, 131-148.
- Yli-Renko, H., Autio, E. and Sapienza, H. J. 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, 22, 587-613.
- Yli-Renko, H., Autio, E., & Tontti, V. 2002. Social capital, knowledge, and the international growth of technology-based new firms. *International Business Review*, 11(3), 279-304.
- Ylinenpää, H. 2009. Entrepreneurship and innovation systems: Towards a development of the ERIS/IRIS concept. *European Planning Studies*, 17, 1153-1170.
- Zahra, S. A., Ireland, R. D., & Hitt, M. A. 2000. International expansion by new venture firms: International diversity, mode of market entry, technological learning, and performance. *Academy of Management Journal*, 43(5), 925-950.
- Zahra, S. A. 2007. Contextualizing theory building in entrepreneurship research. *Journal of Business Venturing*, 22, 443-452.
- Zahra, S. A. and George, G. 2002. Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27, 185-203.
- Zahra, S. A., and Nambisan, S. 2011. Entrepreneurship in global innovation ecosystems. *AMS Review*, 1(1), 4-17.
- Zahra, S. A., and Nambisan, S. 2012. Entrepreneurship and strategic thinking in business ecosystems. *Business horizons*, 55(3), 219-229.
- Zahra, S. A., Sapienza, H. J. and Davidsson, P. 2006. Entrepreneurship and dynamic capabilities: a review, model and research agenda. *Journal of Management Studies*, 43, 917-955.
- Zhao, H. and Seibert, S. E. 2006. The big five personality dimensions and entrepreneurial status: a meta-analytical review. *Journal of Applied Psychology*, 91, 259.

- Zhou, K. Z. and Li, C. B. 2012. How knowledge affects radical innovation: Knowledge base, market knowledge acquisition, and internal knowledge sharing. *Strategic Management Journal*, 33, 1090-1102.
- Zimmer, C. (1986). Entrepreneurship through social networks. The art and science of entrepreneurship. Ballinger, Cambridge, MA, 3-23.
- Zollo, M., and Winter, S. G. 2002. Deliberate learning and the evolution of dynamic capabilities. *Organization science*, 13(3), 339-351.
- Zucker, L. G., Darby, M. R., and Armstrong, J. (1998). Geographically localized knowledge: spillovers or markets? *Economic Inquiry*, 36(1), 65.

## REPORTS

- DANE (2012) Censo proyectado [www.dane.gov.co](http://www.dane.gov.co) accessed on May 2, 2013
- EAN (2011) Emprendimiento en Colombia. [www.ean.edu.co](http://www.ean.edu.co) Accessed on May 2, 2013
- Inpulsa (2010) Separata dinamicos 1 [www.innulsacolombia.com](http://www.innulsacolombia.com) Accessed on May 2, 2013
- Gomez, L., Martinez, P., Figueroa, C, Pereira, F, Quiroga R., Vesga, R, Varela, R and Alvarez, L. (2010) GEM Colombia 2010. [www.gemconsortium.org](http://www.gemconsortium.org) Accessed on May 2, 2013.
- Municipio de Medellín (2010) Plan de competitividad para Medellín Valle de Aburra y Antioquia [www.medellin.gov.co](http://www.medellin.gov.co) Accessed on January 6, 2015.
- Municipio de Medellín (2011) Plan estrategico de emprendimiento regional de Antioquia [www.culturaemedellin.gov.co](http://www.culturaemedellin.gov.co) Accessed on January 7, 2015
- Municipio de Medellín (2014) Sistema de Emprendimiento de Ciudad in *Nuevo Modelo de Emprendimiento de Medellín 2014*. [www.udea.edu.co](http://www.udea.edu.co) Accessed on January 5, 2015
- Observatorio Laboral para la educacion (2013) Mapa de caracterizacion de graduados [www.graduadoscolombia.edu.co](http://www.graduadoscolombia.edu.co). Accessed on June 14, 2014
- OECD (2005) Oslo Manual [http://www.uis.unesco.org/Library/Documents/OECD Oslo Manual05\\_en.pdf](http://www.uis.unesco.org/Library/Documents/OECD Oslo Manual05_en.pdf) Accessed on March 20, 2013
- Parque E (2012) Boletin Cultura E [www.culturamedellin.gov.co](http://www.culturamedellin.gov.co) Accessed on May 2, 2013
- The breakthrough (2012) Escalando el emprendimiento en Colombia [www.ccb.org.co](http://www.ccb.org.co) Accessed on May 2, 2013
- WIPO (2014) WIPO Intellectual Property Handbook. [http://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo\\_pub\\_489.pdf](http://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf) Accessed on February 14, 2014
- World Bank (2012) Doing business 2012 [www.doingbusiness.org](http://www.doingbusiness.org) Accessed on May 2, 2013
- World Bank (2013) Doing business 2013 [www.doingbusiness.org](http://www.doingbusiness.org) Accessed on May 2, 2013
- World Bank (2015a) Leveraging entrepreneurs ambition and innovation: A global perspective on entrepreneurship, competitiveness and development. [http://www3.weforum.org/docs/WEFUSA\\_EntrepreneurialInnovation\\_Report.pdf](http://www3.weforum.org/docs/WEFUSA_EntrepreneurialInnovation_Report.pdf) Accessed on July, 2015.
- World Bank (2015b) Bridging the skills and innovation gap to boost proactivity in Latin America. The competitiveness Lab: A World Economic Forum Initiative. [http://www3.weforum.org/docs/WEF\\_Competitiveness\\_Lab\\_Latin\\_America\\_15.pdf](http://www3.weforum.org/docs/WEF_Competitiveness_Lab_Latin_America_15.pdf) Accessed July, 2015.

