

**MIETE – Master Program in Innovation and Technological
Entrepreneurship**



Master Thesis

**A framework for identification, selection and
collaboration of Corporations with Start-ups within
Open Innovation**

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Abstract

The modern paradigm of innovation places knowledge as one of the major cornerstones of innovation. The abundance of knowledge outside organizations' boundaries push companies towards open innovation (OI) systems. In this search for knowledge, Start-ups are perceived as relevant knowledge sources, once they are capable to agilely explore innovations and new technology applications. However, in a sources' abundant scenario, knowing whom to exchange knowledge with becomes a challenge. It is the purpose of this research to provide a structured process for large corporations to design knowledge exchange relationships with Start-ups. By using abductive reasoning method, reconciling general theory and case specific idiosyncrasies, the research explored the literature to construct a knowledge collaboration framework and providing a conceptual validation in the context of the hosting company Consoveyo S.A. The analysed literature claimed that asymmetric partnerships are likely to face complications due to differences between large corporation and Start-up, thus structured process are required to support effective construction of these relationships. Three structuring stages are identified as foundations the relationships: *System Strategy*, *Partner Identification & Selection* and *Knowledge Collaboration*. Extensive stages description and application are provided, offering practical guidelines for firms' gatekeepers structure knowledge collaboration relationships with ventures.

Keywords: Open Innovation, Start-ups, Knowledge sources, Start-ups assessment, Decision-making

Resumo

O paradigma moderno de inovação coloca conhecimento como uma das bases da inovação. Abundante conhecimento fora dos limites das organizações força empresas em direção a sistemas abertos de inovação (*Open Innovation*). Nessa busca por conhecimento, *Start-ups* são relevantes fontes de conhecimento, uma vez que são capazes de agilmente explorar inovações e novas aplicações de tecnológicas. No entanto, num cenário abundante em fontes, saber com quem trocar conhecimento se torna um desafio. Esta pesquisa tem como propósito fornecer um processo para grandes empresas desenhar relacionamentos de troca de conhecimento com *Start-ups*. Pela utilização do método *abductive reasoning* (raciocínio abduutivo), que reconcilia teorias gerais com peculiaridades de casos específicos, a pesquisa explorou a literatura para construir um modelo de colaboração de conhecimento, fornecendo validação do modelo no contexto da empresa parceira Consoveyo S.A. A literatura analisada afirma que parcerias assimétricas são propícias a complicações devido às diferenças entre grandes empresas e *Start-ups*, portanto são necessários processos estruturados para suportar a construção desses relacionamentos. Três estágios estruturantes foram identificados como fundações dos relacionamentos: *Estratégia do Sistema*, *Identificação e Seleção de Parceiros* e *Colaboração de conhecimento*. Extensa descrição e aplicação dos estágios é fornecida, oferecendo orientações práticas para guardiões de conhecimento das empresas estruturarem relacionamentos de colaboração de conhecimento com *Start-ups*.

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List of abbreviation

A&D	Acquisition & Development
BA	Business Area
BU	Business Unit
CIM	Closed Innovation Model
CVC	Corporate Venture Capital
CVY	Consoveyo S.A.
EC	Evaluation Clusters
HEI	High Education Institutions
IRR	Internal Return Rate
KAG	Körber AG
KLS	Körber Logistics Systems GmbH
MCDM	Multi-criteria Decision Making
MCEM	Multi-criteria Evaluation Methods
OECD	Organization for Economic Co-operation and Development
OI	Open Innovation
R&D	Research and Development
VCs	Venture Capitalists
WFGM	Want & Find - Get & Manage
Strats	Strategic Organization Level Representatives
Tacts	Tactical Organization Level Representatives
Opes	Operational Organization Level Representatives

1 Chapter: Introduction

Nowadays sustaining competitiveness and innovativeness employing exclusively internal knowledge sources is becoming increasingly untenable (Chesbrough, 2007; Kohler, 2016). The modern framework poses innovation within the business sector as an extremely distributed process grounded on the management of the flows of knowledge across the boundaries of organizations (OECD, 2018).

In the effort to keep up with the modern innovation paradigm, corporations are increasingly relaying on external sources of knowledge, and accurately selecting and managing these sources is a major challenge for open innovation (Kruse, 2012). Also the kinds of partners for innovation are relevant for innovation performance since different types of innovation rely on specific sources of knowledge and links (Chen, Chen, & Vanhaverbeke, 2011).

The management of Open Innovation (OI) systems (Chesbrough, 2003) is a complex task, since it involves various different agendas, timings and objectives (Boehmer & Lindemann, 2015). Managers are required to have deeper understanding on how to design interfaces capable to generate innovation for the corporation and add value for the partner (Kohler, 2016). To acknowledge the existing practices in OI interfacing models will support managers to better design their own approaches.

Therefore, being capable to select and manage specific knowledge from external sources are two of the main challenges and keys for innovation (Kruse, 2012). Given the significance of Start-ups as sources of knowledge for innovation (Spender, Corvello, Grimaldi, & Rippa, 2017) and the lack of guidelines for strategically include these ventures in large firms innovation systems (Walsh & Linton, 2011), it is useful to consider a framework for large corporations to identify, select and collaborate with Start-ups.

This research builds on the practice of OI aiming to design a framework for identification, selection and collaboration with Start-ups as external sources of knowledge. Providing an overview of assessment models, knowledge collaboration approaches and a framework to engage in OI with Start-ups.

The document is organized in the following sections: First section approaches the research topic, detailing research objectives and methodology. Section 2 reviews the literature on knowledge sources and flows, OI collaboration models and Start-ups assessment models, aiming to set the foundations for the identification, selection and collaboration with external knowledge sources. Section 3 convers the conception of the framework for identification, selection and collaboration with Start-ups. Section 4 presents and discusses the framework and it's validation, assessing its applicability as theoretical and practical model. Section 5 presents the conclusion and key takeaways of the research, debating the process learnings. Section 6 presents research limitations and future research.

1.1 Research Motivation

The researcher current professional activity is related with design of a technology scouting approach for the Körber Logistics Systems GmbH (KLS), logistics Business Area (BA) of the large German technology group Körber AG (KAG).

Focusing on build an approach to select and collaborate with external technology sources, the researcher activities take place in the Portuguese firm Consoveyo S.A. (CVY), one of the KLS companies, selected to host the research. (*Figure 10 in Section 4.1 presents the corporate organigram*)

The interest for the subject of this research comes from the researcher previous activities with the industry and entrepreneurship environments, supporting development of entrepreneurship ecosystems linked with large corporations.

Corporations frequently struggle to efficiently include Start-ups in their innovation systems, difficulties to identify interesting Start-ups of relevance for the company, understand what value those new ventures might be able to create and how to exploit such value, are challenges constantly faced by corporations and topics of interest for the researcher.

Additionally, the pursue of modern innovation practices and its implementation within large corporations are first order subjects for the industries competitiveness and for the researcher's future professional activities. Therefore, this work contributes to the development of crucial competencies and knowledge for an innovation management practitioner.

1.2 Objectives of research: Design of a framework for identification, selection and collaboration of Corporations with Start-ups within Open Innovation

Open Innovation configurations and practices are still a challenging, yet highly relevant, theme for corporations' strategy. As theory and practice hardly offer clear guidelines for filling the gaps between technology and strategy (Walsh & Linton, 2011). In such perspective, it is the research objective to extend the body of knowledge and practice on methods large corporations deploy to access and capture external knowledge into their innovation systems, focusing on the Start-ups as knowledge sources for innovation.

In the context of KLS, clarity over the relevance of interfacing with external sources of knowledge (Chesbrough, 2003; Kruse, 2012), management of external knowledge flows (Kang & Kang, 2009; Spender et al., 2017) and models of collaboration with specific external knowledge sources (Berchicci, 2013; Chen et al., 2011; Chesbrough, 2007; Tether & Tajar, 2008) are first order matters to sustain openness of the BA technology innovation model. Having this in consideration, the research objectives are:

- Design a framework for knowledge sources identification, selection and collaboration between large corporations and Start-ups;
- Study of different collaboration models and value chains with Start-ups.

1.3 Research question

In alignment with the observations of the literature and the research objectives, the first research question aims to address the issue of large corporations to identify, select and collaborate with relevant Start-ups (as external knowledge sources). Being so formulated as follows:

- *How can large corporations identify, select and collaborate with Start-ups?*

In order to develop a tool that helps the company on the implementation process of the knowledge collaboration with Start-ups, the second question emerges:

- *How to design a framework to be applied for the identification, selection and collaboration models of Corporations with Start-ups?*

1.4 Research design and methodology: An Abductive Reasoning and Design Science approach

As indicated, one of the objectives of this research is to validate the framework for identification, selection and collaboration of Corporations with Start-ups within CVY. To accomplish such task, the chosen approach was a abductive reasoning.

Linked with case study research, abductive reasoning method permits to reconcile the general theory with the contextual peculiarities of the specific case (Wilhelm & Dolfma, 2018), allowing a practical validation of the framework conceived.

Additionally, based on the objectives proposed for this study an applied research method was deemed appropriate, since Design Science approach supports construct and evaluate artefacts oriented to solve recognized organizational problems (Hevner, March, Park, & Ram, 2008).

It is intended to apply such approaches with the objective of integrating the existing perspectives and concepts of collaboration with new ventures to support construct a framework that responds to the research questions.

The proposed research will unfold as follows:

- Theoretical: research and revision of literary body of knowledge of the core themes (External knowledge sources and flows, OI collaboration models and Start-up assessment models); the goal here is to identify the main elements for identification and selection of external knowledge sources (namely Start-up) and compile the existing collaboration practices with these sources of knowledge. The key elements from the theoretical phase will provide foundation for a Design Science approach to the problem.
- Theoretical-practical: development of a theory-based framework; based on the collected elements a framework (artefact) will be developed. Such construct will represent the researcher's understanding of the knowledge offered by the literature and structure a theoretical approach for solving the problem.

- Practical: Validation of the artefact by interviews; to reach a comprehensive answer that is capable to stand in practice and not only in theory. The proposed framework will be applied to an exploratory qualitative study (interviews with key stakeholders within CVY), in order to access the environment and evaluate the model.

Personal interviews will be conducted with the company Head of Technology Management of KLS and Head of Research and Development (R&D) during the theoretical-practical phase, to allow gathering company-specific information input for the construction of the model, and during the practical phase to support validation of the framework. Additional interviews may be performed with relevant internal stakeholders (e.g. Management engineering, KLS Digital Team, Technology Clusters Coordinators, Körber Digital, etc.)

In order to answer the research questions, the research work followed the phases presented below:

Table 1 - Research Phases

<i>Phases</i>	<i>Objective</i>	<i>Output</i>
1. Literature review	1.1- Review of the literature regarding main OI with external knowledge sources and assessment of Start-ups.	- Identification of key elements for Start-ups' assessment and main models of OI with Start-ups.
2. Theoretical framework construction	2.1- Interviews with CVY representatives to complement literature theory. 2.2- Proposition of framework for identification, selection and collaboration of Corporations with Start-ups.	- First version of the Framework for identification, selection and collaboration of Corporations with Start-ups.
3. Validation of the framework	3.1- Interview with CVY representatives to analyse the framework developed.	- Feedback on first version of the Framework for identification, selection and collaboration of Corporations with Start-ups.
5. Framework review	5.1- Development of upgraded Framework for identification, selection and collaboration with Start-ups based on finding of previous steps. 5.2- Compilation of learnings and closure of research.	- Upgraded version of the Framework for identification, selection and collaboration of Corporations with Start-ups. - Research conclusion.

2 Chapter: Literature Review on Knowledge sources and flows for innovation, Open Innovation collaboration models and Start-ups identification, selection and collaboration models

2.1 Methodology and organization

The initial task was to perform search of the topics: *Knowledge sources within Open Innovation; Open innovation with Start-ups and Models for assessment of Start-ups*. Using *Scopus* (a large database of abstracts and citations with peer-reviewed literature)

the search was performed as described in *Table 2*. Additionally, identification of the most cited journals and authors was made using an analytical approach, counting the number of times each journal and author was cited within each of the universes of search results. E.g.: In the “*Knowledge sources within Open Innovation*” search a total of 483 results was found. Within this universe the “*Journal of Business Venturing*” appears as source in 20 results, and the author “*Chesbrough, H.W.*” was cited 114 times. This approach was used to indicate which papers might be more relevant in the fields searched.