**Appendix 1. Comparing theoretical frameworks for EL in Harrison and Leitch (2008) (Part A)**

	<b>Author/Theme</b>	<b>Type of Entrepreneurship</b>	<b>Theoretical framework(s) – Types of Learning</b>	<b>Empirical/ Conceptual</b>	<b>Data? What type? From where?</b>
1	Chia, Robert/A	Entrepreneurial ventures	Multivariate contingency framework. Entrepreneurial Orientation-performance relationship.	Conceptual (peripheral vision)	No data
2	Politis/A	<b>New Ventures</b>	Theories of Experiential Learning (static to dynamic perspective)	Conceptual (prepositions)	No data
3	McHenry/A	Entrepreneurial ventures	Cognitive learning theories (rejecting behaviourist theories), action and situated learning	Empirical	Longitudinal case study, old (1972) medium-sized Norwegian computer consultancy (governmental agency)
4	Lichtenstein and Lumpkin/B	Entrepreneurial ventures	Behavioural, action and cognitive learning (multiple levels of analysis)	Conceptual (prepositions)	No data
5	Corbett/B	(Entrepreneurial opportunities)	Experiential Learning Theory	Conceptual (prepositions)	No data
6	Sawyer and Gilsdorf/B	<b>Start-ups</b> (in the high tech sector)	KBV	Empirical (prepositions)	Semi-structured interviews in five companies
7	Ekanem and Smallbone/B	Small manufacturing firms	Behavioural theories (decision-making) and single and double (open) and complex or closed-loop learning (Stacey, 1996)	Empirical	Eight case studies
8	Rowe and Christie/B	Local governmental authorities (civic entrepreneurship: innov. public adm.)	Leadership (key employees and customers)	Empirical	Top management teams of eight firms, questionnaire in Queensland
9	Friga/C	<b>New ventures</b>	RBT (entrepreneurs as a resource), KV/OL and Schumpeter (Behavioural and background: Cognitive factors), absorptive capacity theory	Empirical	Survey to 492 entrepreneurs
10	Gonsales and Gray/C	SMEs	RBT, OL a multi-dimensional construct partially consisting of Personal Cognitive Learning, Social Constructive Learning and Institutional Constitutive Learning	Conceptual (prep. and hyp.)	No data

	<b>Author/Theme</b>	<b>Type of Entrepreneurship</b>	<b>Theoretical framework(s) – Types of Learning</b>	<b>Empirical/ Conceptual</b>	<b>Data? What type? From where?</b>
11	Waalkens, Jorna and Postma/C	Architectural and engineering SMEs	KBV and ACAP	Conceptual and empirical (hyp.)	Telephone inquiry, 163 SMEs in Netherlands.
12	Tell/C	Small traditional manufacturing enterprises	Network: a development model, not an analytical tool. Single and dooble-loop (and situated learning) Learning by Action and reflection.	Empirical	Questionnaire, semi-structured interview, meetings for promoting collaboration
13	Smith/D	Famous Entrepreneurs	Behavioural: Dyslexia and entrepreneurs: being differently abled	Empirical	57 entrepreneurs/ second inform (8 specific comm.)
14	Fisher, Graham and Compeau/D	Potential Entrepreneurs	Cognitive, skill-based/behavioural and affective	Empirical	113 undergraduate students

(A) Conceptual approaches; (B) Intra-organisational learning; (C) Inter-organisational learning; and (D) learning, education and development.

Source: Compiled by author.

***Appendix 2. Comparing theoretical frameworks for EL in the Special Issue of ET & P, 2005 (Two papers were published again in Harrison and Leitch's book: Politis and Corbett).***

	<b>Author/Theme</b>	<b>Type of Entrepreneurship</b>	<b>Theoretical framework(s) – Type of learning</b>	<b>Empirical/ Conceptual</b>	<b>Data? What type? From where?</b>
1	Cope (2005)/A	New Firms	Functional, personality and behavioural perspective. Learning by experience, reflection and doing.	Conceptual	None
2	Dutta and Crossan (2005)/A	New Firms/ opportunities recognition	Theories of Entrepreneurship (Schumpeter and Kirzner) and OL: 4I framework (Intuiting, Interpreting, Integrating, and Institutionalising)	Conceptual	None
3	Lumpkin and Lichtenstein (2005)/B	New Firms/ opportunities recognition	OL: Behavioural, cognitive and action	Conceptual	None
4	Schildt et al. (2005)/C	Corporate ventures (CE)	OL: exploitation and exploration, knowledge relatedness, dynamic capabilities	Empirical/ Conceptual	ICT industry, USA (110 firms)
5	Clercq and Sapienza (2005)/C	Venture capital firms (VCFs)	KBV, ACAP, Behavioural theories	Empirical/ Conceptual	298 U.S.-based VCFs

(A) Conceptual approaches; (B) Intra-organisational learning; (C) Inter-organisational learning; and (D) learning, education and development.

Source: Compiled by author.

**Appendix 3. Papers – published after August 2012 – which follow criteria in Table 3.6.**

	<b>Author (year)</b>	<b>Knowledge (K) properties, type, dimensions or content</b>	<b>Network properties or dimensions</b>	<b>Theoretical framework(s) – Type of learning</b>
1	Jonsson and Lindbergh (2013)	K homophily (similarity in cognitive schemes motivates interaction because communication is easier)	Existent embeddedness through increased interaction or reciprocity (relational dimension)	Social Capital No Theory of Entrepreneurial Learning (TEL) identified but financial knowledge is the main topic of this paper.
2	Plummer and Acs (2014)	New (market) knowledge		K spillover
3	Qian and Acs (2013)	New knowledge and entrepreneurs' absorptive capability		TEL: Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George).
4	Milanov and Fernhaber (2014)	Top Management Team (TMT) international experience (experiential knowledge)	Informal and formal relationships for international exposure	Networks, International Entrepreneurship No TEL identified but international knowledge is the main topic of this paper.
5	Wood et al. (2014)	K relatedness (knowledge required to identify, evaluate, and exploit an opportunity is similar to the knowledge the entrepreneur already possesses)		Theories of opportunity belief formation. March's exploratory and exploitative learning.
6	Tan et al. (2013)	Knowledge and information flows	Network centrality and periphery (isomorphism)	Institutional theory (Legitimacy) Network theory in clusters
7	Naldi and Davidsson (2013)	Knowledge acquisition from international markets		KBV Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George). Huber's organisational learning.
8	Parker (2013)	Depreciation ("positive effects are nearly completely exhausted by the end of the next spell", p.662)		Learning by doing and selective learning from failure (entrepreneurial knowledge). March's exploratory and exploitative learning.
9	Fernhaber and Li (2013)		International exposure through network relationships	Network theory, attention-based theory No TEL identified but international knowledge is a main topic of this paper.
10	De Clercq et al. (2013b)	Internal knowledge sharing	Organisational social capital (structural dimension: formalisation)	Social capital. Firm'EO. No TEL identified but knowledge sharing is a main topic.