Table 2 - Procedure for literature selection

<i>Literature review approach</i>	
Knowledge sources within Open Innovation	
Query used in <i>Scopus</i> : (open AND innovation) AND (knowledge AND sources)	
Initial n° of results found: 867	
Reduction Criteria	N° of results after reduction
Limit to subject areas (Business, Management & Accounting; Social Sciences; Economics, Econometrics & Finance; Decision Sciences; Multidisciplinary)	549
Limit from 2008 to 2019	483
Reduction by Title adherence to the research topic	67
Identification o most cited Journals and authors and cross checking with results	55
Reduction by abstract adherence to the topic	17
Open documents available used in the review	11
Open innovation with Startups	
Query used in <i>Scopus</i> : (open AND innovation) AND (startups OR start-ups OR ventures)	
Initial n° of results found: 480	
Reduction Criteria	N° of results after reduction
Limit to subject areas (Business, Management & Accounting; Social Sciences; Economics, Econometrics & Finance; Decision Sciences; Multidisciplinary)	327
Limit from 2008 to 2019	292
Reduction by Title adherence to the research topic	164
Identification o most cited Journals and authors and cross checking with results	40
Reduction by abstract adherence to the topic	27
Open documents available used in the review	12
Models for assessment of Startups	
Query used in <i>Scopus</i> : (start-ups OR startups) AND ((assessment OR evaluation) AND model)	
Initial n° of results found: 2270	
Reduction Criteria	N° of results after reduction
Limit to subject areas (Business, Management & Accounting; Social Sciences; Economics, Econometrics & Finance; Decision Sciences; Multidisciplinary)	546
Limit from 2008 to 2019	371
Reduction by Title adherence to the research topic	109
Identification o most cited Journals and authors and cross checking with results	77
Reduction by abstract adherence to the topic	32
Open documents available used in the review	16

The literature review is further systematized identifying what subject is approached by each author and under which perspective. Detailing of the systematization is available at *Appendix1*.

The literature review is organized in two main components: first presenting the research background concepts and second discussing the core topics for identification, selection and collaboration with external knowledge sources.

The first section, Background Concepts, approaches the topics of Innovation, the role of knowledge for innovation, the flows and sources of knowledge for innovation, the Open Innovation paradigm and the Start-ups as external sources of knowledge for innovation. Aiming to detail the key role of knowledge and its application as enabler of innovation, the relevance of knowledge flows in innovation systems allowing actors to foster innovation, the modern paradigm of innovation exploiting knowledge from internal and external sources of innovation and the role of Start-ups as powerful external sources of innovation.

The second section, Discussion on Core Topics for Identification, Selection and Collaboration with External Knowledge Sources, unfolds over the description of most relevant topics to be considered when aiming to identify, select and collaborate with external sources of knowledge in open innovation systems, namely Start-ups. The goal is to describe which dimensions are essential and must be taken into account as components of a framework for identification, selection and collaboration with Start-ups.

2.2 Background concepts

2.2.1 Innovation and knowledge

This section approaches the core concepts framing the research: Innovation, The role of knowledge flows and sources for innovation, Open Innovation paradigm and Start-ups as external knowledge sources for innovation.

The OECD (2018) conceptualizes knowledge as a basis for innovation, posing the demand for implementation as differentiating factor of innovation from other concepts (e.g. invention). Therefore, in order to create a levelled understanding, definitions of some core concepts of the research are provided following:

- Innovation: *“An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)”* (OECD, 2018, pg. 32:1.25).
- Innovation System: *“Theories of innovation such as Kline and Rosenberg’s (1986) chain-link model and innovation systems theory (Freeman, 1987; Lundvall, 1992; Nelson [ed.], 1993; OECD, 1997) stress that innovation is not a linear, sequential process, but involves many interactions and feedbacks in knowledge creation and use. In addition, innovation is based on a learning process that draws on multiple inputs and requires ongoing problem-solving”* (OECD, 2018, pg. 45:2.9).
- Innovation Management: *“Innovation management includes all systematic activities to plan, govern and control internal and external resources for innovation. This includes how resources for innovation are allocated, the*

organisation of responsibilities and decision-making among employees, the management of collaboration with external partners, the integration of external inputs into a firm's innovation activities, and activities to monitor the results of innovation and to support learning from experience. Innovation management includes activities for establishing policies, strategies, objectives, processes, structures, roles and responsibilities to deal with innovation in the firm, as well as mechanisms to assess and review them. Information on innovation management is relevant to research on the efficiency of expenditures on innovation activities to generate sales or other innovation outcomes” (OECD, 2018, pg. 91:4.2.8).

- Knowledge: *“Knowledge refers to an understanding of information and the ability to use information for different purposes. Knowledge is obtained through cognitive effort and consequently new knowledge is difficult to transfer because it requires learning on the part of the recipient. Both information and knowledge can be sourced or created within or outside a relevant organisation” (OECD, 2018, pg. 46:2.13).*
- Knowledge Flows: refers to the exchange of knowledge between actors of an innovation system, channels may include knowledge carried in the minds of individuals or organizations networks and linkages (OECD, 2018; Spaeth, Stuermer, & Von Krogh, 2010).
- Knowledge Sources: internal or external actors that create, diffuse or source knowledge or new ideas for innovation (OECD, 2018; Toedtling, Grillitsch, & Hoeglinger, 2012).
- Open Innovation: paradigm of innovation that postulates existence of rich knowledge outside one organization boundaries, consequently to better seize innovation opportunities, organizations should make their boundaries permeable allowing for inbound and outbound flows of knowledge and ideas with the external environment (Chesbrough, 2003, 2007; OECD, 2018).
- Start-ups: a temporary organizations designed to create scalable, repeatable and profitable business models in conditions of extreme uncertainty (Blank & Dorf, 2012; Ries, 2011).

Knowledge is the most valuable and strategic resource for firms and the way it is accessed and employed is critical for organizations innovation activities (Kang & Kang, 2009; Kruse, 2012; OECD, 2018). Due to changes in several factors on the foundations of innovation practice, the Closed Innovation Model (CIM), e.g.: internal R&D, is no longer capable to cope with the mobility of knowledge and growing access to private venture capital (Chesbrough, 2003; Kruse, 2012; Vanhaverbeke, Van de Vrande, & Chesbrough, 2008). Firms are increasingly realising the prohibitive cost and slow time to market of internal R&D. Thus collaborations with external technology partners are being proven to be a powerful solution (Chen et al., 2011). As a result, firms unable to maintain

competitiveness and innovativeness relaying exclusively on internal knowledge sources, start looking to their outside environment to foster innovation.

2.2.2 Knowledge Sources and Open Innovation

The innovation processes have suffered significant changes in the recent years. The relevance of knowledge flows rises from the acknowledgement that knowledge generation, distribution and usage is performed by various actors of an innovation system (Chesbrough, 2003). Thus, firms must draw on external knowledge sources, purposing knowledge inflows and outflows, to foster innovation.

Chesbrough (2003) introduces the Open Innovation paradigm, proposing that companies could and should utilize internal and external ideas, and internal and external (in-bound and out-bound) paths to market, to advance their technology. Within the OI paradigm, firms are seeking for knowledge sources and interesting ideas far beyond the boundaries of their organizations (OECD, 2018; Spender et al., 2017; Traitler, Watzke, & Saguy, 2011; Vanhaverbeke et al., 2008), managing the knowledge flows necessary to innovate either by technology joint ventures, licensing agreements, acquisitions or spin-offs among other knowledge interfacing formats (Ferrary, 2011). Therefore, the OI paradigm places knowledge flows, sources and collaborations as cornerstones for innovation. To create and capture the most value of this system, the boundary between an organization and the environment surrounding it must be permeable, enabling innovation to easily move between the two.

OI has largely raised awareness on the distributed behaviour of knowledge creation and use across actors of an innovation system, and the relevance of accessing specialised networks and markets knowledge (OECD, 2018). Consequently, organizations are increasingly seeking for innovation through knowledge-based linkages with several external actors such as customers, High Education Institutions (HEI), suppliers and even competitors (Chesbrough, 2003; Kruse, 2012). In this perspective OI becomes a transversal concept for generalising flows of knowledge across firms boundaries, being these flows either existent and prospective (OECD, 2018).

Ferrary (2011) introduces the concept of organizational ambidexterity, describing the dual behaviour large corporations present when interfacing within OI, acting simultaneously as knowledge explorer and exploiter. This behaviour is found to be damaging for the innovation performance, as the large corporation should concentrate in exploiting the value (since they are better positioned in market and resources) while Start-ups in exploring to create value (once they have more flexible and agile business models).

In contrast, Berchicci (2013) observes that increasingly relying on external knowledge sources is highly beneficial to innovation performance only up to a limit. Past such threshold, increase in the use of external knowledge sources decreases firm's innovation performance, even affecting critical innovation structures (e.g. knowledge stock, absorptive capacity, R&D capabilities and Engineering & Design competences).

Through an extensive review of the literature on the relationship of Start-ups and OI, Spender et al. (2017), observes that new venture companies are a powerful engine for innovation, playing a key role in the innovation process. Increasing disruption of

attendants by Start-ups, demand larger corporations to design more agile ways to engage with new ventures on innovation activities (Hogenhuis, Van Den Hende, & Hultink, 2017). It is also essential to recognize the relevance of partnerships, external co-development and competence matching in OI (promoting top-down, bottom-up and outside-in strategies) (Trautler et al., 2011).

Within the lifecycle of innovation, Start-ups embody the intermediate organization of innovation between exploration and exploitation (Ferrary, 2011), currently representing one of the major sources of innovation (Kohler, 2016). As Start-ups pose a meaningful role in the open innovation system, it is seen as relevant to further understand in which dimensions a technology venture might be able to create value to a large corporation and how this corporation can better exploit the value generated by the Start-up.

Firms looking to actively pursue innovation might undertake a set of activities relevant to innovation performance (OECD, 2018): R&D activities; Design, engineering and creative activities; Brand equity and marketing activities; IP-related activities; Human resources training activities; Database and Software development activities; Tangible assets acquisition and leasing activities; and Innovation management activities. Particularly the last topic (Innovation Management) compasses the process of searching for external sources of innovation ideas, accounting for practices of collaboration and integration of external players and inputs into a company's innovation activities (OECD, 2018).

Although there is no clear understanding over what critical dimensions of external knowledge search strategy account to a firm innovation success (Chen et al., 2011), companies, either innovation-active or non-innovative, may regularly scan their external environment looking for potentially valuable knowledge for innovation, as well as provide potentially relevant knowledge to the outside environment (Herzog, 2011; OECD, 2018).

Selecting and managing these external knowledge sources is a major and important challenge for open innovation (Chen et al., 2011; Kruse, 2012; Springer, Michelis, & Senges, 2018). In this sense, the process of searching and integrating external knowledge sources into an organization's innovation system is further discussed to clarify the approaches for identification, selection and collaboration with such external sources.

Identification of External Knowledge Sources

The innovation opportunity identification process is fuzzy and complex, frequently requiring risk tolerance, improvement of communication, alignment of vision and strategy, and awareness of the environment surrounding the opportunity (Springer et al., 2018). Therefore, scanning and tracking external technologies are crucial practices to obtain technology partners that fulfil weak spots in a firm's technology portfolio and a valid way of strengthening innovation performance (Chen et al., 2011). This task of scanning and tracking new assets for innovation is often referred as scouting (Hogenhuis et al., 2017).

Spender et al. (2017), highlights that processes and networks are mutually shaped. Meaning that players within networks define new products and services requirements, build, admit or refute new artefacts, and modify processes relations. This perspective is even more relevant when considering ventures entering new networks (e.g.: partnerships or markets) as such ventures necessarily change structures and processes when entering networks (Spender et al., 2017). Thus, due to the impact Start-ups are able to infringe into networks, a major challenge lies in the screening of ventures, opening path for the selection of the ones with highest potential to implement innovation (Trachana, Diakanastasi, Karagiannaki, Pramatar, & Limited., 2017).

Springer et al. (2018) detach the presence of an overarching vision as a highly important topic to encourage entrepreneurship within companies. Hence, alignment of innovations with the incumbent's development system and business model is extremely important for effective collaboration between incumbent and venture (Trachana et al., 2017).

OI entails substantial managerial challenges and financial and cognitive expenses (Chen et al., 2011). Thus, overarching may account negatively for innovation performance when excessive time and energy start being consumed to nurture external linkages and information acquisition and transaction with external suppliers. Management of network complexity has a central role in the overarching positive effects (Spender et al., 2017), the lower the complexity more beneficial the overarching effects.

Additional attention has to be given to the role of asymmetric partnerships (Herzog, 2011; Hogenhuis et al., 2017; Spender et al., 2017; Villasalero, 2018) in OI. Due to discrepancies emerging from differences on size, agenda, organizational structure, policies, communication and management culture between ventures and large firms (Hogenhuis et al., 2017) the knowledge exchange may be jeopardized. Aiming to prevent possible damage arising from partnership asymmetries, management of expectations between partners and within the firm and establishment of a trusting relationship through high quality and constant communication are required (from early stages of relationship) (Wilhelm & Dolfsma, 2018).

Strategy research proposes that superior innovation performance emerges from a fit between the venture competencies and success factors of an industry (Shepherd, 1999). Therefore, the fit arising from the venture competencies and the incumbent industrial organization, embodies the alignment of the firm overarching vision, strategy and system to the venture capabilities, building the networks to support decision-making (Springer et al., 2018).

Since, critical components of companies' knowledge search strategy are unclear (Chen et al., 2011), *Table 3* presents the components posed in the literature, detached by literature reviewer, for scouting the external environment and identifying fit knowledge sources. These components encompass a set of characteristics to be taken into consideration, covering both firms' knowledge sources, when looking to identify the "fit" between firm and source.

Table 3 – Literature critical components for identification of knowledge source fit

Author (Focus of literature)	Components detached	Description of component
Chen et al. (2011) (Effects of external search strategies components in innovation performance)	Scope of the external search Depth of the external search Orientation of the external search Firms model of innovation	Diversity of the external sources Extent to which firms draw on different external sources The role of different types of external sources Innovation model used by to corporation
Hogenhuis et al. (2017) (Key pieces of firm's technological advantage)	Goals and interest areas Communication Dedicated resources Market/Industry Culture differences Venture capacity	Partner alignment with defined growth objectives Clarity of communication, trust and interlocutors Resources allocated to find technology assets Initial market/industry to start search Differences on companies' culture and decision-making cycles Amount of means available in the venture
Kohler (2016) (Dimensions for designing corporate accelerators)	Proposition Process People Place Innovation goals Corporate alignment	Offerings proposed by the program Structure and elements proposed by the program Individuals and key stakeholders to support the program Geographic location and presence of the program Clarify innovation goals for both Firms and Start-ups Alignment with the hosting corporation
Martín-de Castro (2015) (Components of firm's technological advantage)	Innovation strategic orientation Depth of external knowledge search Breadth of external knowledge search Absorptive capacity Market orientation Relational view Resource allocation Organizational culture Organizational learning or intellectual capital	Type of innovation paradigm used by firm (closed vs. open) Number of external sources of knowledge used by the firm Extent to which firms draw deeply from the different external sources Firm's ability to acquire, assimilate, and apply knowledge Firms understanding of customers and competitors Firm's understanding of customer's needs and preferences Amount resources available allocated for innovation Organizational structures, systems and policies used for company management Knowledge stock present within firm (e.g.: employees, patents, products, etc.)
(OECD, 2018) (Guidelines for management and measurement of innovation)	R&D capacity Firm resources Management capabilities Workforce skills & management Technological capabilities	Identification of firm's characteristics (Size, business assets, age, ownership) Business strategy, organizational & managerial capabilities Workforce competences availability and management Technical expertise & stock of knowledge
Springer et al. (2018) (Model for collaboration between Start-ups and corporations)	Risk tolerance Communication Vision & strategy Environmental awareness	Degree of firm's acceptance to uncertainties Flows, channels and actors involved in information exchange Clarity over firm's strategic goals and future vision Degree of firm's awareness over the business external surrounding environment
Tether and Tajar (2008) (Use of specialist knowledge providers in innovation activities)	Absorptive capacity Basic competencies Social capital	Firm's ability to recognize, understand, assimilate and use external knowledge Identification of external source basic competencies Networking capabilities enabled, made available and derived from actors'
Trachana et al. (2017) (Success factors for OI programs)	Identifying business opportunities Market domain	Identification of innovation opportunities related to the incumbent Understanding of specific market domain of the incumbent
Vanhaverbeke et al. (2008) (Corporate Venturing as OI mechanism)	Involvement stage	The stage of involvement (early or late) of the firm with the technology/business opportunity
Wilhelm and Dolfmsa (2018) (Knowledge boundaries management in OI)	Gatekeepers Organization knowledge boundaries	Key actors managing knowledge boundaries in networks Set of interpretative, processing and political limitations regarding knowledge share

2.2.3 Identification of External Knowledge Sources Conclusions

From the examination of the literature, it can be understood that the identification of fit between corporations and external knowledge sources draws on a set of components surrounding the innovation actors:

- Objectives and strategic alignment;
- Innovation/technology domain and stage;

- R&D capacity and key actors enrolled;
- Resources competencies, capabilities and availability

Therefore, in order to validate the “fit” necessary for identification of external knowledge source suitable for collaboration, presence of these components must be considered. *Table 4* presents components for fit identification and respective descriptions.

Table 4 - Components for identification of knowledge source fit

<i>Component</i>	<i>Component description</i>	<i>Reference</i>
<i>Objectives and strategic alignment</i>	This component accounts for the alignment of the source to the corporation’s strategic goals, growth objectives and risk tolerance, industry or market orientation, organizational structure and culture; and simultaneously aligned with the source’s own vision and strategy, and market domain and business opportunity	Hogenhuis et al. (2017); Kohler (2016); Springer et al. (2018); Martín-de Castro (2015); Trachana et al. (2017); OECD (2018)
<i>Innovation/technology domain and stage</i>	This component accounts for the source’s domain of a given knowledge field, existing stock of knowledge and stage of involvement of the corporation with the venture (early or late)	Chen et al. (2011); Springer et al. (2018); OECD (2018); Vanhaverbeke et al. (2008)
<i>R&D capacity and key actors enrolled</i>	This component accounts for the alignment of incumbent’s and venture’s R&D and absorptive capacity - once the relationship draws upon the exchange of knowledge between the parties - and for the gatekeepers and social capital involved in the network	Martín-de Castro (2015); Springer et al. (2018); Tether and Tajar (2008); Kruse (2012); Wilhelm and Dolfmsa (2018); OECD (2018)
<i>Resources competencies, capabilities and availability</i>	This component accounts for the alignment of source’s existing and available resources, either in the form of human and social capital, technology assets or means for information exchange - similar resources are also required for the incumbent to process knowledge transferred	Hogenhuis et al. (2017); Martín-de Castro (2015); Tether and Tajar (2008); OECD (2018)

Nevertheless, “fit” components are not a *sine qua non* conditions, key success factors behave unstably radically changing during development (Shepherd, 1999). Thus, “fit” success components are likely to change (being shifted, complemented or even suppressed) accordingly to search needs. For instance, geographic location of a foreign source might be considered as a limitation in a search looking to find local knowledge sources, or rather be disregard when performing a global knowledge sources search.

In addition, it is of high relevance to manage expectations within the corporation and with the external knowledge source, nurturing a mutual trust relationship with frequent quality communication, especially when dealing with asymmetric partnerships (Wilhelm & Dolfmsa, 2018).

These components refer to the different characteristics of knowledge sources in enhancing the innovative performance of firms. Thus, it is expected for some partners to take a more prominent role than others in invigorating the innovation performance of companies (Chen et al., 2011).

2.3 Selection of External Knowledge Sources

Although stages may present similarities and overlaps they have specificities, as observed by Hogenhuis et al. (2017) in the analysis of partnerships with external knowledge sources using the model Want & Find - Get & Manage (WFGM).

In his model, the process to build partnerships can be understood in two stages: before partnership (Want & Find) and during partnership (Get & Manage). Identification and selection of a source reside in the first (before partnership), while collaboration and management are encompassed by the second one (during partnership) (Hogenhuis et al., 2017).

Differently from the identification of external sources, that focuses on the screening of the external environment and identification of “fit” between parties, selection stage is driven to evaluate the external sources screened and select which opportunities of collaboration will be pursued (Walsh & Linton, 2011). Thus, knowledge sources evaluation is one of the main activities to select who to invest in (Liu, 2011) and the evaluating an opportunity refers to understanding the risks associated with a venture (Tomy & Pardede, 2017).

Research has been extensively developed since begin of the 70's approaching evaluation criteria for assessment of Start-ups in order to support Venture Capitalists (VCs) investments decision-making (Franke, Gruber, Harhoff, & Henkel, 2008). In the effort to address part of the gap in identification and selection of external sources of knowledge, Start-ups assessment methods are consistently discussed and multiple frameworks, indexes and systems were proposed for performing ventures' assessment. *Appendix 4* gives an overview of the assessment models in the literature.

In addition, several perspectives of Start-ups evaluation approaches can be observed in the decision making literature, exposing plurality of views and particularities of evaluators:

- **Venture Capitalists:** evaluation of investment opportunities;
- **Corporate Venture Capital (CVC):** evaluation of business and investment opportunities;
- **Start-ups:** Self-performance evaluation and evaluation of opportunities;
- **Corporations:** OI management, dynamics of asymmetric partnerships, networks management and R&D capacity;
- **Higher Education Institutions:** role and enabling factors of Research Institutes, Science Parks or Universities for venture creation (Spin-offs/Spin-outs);
- **Accelerators & Incubators:** enablers and success factors for networks and ecosystems performance;
- **Public innovation policies:** policies, determinants of success and impacts of positive venturing ecosystems.

Franke et al. (2008) emphasises that knowledge concerning evaluation criteria presents a dual behaviour: on the one hand supporting VCs community perform peers'

judgement based on accumulated experimental knowledge; and on the other, serving the ones who seek funding to better assess their own initiatives. Within this environment with a large variety of methods for assessment of Start-ups (Malyar, Polishchuk, Sharkadi, & Liakh, 2016), VCs are posed as reputable experts in distinguish promising ventures. Therefore their evaluation criteria is acknowledged as success factor for new ventures (Franke et al., 2008).

Driven by lack of availability of quantitative information and high level of uncertainty about Start-ups activities, VCs find subjective judgments the most adequate decision-making method. This approach allows to measure preferences and reflect knowledge about the interdependencies amongst decisions criteria and strengths with which these interdependencies occur (Milkova, Andreichikova, & Andreichikov, 2018).

Academics often refer to the risk determinants as uncertainties (Tomy & Pardede, 2017), thus, risk is intrinsically related with the predominance of uncertainty.

“Uncertainty is defined as a lack of adequate information to choose from an exhaustive range of possible states to perform a task. [...] Uncertainty can be managed and reduced by developing technical resources and capabilities to predict, infer, estimate and learn” (Tomy & Pardede, 2017, pg. 3).

Nevertheless the topic is not settled, whereas part of the research community claims use of statistics as better practice to support decisions of VCs, others reinforce the relevance of intuition, reasoning that the condition of uncertainty poses too many unknowns and complexities to rely on statistical analyses (Milkova et al., 2018). In addition, as much as a firm's information system is integrated and digitalized, compilation and analysis work will be required (Batocchio, Ferraz Minatogawa, & Anholon, 2017).