	<b>Author (year)</b>	<b>Knowledge (K) properties, type, dimensions or content</b>	<b>Network properties or dimensions</b>	<b>Theoretical framework(s) – Type of learning</b>
11	Wincent et al. (2014)		Network board diversity Network-level EO	Organisational Learning (OL): information processing and decision-making
12	O'Donnell (2014)		Network content (communication, exchange and normative)	RBT, Social capital No TEL identified but market knowledge is a main topic.
13	Semrau and Werner (2014)	Relevant information-knowledge	Relationship quality Network size	Social capital, Network theory No TEL identified but info/knowledge is a key topic (a resource to acquire).
14	Arentz et al. (2013)	Prior knowledge (and alertness)		Kirzner (Opportunities)
15	Maes and Sels (2014)	Internally (K diversity and K sharing capability) and Externally (exploratory, transformative and exploitative capabilities) oriented knowledge		KBV March's exploratory and exploitative learning. Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George).
16	Chun and Mun (2012)	Incoming knowledge spillovers (R+D Cooperation)		K Spillover Absorptive capacity and external learning (Cohen and Levinthal, and Zahra and George).
17	Audretsch and Belitski (2013)	Creativity embodied in an entrepreneur or inventor		K Spillover

Source: Compiled by author.



*Appendix 4. Questions for interview, stage 1.*

Main questions	Additional questions	Clarification questions
1. Do you identify any entrepreneurial ecosystems surrounding your institution?	<ul style="list-style-type: none"> <li>• Agents?</li> <li>• At what level?</li> </ul>	Do you consider that the entrepreneurial ecosystem in which your institution is embedded is efficient?
2. What is the role of your institution in the entrepreneurial ecosystem it belongs to?	<ul style="list-style-type: none"> <li>• National</li> <li>• Regional (city?)</li> <li>• Type of entrepreneurship (definition of NTBF)</li> <li>• Interaction with the system university-government-industry</li> </ul>	(Structure, governance, cognitive)
3. Which ones do you consider the key agents in the value chain of the technology-based entrepreneurial ecosystem?	<ul style="list-style-type: none"> <li>• Agents?</li> <li>• Trust?</li> <li>• Capacities?</li> <li>• Factors (external)?</li> <li>• Sector?</li> <li>• Region?</li> </ul>	Do you consider that the technology-based entrepreneurial ecosystem in which your institution is embedded is efficient?
4. In the construction of a database of NTBF (ICT), what firms do you think have to be included?	<ul style="list-style-type: none"> <li>• Business plans</li> <li>• New firms</li> </ul>	
Considering our talk and the aim of this research, do you have any suggestions or comments?		

***Appendix 5. Telephone Questionnaire. Survey of second stage of methodology.***

Good morning/afternoon, my name is Elizabeth Montoya, I am doing a PhD in NTBFs in Colombia and I am collecting general information to select firms in Medellín that develop software. The aim of this phone call is to ask some questions such as when the firm was created. It is composed of four topics and it does not take more than five minutes.

Are you available to answer them now? Yes \_\_\_ No \_\_\_

If so, what is your name and role in the firm? \_\_\_\_\_

**1. ABOUT THE CREATION OF THE FIRM**

- What is the name of the firm? \_\_\_\_\_
- What type of business is it? Corporation? SAS? \_\_\_\_\_
- Is it legally created? Yes \_\_\_ No \_\_\_ If so, when was it created (year)? \_\_\_\_\_
- When did the idea of creating a business emerge? \_\_\_\_\_

**2. ABOUT THE PRODUCTS**

- Do you have a business plan? Yes \_\_\_ No \_\_\_
- When was the first product sold (year)? \_\_\_\_\_
- If you have more than one product, do you offer different types of services? Yes \_\_\_ No \_\_\_ If so, how many? \_\_\_\_\_
- What is the core product? \_\_\_\_\_ When did you start selling it (year)? \_\_\_\_\_ Does it have more than one version? Yes \_\_\_ No \_\_\_ . If so, how many? \_\_\_\_\_

**3. ABOUT THE EMPLOYEES**

- How many employees does the firm have? \_\_\_\_\_
- Have you been an employee of the firm since it was created? Yes \_\_\_ No \_\_\_ If not, when did you become an employee? \_\_\_\_\_
- How many people created the firm? \_\_\_\_\_
- Do any of the entrepreneurs work in the firm? Yes \_\_\_ No \_\_\_
- Do any software developers work in the firm (as employees)? Yes \_\_\_ No \_\_\_ If so, how many? \_\_\_ Do they have certifications? Yes \_\_\_ No \_\_\_

**4. ABOUT THE ENTREPRENEURS**

If this firm is chosen as a case study, we will need to contact the CEO and the entrepreneurs, can you please give their phone numbers and emails?