Further, decision-making literature recognizes that decision makers do not have perfect rational, rather, they are “boundedly rational” (Milkova et al., 2018). Meaning decision makers rationality is limited by the decision problems tractability, their minds cognitive limitations and available time for the decision.

In all cases a decision problem might be understood as construct of benefits/opportunities and risks networks, iterating dependences and feedbacks with decision criteria and alternatives (Milkova et al., 2018). The decision process of VCs' aligns uncertainty on evaluation with decision criteria and progress of the process (Liu, 2011), balancing these variables to identify the optimum investment options. The same tactic may be carried to gradually evaluate Start-ups depending on the relationship (Franke et al., 2008).

Neither for academics, managers or practitioners, there are no generally accepted performance indicators for assessment of the performance of ventures (Batocchio et al., 2017). Instead, selection of criteria or metrics to be applied for the venture evaluation process has to adapted for the task (Traitler et al., 2011). Hence, to handle the complexity of iterating multiple variables (such as networks of benefits and uncertainties, decision criteria dependences and evaluation metrics) within the decision making scenario, the multi-criteria decision making (MCDM) methods are deemed adequate (Stankeviciene & Zinyte, 2012).

As uncertainty environment poses multidimensional decision criteria, with dependences that work in various different directions, MCDM employ multi-criteria evaluation methods (MCEM) able to connect all criteria into descriptive measure (Stankeviciene & Zinyte, 2012). MCEM are based on the core concept of integration of criteria values and weights into a unified magnitude.

MCDM is an approach that enables simultaneous examination of various unrelated criteria, under a simplified structure composed by: a limited or unlimited set of “actions” (alternatives, solutions, etc.), at least two criteria and one (or multiple) decision makers (Stankeviciene & Zinyte, 2012). Thus, MCDM holds close similarity with individual’s way of making decisions, being one of the most extensively applied decision methodologies in project selection issues and allowing extraction of objective answers about venture’s effectiveness through generalized indicator that mutually considers qualitative and quantitative data (Stankeviciene & Zinyte, 2012).

Ultimately, as VCs decision making are highly complex, the MCDM approach enables finding the optimum investment strategy by supporting VCs in circumstances when multiple conflicting decision factors (e.g.: strategy, objectives, risks, criteria, etc.) must be simultaneously considered (Milkova et al., 2018). Selecting opportunities (alternatives) demand interactively balancing information, criteria, and progress of relationship (Franke et al., 2008; Liu, 2011; Milkova et al., 2018; Stankeviciene & Zinyte, 2012).

Multi-criteria methods are considered to be the most adequate approach to perform evaluation of Start-ups within the process of selecting the best collaboration opportunities, once the lack of information about ventures raise uncertainty make it difficult to assess these knowledge sources.

Since a wide variety of models, indexes and systems for ventures assessment have been developed, *Table 5* systematizes the categories of evaluation criteria posed in the reviewed literature. (*Appendix 2* presents full overview of all assessment criteria composing the *Table 5* categories)

Table 5 - Literature criteria categories for evaluation of knowledge sources

<i>Author</i>	<i>Categories of criteria</i>
<i>Batocchio et al. (2017)</i>	Financial Customer Internal business process Learning & growth
<i>Bigliardi, Galati, and Verbano (2013)</i>	University’s characteristics Founder’s characteristics Environmental characteristics Technological characteristics
<i>Liu (2011)</i>	Index of affecting investment venture Index of affecting investment income
<i>Milkova et al. (2018)</i>	Growth for the last year Society Team Promotion Prospects Production
<i>Mendialdua (2014)</i>	Interest of the sector Expected demand Tangible resources Non-tangible resources

<i>Author</i>	<i>Categories of criteria</i>
<i>Tomy and Pardede (2017)</i>	Technological Uncertainty Political Uncertainty Competitive Uncertainty Customer Uncertainty Resources Uncertainty
<i>Minola and Giorgino (2008)</i>	Management profile & skills Entrepreneurial and growth orientation, Project profitability Time accordance with external financing Technology Size Assets Market
<i>Shepherd (1999)</i>	Market considerations Competition considerations Management Capability Considerations Industry related competence
<i>Malyar et al. (2016)</i>	The essence of the idea Authors of the idea Comparative characteristic of the idea Commercial validity of the idea Expected results
<i>Mutanov and Yessengaliyeva (2013)</i>	Innovation criteria Competitiveness criteria
<i>Stankeviciene and Zinyte (2012)</i>	Owner's profile External ties Market opportunities Investment period Financing model Portfolio Company's profile
<i>(Tether & Tajar, 2008)</i>	Size new firm Group Internal market Exporter
<i>Toedtling et al. (2012)</i>	Introduction of Innovation Patents R&D department/employees
<i>Wu (2009)</i>	Entrepreneur competencies
<i>Walsh and Linton (2011)</i>	Generic managerial capabilities Specialized managerial capabilities Technology maturity Generic engineering skills Specific engineering skills Specific technological skills

2.3.1 Selection of External Knowledge Sources Conclusions

After a careful review of the categories and criteria encompassed within the literature, a clustering technique was applied to synthesize the topics of the assessment methods. A set of Evaluation Clusters (EC) were deductively extracted from the criteria observed, grouping the assessment categories and criteria by correlation shared between them.

For example, Tomy and Pardede (2017) present the category “Technological uncertainty”, while Walsh and Linton (2011) introduce the category “Technology maturity”. In the construction of the EC both topics are indexed under the Cluster Technology, Product & Innovation.

This clustering approach was used to allow compilation of similar and closely related criteria distributed among the several different evaluation methods and systems

into “umbrellas” that cover a common evaluation topic. *Table 6* details the proposed Evaluation Cluster.

Table 6 - Evaluation Clusters

<i>Evaluation Cluster (Cluster description)</i>	<i>Criteria encompassed by cluster</i>	<i>Reference</i>
<i>Entrepreneur enablers & networks</i> Cluster the categories related with entrepreneurs’ expertise, preparation, background, motivation and networking capabilities	Career orientation Competency Entrepreneur’s education Expertise Need for autonomy Personal motivation & disposition Personal qualities & networks Professional training & experience Risk-taking responsibility Soft skills Team Leadership & management Technical experience & background	(Bigliardi et al., 2013) (Liu, 2011) (Malyar et al., 2016) (Mendialdua, 2014) (Minola & Giorgino, 2008) (Tomy & Pardede, 2017) (Walsh & Linton, 2011) (Wu, 2009)
<i>Team power & enablers</i> Cluster the categories related with teams’ expertise, experience, competencies and motivation	Availability of specialists in non-technical areas Educational capability Experience in project implementation Experience of top management in the Start-ups Generic & specific skills Industry-related competence Internal experts and championships Quantity of hours of persona time invested Team professional satisfaction Team synergy & engagement	(Malyar et al., 2016) (Milkova et al., 2018) (Shepherd, 1999) (Tether & Tajar, 2008) (Tomy & Pardede, 2017) (Trautler et al., 2011) (Walsh & Linton, 2011)
<i>Technology, Product & Innovation</i> Cluster the categories related with technology/products’ innovativeness, robustness, and protection	Degree of innovativeness & novelty Innovation speed Patents and copyrights Technological content Technological resources Technology maturity Technology Push/Market Pull Technology/product type & application field Type & specificity	(Bigliardi et al., 2013) (Liu, 2011) (Malyar et al., 2016) (Milkova et al., 2018) (Minola & Giorgino, 2008) (Mutanov & Yessengaliyeva, 2013) (Toedting et al., 2012) (Tomy & Pardede, 2017) (Trautler et al., 2011) (Walsh & Linton, 2011)
<i>Organization, management & strategy</i> Cluster the categories related with business organizational structure, processes, resources & strategies	Business structure & processes complexity Culture & internal environment Firm size & lifetime Innovation process Learning & growth Management level & experience Management stile Metrics & efficiency Partners, alliances & value chain R&D expenditures & team Related risks Resources & technological infrastructure Strategy & plans Timing of entry & expansion	(Batocchio et al., 2017) (Liu, 2011) (Malyar et al., 2016) (Mendialdua, 2014) (Milkova et al., 2018) (Mutanov & Yessengaliyeva, 2013) (Shepherd, 1999) (Stankeviciene & Zinyte, 2012) (Tether & Tajar, 2008) (Toedting et al., 2012) (Tomy & Pardede, 2017) (Trautler et al., 2011) (Walsh & Linton, 2011)
<i>Market, Competition & Industry</i> Cluster the categories related with market attractiveness, conditions, competition and approach	Competition, substitutes & rivalry Customer needs & demands clarity Distribution & communication channels Leading competitor Market maturity & timing Market potential, size & segmentation Markets availability Offering types & validity Substitute technological solutions	(Batocchio et al., 2017) (Liu, 2011) (Malyar et al., 2016) (Mendialdua, 2014) (Milkova et al., 2018) (Minola & Giorgino, 2008) (Mutanov & Yessengaliyeva, 2013) (Shepherd, 1999) (Stankeviciene & Zinyte, 2012) (Tether & Tajar, 2008)

<i>Evaluation Cluster (Cluster description)</i>	<i>Criteria encompassed by cluster</i>	<i>Reference</i>
		(Tomy & Pardede, 2017) (Trautler et al., 2011) (Walsh & Linton, 2011)
<i>External actors & environment</i>	Access to qualified support Availability of venture capital Environment policies (tax, law, etc.)	(Bigliardi et al., 2013) (Liu, 2011) (Mendialdua, 2014)
Cluster the categories related with external forces, industry specificities and geographic influences	General environment (economy, politics, society, etc.) Government support Industry characteristics Location & regional infrastructure	(Milkova et al., 2018) (Tomy & Pardede, 2017)
<i>Finance & Financing</i>	Current & future return projections Financing portfolio (equity, debt, mixed, self, etc.) Investment period	(Batocchio et al., 2017) (Bigliardi et al., 2013) (Liu, 2011)
Cluster the categories related with business' financial relationships, commitment, strategies and robustness	Operating expenses Profit capacity & attractiveness Relationship with capital companies Revenue streams Size & stage of investment Urgency of financing Venture economic feasibility	(Malyar et al., 2016) (Mendialdua, 2014) (Milkova et al., 2018) (Minola & Giorgino, 2008) (Mutanov & Yessengaliyeva, 2013) (Stankeviciene & Zinyte, 2012) (Tomy & Pardede, 2017)

It is of relevance to recall that, as stated by Batocchio et al. (2017), there is no standardized set of evaluation criteria able to fulfil all possible assessment scenarios. Therefore, the above criteria detached from literature are to be considered as initial input for assessment, being then complemented with additional specific criteria whenever necessary. For instance, while assessing a venture looking for acquisitions, a corporate might consider adding financial criteria such as: IRR (Internal Rate of Return) or Ratio tangible/non-tangible assets or Equity linked investments, among others.

Additionally, approach the multidimensional decision criteria (Stankeviciene & Zinyte, 2012) relating with different types of collaboration relationships, allows for better contextualization and segmentation of the assessment topics. Such perspective of the evaluation criteria application opens space to modulate the complexity and depth of the assessment accordingly to the degree of bond of the relationship between venture and corporation. This modulation of ventures evaluation helps lowering the relationships' complexity, thus increasing benefits arising from it (Spender et al., 2017).

2.4 Collaboration models with External Knowledge Sources

“A knowledge network consists of the knowledge-based interactions or linkages shared by a group of firms and possibly other actors. It includes knowledge elements, repositories and agents that search for, transmit and create knowledge. These are interconnected by relationships that enable, shape or constrain the acquisition, transfer and creation of knowledge” (OECD, 2018, pg.129:6.11).

In the OI paradigm described by OECD (2018) external knowledge sources are meaningful actors of an innovation system, capable to radically increase companies innovation performance. Nevertheless, the OI potentialities can only be achieved when

organizations are able to actually build flows of knowledge between external sources and internal structures.

These flows or linkages (Chen et al., 2011) are embodied by collaboration models that enable structured processes to exchange knowledge within an innovation system. Hence, innovation models are considered to play a central role in the exchange of knowledge (Chen et al., 2011). Establishing knowledge flows demand support systems, institutions and procedures that allow social relationships and networks to identify and collect knowledge from sources (OECD, 2018).

Hogenhuis et al. (2017) claims that a “solid process” is recommended in order to facilitate the partnership. Firm’s should previously define the partnership outlines and stages of collaboration process, clearly communicating the needs, objectives and methods to the collaboration partners.

As processes and networks are jointly shaped (Spender et al., 2017) and key success factors frequently change during development (Shepherd, 1999), different collaboration models will affect the performance of knowledge exchange (Kang & Kang, 2009). Thus, it becomes critical to define the most suitable collaboration model to fulfil the collaboration specificities and achieve desired knowledge exchange.

Partnerships are designed to solve problems, fulfil gaps or discover responses in a more rapid and efficient way (Traitler et al., 2011) e.g.: close innovation gaps, solve business challenges, expand to new markets, rejuvenate corporate culture, attract and retain talents, access resources, increase credibility, access to markets or getting funding ensure corporate alignment (Kohler, 2016).

Consequently, previous research proposes a variety of knowledge sourcing methods, suggesting classification by the extent of commitment of agreement (Kang & Kang, 2009). For instance, companies can acquire technology through R&D co-operation, technology acquisition, technology licensing, spin-ins, and corporate venturing (Chen et al., 2011). Thus, systematization of external knowledge sourcing (or collaboration) strategies approaching Start-ups can be observed at *Table 7*. (Overview of all collaboration strategies from reviewed literature are provided at *Appendix 3*)

Table 7 - External Knowledge Sources collaboration strategies

<i>Collaboration Strategies</i>	<i>Collaboration description</i>	<i>References</i>
<i>Acquisition & Development (A&D) (Mergers & Acquisitions)</i>	Innovation strategy that deploys acquisition of complementary technology or capabilities to solve specific business problems and enter new markets	<i>Ferrary Kang Kohler</i>
<i>Information transfer from informal network</i>	Informal information transfer from networks to exchange knowledge disregard of organisational interactions or formal agreements or contracts	<i>Kang Tödtling</i>
<i>Corporate Hackathons</i>	Intense collaboration of diverse teams within a restricted time limit to solve a corporate innovation challenge	<i>Kohler</i>
<i>Corporate Incubation</i>	Internal organization for creation of new knowledge and its transfer to and from Start-ups providing a path to market for corporate non-core innovations	<i>Kohler Spender</i>
<i>Corporate Venturing</i>	Strategy for corporations to participate in the success of external innovation and helps to gain insights into non-core markets and access to capabilities	<i>Kohler Spender Vanhaverbeke</i>
<i>Joint Ventures</i>	Legal entities in which equity ownership is shared between firms that pool capabilities in order to develop common innovation activities	<i>Santamaria Spender</i>

<i>Collaboration Strategies</i>	<i>Collaboration description</i>	<i>References</i>
<i>Non-equity strategic alliances</i>	Alliances between Start-ups and other firms to merging their complementary skills to impact on incremental and radical innovation performance	<i>Santamaría Spender</i>
<i>Corporate VC</i>	Collaborations in which shared equity ownership does not occur Programmes for backing and supporting Start-ups to provide corporations' access to new markets and capabilities and at the same time, Start-ups benefit from favourable terms relative to traditional sources of venture capital	<i>Spender Kohler</i>
<i>Co-operation / formal networks</i> (E.g.: Corporation supports pilot project, Corporation becomes Start-up customer, Corporation becomes distribution partner, R&D collaboration)	Formal networks mechanisms that enable the transfer of knowledge (including tacit), supported by specified agreements, interactively merging complementary skills to impact on more complex, dynamic and collective innovations	<i>Kohler Santamaría Spender Tödtling</i>

External knowledge sourcing methods impact innovation performance of the knowledge relationships (Kang & Kang, 2009), and formality of ties (e.g.: formal and informal agreements) influence the interactions and boundaries of the cooperation, thus, shaping the extent of use of the external knowledge.

Weak ties (e.g.: informal information exchange) demand very low network maintaining efforts, allowing firms to access knowledge sources more easily and faster through informal networks, while strong ties (e.g.: R&D collaborations) enables deeper resources and capabilities sharing. Consequently, authors determined that relationships seem to positive as long as they are not overly strong or complex (Spender et al., 2017).

Nevertheless, setup of relationship is required once asymmetric partnerships poses challenges to the collaboration partners communication (Hogenhuis et al., 2017). Well-structured communication between partners allows to clarify needs, contributions, goals and align expectations and roles for the relationship. The asymmetries between Start-ups' and corporations' rise the difficulty for the venture to initiate contact and engage with the large organization (Hogenhuis et al., 2017).

As asymmetric partnerships present several challenges for establishment of knowledge flows (Herzog, 2011; Hogenhuis et al., 2017; Spender et al., 2017; Villasalero, 2018), misalignments and boundaries emerged from the collaboration dynamics need to be bridged (Wilhelm & Dolfmsma, 2018). Within this context gatekeeper are recognized to play a key role.

Gatekeeping surpass the simple networking activity, instead, it demands "translating between two systems", partaking on the acquisition, translation and dissemination of external knowledge (Wilhelm & Dolfmsma, 2018). Gatekeepers, personified by innovation managers, scan the external environment for emerging knowledge/technology relevant for the corporation's strategic objectives, translate the external knowledge into better adjusted terms for the information recipient and disseminate the acquired knowledge to the right recipients within the organization.

2.4.1 Collaboration Models Conclusions

In order to support structuring of processes that enable establishment of meaningful interactions with ventures, the works of Boehmer and Lindemann (2015) and Hogenhuis et al. (2017) are integrated into a three stages construct for collaboration with ventures:

- **First stage:** encompass identify and prioritize corporations' growth objectives (specific areas of interest and firm objectives), defining the relationship outlines (modulating complexity based on knowledge need scope and depth), formality and supporting structures (actors, roles, stakeholders, mechanisms, boundaries, agreements, etc.).
- **Second stage:** deals with identification and selection of knowledge sources for collaboration. Here, evaluation criteria may also demand modulation in accordance to first stage definitions.
- **Third stage:** covers the construction and management of collaboration structures, defining the collaboration model in accordance with the strategic objectives, the knowledge type and depth, the intended relationship complexity and formality, and the actors/gatekeepers enrolled.

2.5 Literature Review Conclusions

Grounding the foundations of the framework and the establishment of structured processes for building relationship with the ventures, three main research fields compose the present study:

1. The literature on identification of knowledge sources: sensitize that fit of knowledge source emerges from alignment of the source competencies with the incumbents' (A) objectives and strategic alignment, (B) innovation/technology domain and stage, (C) R&D capacity and key actors enrolled; and, (D) Resources competencies, capabilities and availability.
2. The literature on Selection of knowledge sources provides understanding of evaluation as an iteration of benefits/risks networks and decision criteria in a multidimension environment, modulating evaluation aspects according to individual collaboration requirements.
3. The literature on collaboration with knowledge sources reinforces that collaboration models' selection and development must ground on structured processes, defining partnership guidelines closely managed and moderated by gatekeepers.

3 Chapter: Design of a framework for identification, selection and collaboration with Start-ups

The objective of a framework is to connect concepts of a theory within a pattern (Boehmer & Lindemann, 2015). In this sense, a framework for identification, selection and collaboration with Start-ups link together theories of Innovation Systems, Strategy Research and Decision Sciences into a construct that supports organizations' define structured processes to establish knowledge exchange relationships with ventures.

Figure 1 demonstrates the interactions between the grounding theories behind the framework and the knowledge offerings each one brings to shape the construct.

Innovation Systems Theories relate with the systems, processes and models for innovation, such as co-operations or strategic alliances models. Therefore, offering knowledge about the collaboration models available to build relationships with Start-ups.

Strategy Research relate with organizations' strategies and management structures, such as technology management or strategic plans. Therefore, offering knowledge about strategic objectives and organizational complexity to build the relationships with Start-ups.

Decision Sciences relate with systems, process and methods to enable decision making, such as evaluation models or weighting models. Therefore, offering knowledge about the decision criteria available to evaluate Start-ups.

The knowledge offerings of the theories shape the networks that influence and support the process of identification, selection and collaboration of Start-ups. For instance, the knowledge “objectives and complexity”, offered by Strategy Research, influences the “collaboration models” offered by Innovation Systems Theory. Likewise, the same “objectives and complexity” knowledge also influence the “decision criteria” knowledge offered by Decision Sciences.

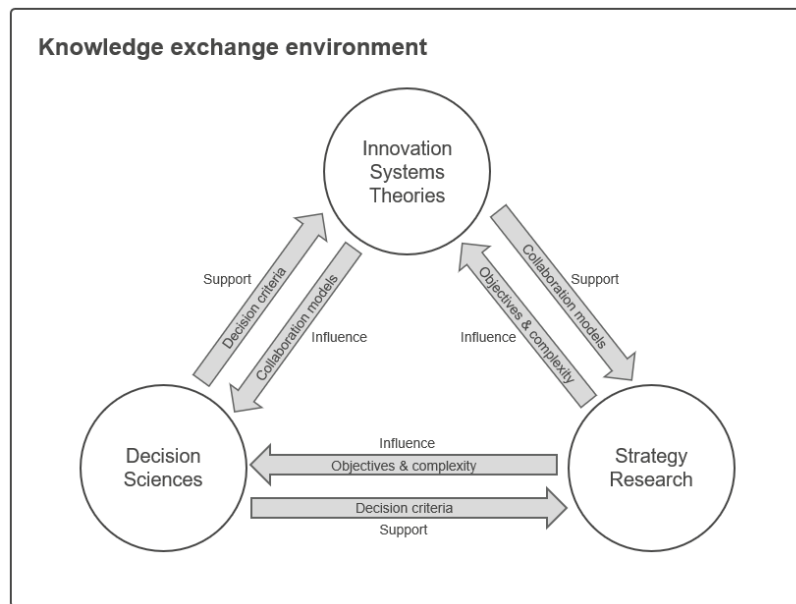


Figure 1 - Grounding theories interactions

The framework for identification, selection and collaboration with Start-ups allows to design the networks of knowledge exchange relationships, modulating the criteria for partners identification, partners selection and the collaboration models in a dynamic way. Thus, offering gatekeepers guidelines to design structured knowledge exchange processes with Start-ups.

To do so, the framework must balance three fundamental concepts shaping the knowledge exchange environment:

- evaluation criteria are context specific and dynamic;
- collaboration models vary according to firms' strategic objectives and knowledge sources;

- formality and complexity of relationship impact the extent of knowledge exchange.

3.1 Conceptual framework

To enable construction of meaningful interactions with ventures (Hogenhuis et al., 2017) it is critical to cover the full spectrum of relations required to materialize the knowledge exchange, approaching the whole learning cycle (Boehmer & Lindemann, 2015).

The framework stages are proposed structuring the process:

- **System Strategy:** approaches the corporations' alignment of an overarching strategical vision to drive the identification, selection and collaboration stages towards the same objectives.
- **Partner identification & Selection:** addresses defining the processes and evaluation criteria for, first, identification of strategic “fit” between venture and corporation, and second, selection of sources for collaboration.
- **Knowledge Collaboration:** deals with the definition of the collaboration model and enablers of knowledge exchange to be applied in the relationship with the venture.

3.1.1 System Strategy Stage

This stage addresses the strategical component of the framework, where background outlines must be established to create a common overarching vision to all actors involved (Springer et al., 2018), building a structured guidelines for the relationship with the ventures (Spender et al., 2017) and to drive other stages towards the same goals. (Stage detailing available at *Figure 2*)

In this sense, the corporation applying the framework must state the:

- overarching vision and goals of the relationship (Hogenhuis et al., 2017);
- technology/business gaps to be addressed (Traitler et al., 2011);
- knowledge stock needed (Martín-de Castro, 2015);
- firm absorptive capacity (Tether & Tajar, 2008);
- network management structure (Hogenhuis et al., 2017);
- scope and depth of knowledge intended (Chen et al., 2011);
- degree of formality of the relationship (Kang & Kang, 2009);
- actors and gatekeepers to be involved (Wilhelm & Dolfma, 2018).