Many thanks for your time and collaboration.

*Appendix 6. Questionnaire of first interview of second stage of methodology.*

**FIRM:**

**CEO\_/FOUNDER\_:**

Duration of the interview:

**1. MY PRESENTATION**

I am Elizabeth Montoya, a PhD student in Management at the University in Edinburgh. I belong to the Entrepreneurship and Innovation group of the Business School. My interest in entrepreneurship research and my desire to explore further the field of learning entrepreneurship (entrepreneurship education and training) stems from my MSc thesis in "Creation of spin-offs in the National University, Medellin" and my personal, first-hand experience in leading and managing C&T educational programmes for 7 years in Colombia.

**2. AIMS**

OF THE RESEARCH:

To examine the role of coordination/integration abilities of the entrepreneurial team of New Technology-based Firms (NTBF), in particular my aim is to understand the influence of knowledge integration in The New Product Process Development (NPPD).

OF THE INTERVIEW:

To collect information that allows me to map the most important sources of information while: the prototype was designed, patents managed and the first product commercialised.

**3. CONFIDENTIALITY**

**4. QUESTIONNAIRE** (and checklist with additional questions if needed)

**Can you please tell me how the process of developing the first product was? Who was in the team? What were the key events?**

**4.1 Can you please tell me what the motivation was for creating the firm?**

**DRIVER:**

What was the motivation for creating the firm?

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Can you please tell me the history of formation of the firm?

Was it formed because of a necessity and/or because of an opportunity?

**Was there a gap in the market that a new technology could solve?**

**Or, was there a new technology and a gap in the market was being/had been created?**

**Have you had a (potential) customer working with you? Since when?**

**4.2 Can you please tell me what you consider the key events for the following?**

**KEY EVENTS REGARDING**

**NPPD:**

What do you consider the key events in the process of designing the (first) new product?

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Year of the entrepreneurial event:

Did the entrepreneurial firm have a business plan?

Year of creation of the firm:

Does it have a patent? When was it obtained?

Did it have prototype? When was the first prototype designed?

How many prototypes have been designed?

How long did it take from the first prototype to the product (first sale)?

Year of launching of the first product:

Was the first product a tailored product (did it have a specific/defined client asking for it)?

**How did you have input of quality?**

How many products have been sold?

How many sold products represent the core of the firm?

**KEY POINTS REGARDING THE TEAM:**

What is the background of the founder team?

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Content Knowledge (TK,MK) acquired by formal education

Belong to research group/Part of research project

Content of K acquired by expertise (personal background)

**Previous networks (ties, cohesion)**

Were members introduced in the start-up process in order to improve procedures such as marketing or developing the technology?		Is the firm a spin-off? From a university, a company, other?
		<b>How many staff? When (year)? Expertise? Full-time or part-time?</b>
		<b>Why did you contract him/her? And how did you find him/her?</b>
		Is the current entrepreneurial team a well-balanced skilled team (functional expertise, management skills, decision-making styles, and experience)?
		How many partners does the firm have? If more than one, are there defined roles for the partners?
		How many partners did the firm have when it was created? If more than one, were there defined roles for the partners?

**KEY POINTS REGARDING SUB-TEAMS:**

Do you identify a particular change in roles of members during the NPPD?		<b>Can you identify several leaders or only one leader during all the process?</b>
		Was it a different team for the prototype, for the patent and for the product?
		If so, how different were they in terms of roles? Mostly technical, mostly marketing, mostly manufacturing?

**4.3 Who have been the most useful contacts for the new product process development? And why?**

**KEY POINTS REGARDING THE NETWORK AS SOURCE OF KNOWLEDGE:**

Who have been the most useful contacts for designing & developing the prototype? And Why?		<b>What was the content of that information? __ mainly TK __ mainly MK</b>
		Was the information obtained useful - novelty?
		Was the information obtained useful -temporality?
		Was the information obtained useful -relevancy?
		Was the information obtained useful -trust?
		Was the information obtained useful -comprehension (prior K)?
		<b>How did you get access to this contact?</b>
		<b>What was the content of that information? __ mainly TK __ mainly MK</b>
		Was the information obtained useful -novelty?
		Was the information obtained useful -temporality?
		Was the information obtained useful -relevancy?

What has been the most useful contacts for commercialising the product? And Why?

	Was the information obtained useful -trust?
	Was the information obtained useful -comprehension (prior K)?
	<b>How did you get access to this contact?</b>

KEY POINTS REGARDING OTHER SOURCES OF KNOWLEDGE:

Training programmes	Has the firm won any contests?
	If so, what (local) competition and in what year? What was the reward?
	<b>Has the entrepreneurial team participated in any training programme? Which one? When? What was the most useful information acquired?</b>

SOURCES OF FINANCIAL CAPITAL:

Financial capital	Was financial capital required to start-up? How it was collected?
	If they have a patent, how did they pay for it?
	How did they resource the prototype? And production?
	Have they grown? Number of team members, revenues since first sale...

*Appendix 7. Mind map 1 of first interview of second stage of methodology.*

*FIRM:*

*INDUSTRY:*

*Subsector:*

*DRIVER (M1,M2,T1,T2):*

*INTERVIEWEE (AND ROLE):*

*TEAM FOUNDER(S):*

*No. MEMBERS:*

SOURCES (M, T)	TEAM (M, T)

*Appendix 8. Mind map 2 of analysis of data collected in second stage of methodology.*

FIRM:  
DRIVER (M1,M2,T1,T2):

INTERVIEWEE (AND ROLE):  
No. MEMBERS:

DATE:

<p>SOURCES (M, T)</p>		<p>TEAM (M, T)</p>
<p>PROJECTIONS:</p>		



**Appendix 9. Table for clarification for second interview of second stage of methodology.**

**Checklist:**

<b>Drivers:</b>	MarketPull	TechPush
Effectuation (resources available)		
Causation (look for resources needed)		
Bricolage (change use of resources)		

<b>Key events (NPPD):</b>	Date	Why is this a key event?

<b>Team expertise (roles)</b>	Prototype			Product		
	New member	Founder	External	New member	Founder	External
Technical						
Marketing						
Managerial						
Entrepreneurial						
Leadership						

<b>Utility of information for the prototype</b>	External source (name of institution/person/people)					
	Inst. 1 ___	Inst. 2 ___	Inst. 3 ___	Inst. 4 ___	Inst. 5 ___	...
?mainly TK						
?mainly MK						
Relevancy						

Novelty						
Temporality						
Trust						
Comprehension						

Utility of information for the patent	External source (name of institution/person/people)					
	Inst 1 ____	Inst 2 ____	Inst 3 ____	Inst 4 ____	Inst 5 ____	...
?mainly TK						
?mainly MK						
Relevancy						
Novelty						
Temporality						
Trust						
Comprehension						

Utility of information for the product	External source (name of institution/person/people)					
	Inst. 1 ____	Inst. 2 ____	Inst. 3 ____	Inst 4. ____	Inst. 5 ____	...
?mainly TK						
?mainly MK						
Relevancy						
Novelty						
Temporality						
Trust						
Comprehension						

*Appendix 10. Focus group protocol of second stage of methodology.*

**PRE-FOCUS GROUP**

Draw the mind map on a big piece of paper so that all the members of the focus group can read it at the same time.

**DURING FOCUS GROUP 1 – PRESENTATION**

If there are more than three participants, two roles are assigned: temporal moderator to keep track of the time and dual moderator to help to develop the session in a smooth and comfortable way.

The researcher presents herself and asks the team to present themselves (name and role in the firm).

**DURING FOCUS GROUP 2 – MIND MAP REVIEW**

The summary of the previous interviews are presented using the mind map developed after the analysis and verifying dates and key events with all the participants.

Key events are completed and dates are changed, if needed.

**DURING FOCUS GROUP 3 – SELECTION OF PRODUCTS TO STUDY**

This is OPTIONAL (this section is developed when more clarification is needed).

- a. Regarding the first product(s), was it necessary to increase the number of people of the team solving the need? Who were hired as employees? What was their profile and criterion of selection? How was the interaction with the customer?
- b. Comparing the process of development and commercialisation before and after \_\_\_\_\_ (a key event identified is very important for the phenomenon of development and commercialisation of new products), how have your roles changed? What were the key products before the event?

**DURING FOCUS GROUP 4 – CLOSING**

Summary of the key points discussed, acknowledgements and planning of the next interview if needed.