These outlines intend to frame the knowledge collaboration vision, goals, knowledge need and actor's capacity, allowing to define the knowledge scope and depth, and the relationship formality.

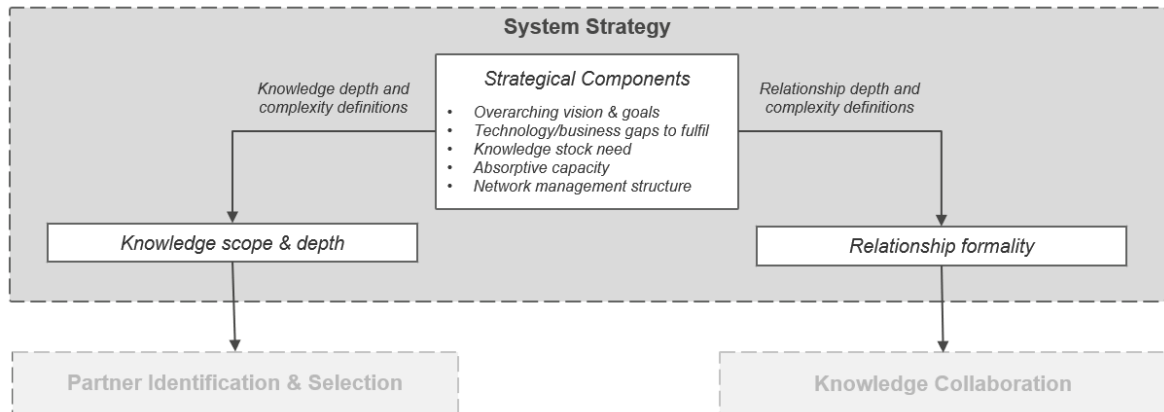


Figure 2 - System Strategy Stage overview

The stage *Strategical Components* provide the context of the collaboration, building the information necessary to align the knowledge exchange relationship with the corporation overarching strategy. The components of this topic support clarifying, on one hand, the type of knowledge need and the degree of complexity of the knowledge; and on the other hand, the degree of bound and formality intended for the knowledge exchange relationship.

- **Overarching vision and goals of the relationship:** this component encompass definition of the vision and goals expected for the collaboration. Questions to be asked: Which topic of the company strategy is being addressed? What is the envisioned outcome for the collaboration?
- **Technology/business gaps to be addressed:** this component encompass definition of the specific technology or business process to be addressed by the collaboration. Questions to be asked: What gap on the company's technology portfolio or business process will be addressed? What technology or business process needs to be fixed/improved/fulfilled?
- **Knowledge stock needed:** this component encompass definition of the complexity of the knowledge needed. Questions to be asked: Is the knowledge "state-of-the-art", highly specific or ordinary? What knowledge competencies are expected from the partner?
- **Firm absorptive capacity:** this component encompass definition of the company's ability to understand the knowledge. Questions to be asked: Is the current company knowledge base aligned with the intended knowledge? Does the company has gatekeepers schooled in the domain of the intended knowledge?
- **Network management structure:** this component encompass definition of the collaboration management topics, specially the relationship gatekeepers, communication channels and collaboration governance structure and timeline. Questions to be asked: Who are the company experts in the

intended knowledge field? What are the simplest ways to exchange the intended knowledge (meetings/work sessions/publications/etc.)?

The *Knowledge scope & depth* component of the stage provides a compilation of the strategical definitions about type and complexity of the intended knowledge. This component aims to create a unified contextual view about the scope and the depth of knowledge need to support the *Partner Identification & Selection* stage. The definitions can be structure in a technology roadmap, a target picture, strategic plan or a problem statement. Nevertheless, despite the chosen tool to structure the information, clear and wide communication of knowledge scope and depth is imperative.

The *Relationship formality* component provides compilation of the strategical definitions regarding degree of formality of intended relationship. This component aims to establish the degree on knowledge bound expected for the relationship, supporting the *Knowledge Collaboration* stage in the identification of the optimum knowledge exchange model for the case. The degree of formality can be expressed by reference to previous collaboration approaches, such as, joint venture projects, co-operation projects or informal knowledge exchanges. Nonetheless, the relation between knowledge bound and formality can be understood as: the higher the knowledge bound degree, the higher the relationship formality degree.

3.1.2 System Strategy Conclusions

The two definitions, Knowledge Scope & Depth and Relationship Formality, are necessary to modulate the *Partner Identification & Selection* criteria and the *Knowledge Collaboration* models in accordance with knowledge and relationship complexity. For instance, low complexity knowledge stocks are likely to require low formality networks to enable knowledge exchange. Whereas highly complex or specific knowledge may demand more formal networks and co-operations to enable knowledge exchange.

As observed, the scope and depth of the intended knowledge directly affects the components of the knowledge source identification (e.g.: strategy focus or industry focus) and selection (e.g.: source assessment criteria). Similarly, the degree of knowledge bound influences the components of collaboration models' selection (e.g.: collaboration model selection) and collaboration setup (e.g.: alignment of expectations or collaboration process detail).

It is crucial, though, to keep in mind that networks are mutually shaped, thus considering inputs from other stages and even reviewing some initial definitions during the process are relevant to enable a dynamic adequacy of the framework.

3.1.3 Partner Identification & Selection Stage

This stage entails a two-level process for identification and selection of the knowledge sources: *Source Identification* and *Source Selection*. These levels balance the relationship objectives & complexity with the evaluation criteria, interactively shaping the process of collaboration partner selection (Stankeviciene & Zinyte, 2012).

3.1.3.1 Sources Identification Level

The identification level, *Sources Identification*, covers alignment of scouting requirements with the corporation strategic components, defining the guidelines for the sources search (Hogenhuis et al., 2017). (Stage detailing available at *Figure 3*)

Thus, in the Sources Identification level organizations must execute:

- alignment of strategic focus (Hogenhuis et al., 2017);
- definition of focus industry (Hogenhuis et al., 2017);
- alignment of knowledge stock scope and depth (Martín-de Castro, 2015);
- definition of actors and gatekeepers (Wilhelm & Dolfsma, 2018);
- definition of strategic “fit” assessment criteria (Traitler et al., 2011);
- sources scouting (Hogenhuis et al., 2017);

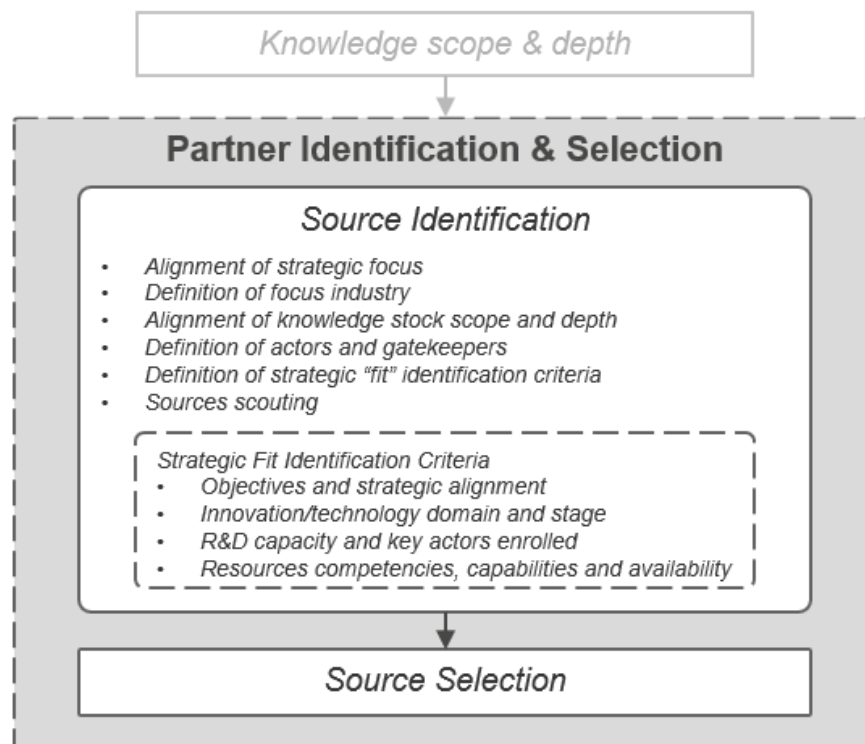


Figure 3 - Source Identification level overview

The level *Source Identification* structures the task of scouting environment for knowledge partners, it frames the alignment with the company strategy, drives the sector and type knowledge wanted, and defines actors and criteria for identification of sources that fit the knowledge requirements.

- **Alignment of strategic focus:** this component encompasses alignment of the strategic focus of the relationship with the parties involved in the sources scouting. Questions to be asked: Are the relationship goals and objectives clearly defined? Is the technology gap and knowledge need evident and aligned?
- **Definition of focus industry:** this component encompasses definition of the industry focus for the scouting of technology partners, guiding the field the “scouter” should search on. Questions to be asked: What is the industry most related with

the knowledge gap/need? What is product or technology application mostly related with technology need domain?

- **Alignment of knowledge stock scope and depth:** this component encompass alignment of the type and the depth (extent and complexity) of knowledge need with the actors and gatekeepers. Questions to be asked: What is the type of application expected for the knowledge? Is the knowledge widely available or highly complex and specific?
- **Definition of actors and gatekeepers:** this component encompass definition of the actors and gatekeepers that perform the scouting of knowledge sources. Questions to be asked: Who are the individuals most experienced or experts in the field of the knowledge need within the company? Who are the individuals most skilled in technology transference or trial within the company?
- **Definition of strategic “fit” identification criteria:** this component encompass definition of the criteria to verify fit of a knowledge source with the knowledge need. Questions to be asked: What are the essential conditions a knowledge source must fulfil the be suitable for partnership? What conditions can be relaxed and in which degree?
- **Sources scouting:** this component encompass the job of performing the scouting for knowledge sources. Questions to be asked: Are the *Source Identification* components structured enough to allow the scouting? What are the sources that better fulfil the fit identification criteria?

The Strategic fit identification criteria are detailed at *Table 4* and must be understood as conditions to verify the fit of the knowledge source with the company *System Strategy*. Nevertheless, the weight of each component in the overall assessment must be balanced by gatekeepers.

3.1.3.2 Sources Selection Level

The selection level, *Sources Selection*, deals with the definition of assessment criteria (Walsh & Linton, 2011) modulated by the strategic focus (Hogenhuis et al., 2017) and knowledge scope and depth (Chen et al., 2011). Enabling firms to intensify or simplify the assessment methods based on the complexity of the knowledge under analysis. (Stage detailing available at *Figure 4*)

Therefore, in the Sources Selection level corporations must perform:

- iterative alignment of strategic focus and relationship complexity (Stankeviciene & Zinyte, 2012)
- definition of depth of source assessment (Chen et al., 2011);
- definition of assessment criteria (Franke et al., 2008)
- definition of weighting scale for criteria (Stankeviciene & Zinyte, 2012).
- alignment with firms’ innovation systems (Trachana et al., 2017)

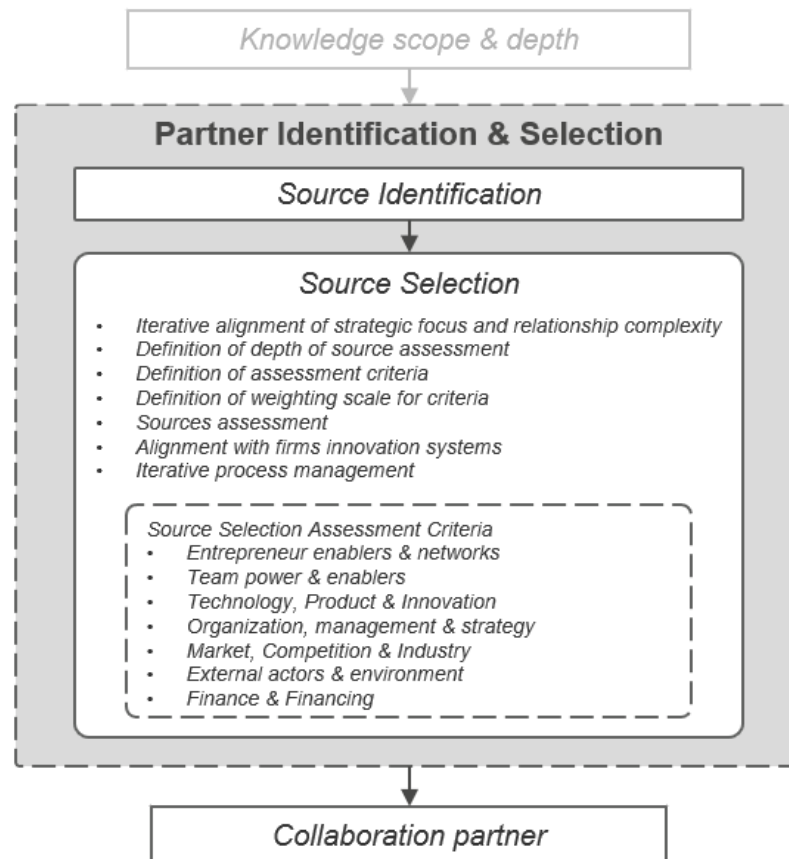


Figure 4 - Source Selection level overview

The level *Source Identification* structures the job of assessing the knowledge sources that presented strategic fit and selecting the ones most adequate as collaboration partner. Its components allow to gatekeepers to manage the complexity of the sources assessment, establishing the least complex selection model to secure the knowledge scope and depth needed.

- **Iterative alignment of strategic focus and relationship complexity:** this component encompass the dynamic alignment of the selection criteria with the collaboration strategic focus and the complexity expected for the relationship. Questions to be asked: What key components of the collaboration strategy and collaboration model influence the source selection? Which balance of source selection components better fits the requirements of strategic focus and relationship complexity?
- **Definition of depth of source assessment:** this component encompass the definition of the degree of complexity and thoroughness of the knowledge source assessment. Questions to be asked: Are all selection criteria required and enough to assess the source? Should additional criteria be considered or replace others due to strategic focus or collaboration model specificities?
- **Definition of assessment criteria:** this component encompasses the definition of each criteria to be applied on the assessment of the knowledge source. Questions to be asked: What are the essential components a source must present to be

selected for collaboration? Are there other components or specificities that must be assessed due to strategic focus or collaboration model?

- **Definition of weighting scale for criteria:** this component encompass balancing the power of each criteria on the overall assessment, modulating the weight of the assessment criteria according to the strategic focus and the collaboration model. Questions to be asked: Which components of the knowledge source are more significant for the knowledge exchange success? Which requirements of strategic focus and collaboration model are more significant for the collaboration success?
- **Sources assessment:** this component encompass the job of performing the knowledge source assessment. Questions to be asked: Are the *Source Selection* components structured enough to allow assessment? What are the sources that better fulfil the source assessment criteria?
- **Alignment with firms' innovation systems:** this component encompass analysing the compatibility of knowledge source to the company's innovation system. Questions to be asked: How is the knowledge source innovation model? Are the knowledge source gatekeepers compatible or accustomed with the company's innovation model?
- **Iterative process management:** this component encompass the dynamic management of the assessment process, aligning and modulating it's components with *System Strategy* and *Knowledge Collaboration* stages requirements. Questions to be asked: What the least complex *Source Selection* structure required to select the most adequate sources for collaboration? What components or criteria of the *Source Selection* level can be managed to reduce risk and uncertainty?

The Source selection assessment criteria are detailed at *Table 6* and must be understood as criteria to verify the degree of development of multiple aspects of the venture business. Nevertheless, it is crucial for gatekeepers to identify which criteria are actually significant and account the most for the context under analysis.

3.1.4 Partner Identification and Selection Conclusions

The Partner Identification and Selection Stage aims to structure the process to select collaboration partners for knowledge exchange by performing the assessment of the knowledge source fit to the collaboration strategic goals (Hogenhuis et al., 2017) and the validity of the scope and depth of the knowledge to be exchanged (Martín-de Castro, 2015).

Special attention, however, has to be given to the degree of formality of the relationship and the extent of knowledge stock of the source, these variables play central role in the definition of the criteria and depth of the assessment to be applied. The role of relationship formality and extent of knowledge stock are better detailed on next stage.

Overview of the Partner Identification and Selection Stage, with the two-level process is available at *Figure 5*.

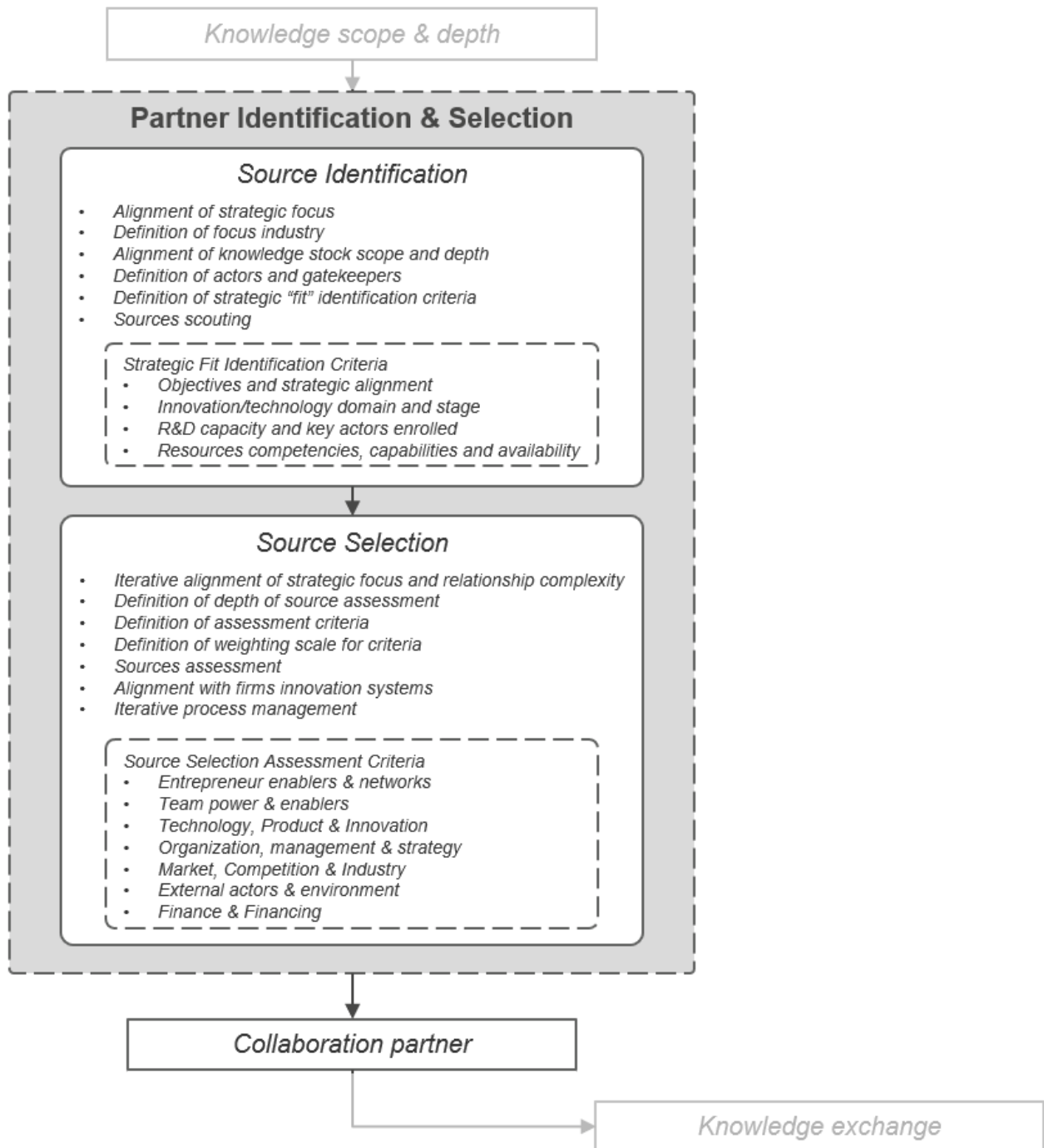


Figure 5 - Partner Identification and Selection Stage

3.1.5 Knowledge Collaboration Stage

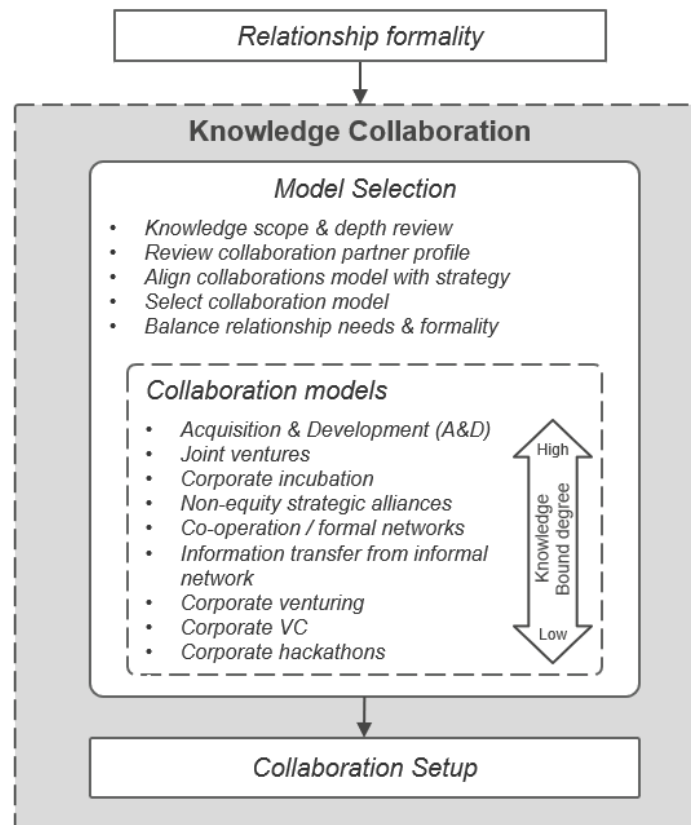
This stage addresses the definition of the collaboration model to be applied on the knowledge exchange relationship with the knowledge source. The collaboration models tangibilize the knowledge flows and play crucial role on enabling the knowledge exchange (Chen et al., 2011). Therefore, collaboration models encompass setting the environment and facilitators for knowledge exchange, creating transparency about the process (Boehmer & Lindemann, 2015; Hogenhuis et al., 2017), enrolling key actors (Wilhelm & Dolfma, 2018) and structuring communication (Hogenhuis et al., 2017).

3.1.5.1 Model Selection Level

Similarly to the previous stage, the *Knowledge Collaboration Stage* is structured in two levels: *Model Selection* and *Collaboration Setup*. The first level, *Model Selection*, relates with the alignment of the collaboration model with: the scope and depth of the knowledge (Chen et al., 2011), the firm and venture organizational structures (Martín-de Castro, 2015), and the relationship formality of ties (Kang & Kang, 2009). (Stage detailing available at *Figure 6*)

Thus, in the Model Selection Level, firms must execute:

- knowledge scope and depth review;
- review collaboration partner profile;
- align collaboration model with strategy;
- select collaboration model
- relationship complexity and formality



The level *Model Selection* addresses the alignment of the collaboration model with the *System Strategy*, supporting gatekeepers in the identification and selection of the model that is more adequate for the specific knowledge exchange. The components of this level support balancing relationship complexity required for the knowledge exchange with the collaboration strategic vision and knowledge sources in the relationship.

- **Knowledge scope and depth review:** this component encompass the review of the type and extent of knowledge to be exchanged, to support identification of collaboration models capable to cope with requirements. Questions to be asked: What is the core knowledge to be exchanged? What are the critical components to enable the efficient knowledge exchange?
- **Review collaboration partner profile:** this component encompass verifying the knowledge source organizational structures and components, to support selection of the collaboration models capable to link the source and the recipient. Questions to be asked: What are the most significant structures of the partner for the knowledge collaboration? Is the collaboration partner profile aligned with the intended collaboration model?
- **Align collaboration model with strategy:** this component encompass verification of the collaboration *Strategy Components* to support selection of the collaboration model most adequate to fulfil the strategic focus. Questions to be asked: Are the *Strategy Components* clearly defined? Is there any critical strategic specificity that must be accounted?
- **Select collaboration model:** this component encompass the job of performing the collaboration model selection. Questions to be asked: What benefits and complexities each collaboration model entails? Which collaboration model or mix of models delivers the required knowledge stock with the least complex relationship?
- **Balance relationship needs & formality:** this component encompass the balance between knowledge to be exchanged and the degree of complexity/formality required by the collaboration model. Questions to be asked: What are the critical relationship components to enable the knowledge exchange? What is the simplest relationship structure to enable the intended knowledge exchange?
- **Degree of knowledge bound:** this component encompass the strength and extent of the knowledge exchange linkages, ties and flows between collaboration partners. Questions to be asked: What are the types and strength of the knowledge bounds required by the collaboration model for knowledge exchange? What are the types and strength of the knowledge bounds required by the knowledge source for knowledge exchange?

The Collaboration Models are detailed at *Table 7* and must be understood as a structure of linkages and bounds that enable gatekeepers to exchange knowledge. Thus, the *Knowledge bound degree* entailed by each collaboration model relates with strength of links with the knowledge stock of the source.

For instance, the acquisition of a Start-up grants full access to all the knowledge stock of the venture, whereas, a corporate hackathon only permits to access the Start-ups' innovation concepts. Consequently, knowledge bound degree must be accounted by gatekeepers when considering the most adequate collaboration model for the knowledge exchange relationship.

Level of formality relates with degree of bound of the network, varying between formal networks and informal networks (Kang & Kang, 2009; Kohler, 2016). The former considers models such as: merges & acquisitions, corporate incubators, corporate venturing, joint ventures, non-equity alliances and co-operation networks; the latter contemplates models such as: informal networks, corporate hackathons and non-equity alliances.

Extent of source knowledge stock relates with the amount and depth of the venture's knowledge base (Martín-de Castro, 2015) being in this research considered knowledge-intensive or boundary knowledgeable. The former considers sources with highly specialized knowledge and technologies, such as: high-tech ventures or research institutions spin-offs; the latter contemplates sources with unspecialized knowledge or technologies, such as: low and mid-tech ventures or early research ventures.

3.1.5.2 Collaboration Setup Level

The second level, *Collaboration Setup*, regards preparing the relationship supporting structures and linkages to enable the collaboration model to function (Trachana et al., 2017), carefully detailing: the collaboration process (Boehmer & Lindemann, 2015), the alignment between source and recipient (Herzog, 2011), the communication channels (Boehmer & Lindemann, 2015), and the actors roles in the relationship (Wilhelm & Dolfmsa, 2018). (Stage detailing available at *Figure 7*)

Thus, in the Collaboration Setup level, organizations must:

- align goals and expectations;
- detail collaboration process (step-by-step);
- define degree of bound;
- specify communication channels;
- clarify actors and gatekeepers' roles.

The level *Collaboration Setup* addresses the alignment of the collaboration model with the *System Strategy*, supporting gatekeepers in the identification and structuring of the model that is more adequate for the specific knowledge exchange. The components of this level support balancing relationship complexity required for the knowledge exchange with the collaboration strategic vision and knowledge sources in the relationship.

- **Align goals and expectations:** this component encompass alignment of the collaboration model steps with the overall collaboration strategy. Questions to be asked: Are the collaboration key *Strategical Components* being addressed? Are the expectations of both collaboration parties clearly stated and converging?

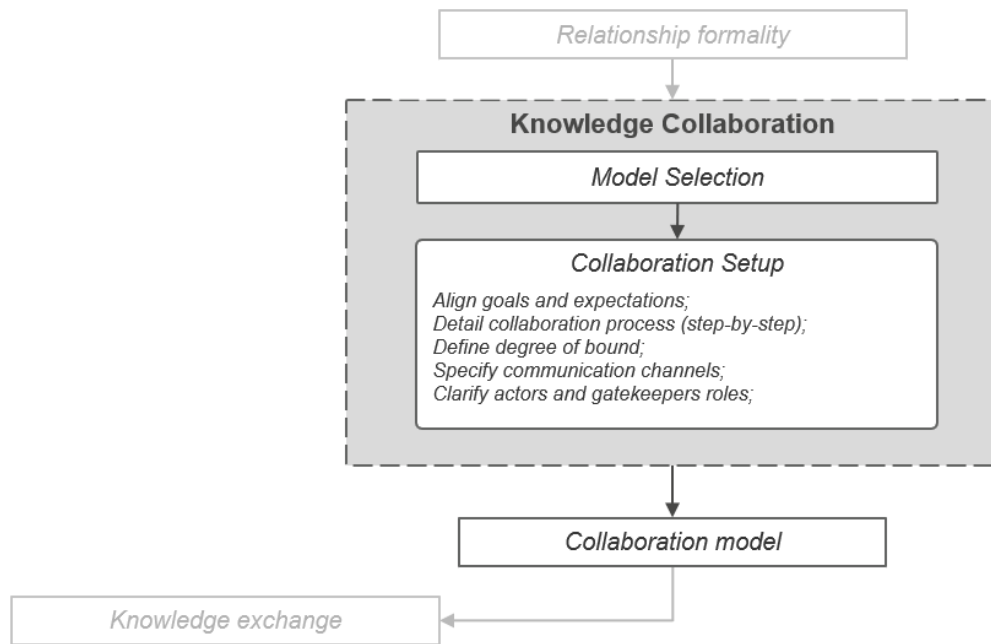


Figure 7 – Collaboration Setup level overview

- **Detail collaboration process (step-by-step):** this component encompass the clear detailing of all the steps of the collaboration model selected. Questions to be asked: Is the collaboration process clear enough to enable parties to exchange knowledge in the simplest possible way? Are the key steps detailed enough to prevent misalignments of the parties during the knowledge exchange?
- **Define degree of bound:** this component encompass defining which degree of formality of the relationship optimizes the knowledge exchange. Questions to be asked: What is the *Knowledge scope & depth* intended for the relationship? Which critical collaboration uncertainties must be considered?
- **Specify communication channels:** this component encompass definition of the communication channels to be applied for the knowledge exchange (e.g.: workshops, meetings, documentation exchange, etc.). Questions to be asked: What is the structure of the knowledge to be exchanged? What are the current communication channels used by knowledge source and recipient?
- **Clarify actors and gatekeepers' roles:** this component encompass clearly defining and detaching the gatekeepers and other actors with their role in the knowledge exchange relationship from both parties. Questions to be asked: Who are the individuals most experienced or experts in collaboration in the field of the knowledge need within the company? Who are the individuals most skilled in technology transference or trial within the company?

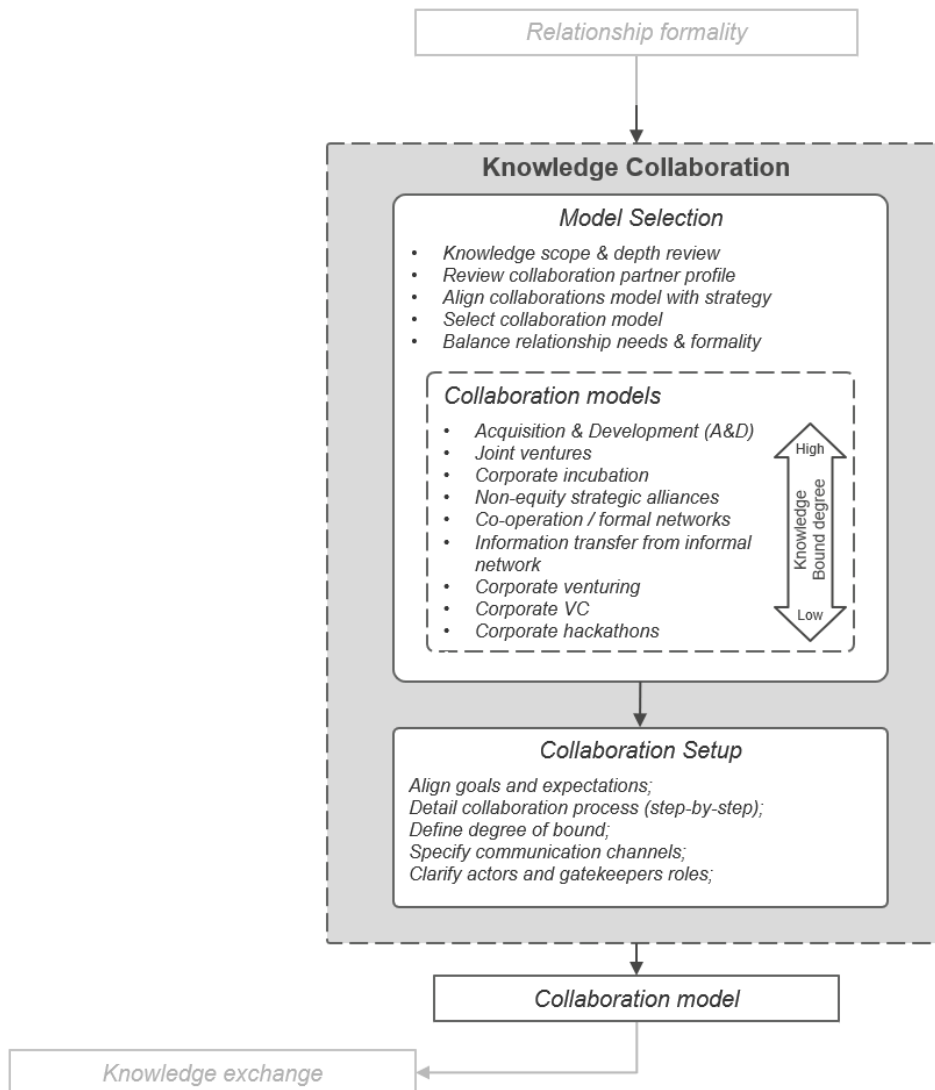
The Collaboration Setup is the environment for gatekeepers to design the actual collaboration process, bringing together its components arranged to optimize the knowledge exchange.

It is of high importance for gatekeepers to give special attention on the transparency of roles of the actors, the communication channel created for the knowledge flows and the alignment of the expectations for both parties (company and Start-up).

3.1.6 Knowledge Collaboration Conclusions

It is critical to ensure the construction of the collaboration process, channels and actors' roles before the beginning of the relationship, iterating this stage with the others, creating a cohesive and dynamic process.

This stage also requires special attention to the degree of formality, extent and depth of the knowledge stock, recipient absorptive capacity, and relationship gatekeepers and degree of knowledge bound, since these factors influence the selection and setup of the collaboration model. (Stage detailing available at *Figure 8*)



For instance, firms looking for fast incremental innovations in their processes may demand a moderate degree of formality and depth of knowledge, presenting abundance of gatekeepers and absorptive capacity suitable for the relationship; thus, opt for an intermediary knowledge bound degree model, such as co-operation, might be an adequate choice for the collaboration relationship.

3.2 Conceptual Framework Conclusions

The guidelines built in the three stages of the framework, *System Strategy*, *Partner Identification & Selection* and *Knowledge Collaboration*, supports structuring the collaboration strategic alignment, type and depth of knowledge need, degree of formality required, gatekeepers involved, sources scouting and selection, and collaboration model definition and preparation.

In order to facilitate the framework application, it is necessary to consider two major background subjects: the level of complexity of the collaboration; and the extent of the source knowledge stock.

These two topics are considered to be some of the heaviest variables of the knowledge source selection (OECD, 2018) as the degree of formality will require more (or less) processes, structures and management of the collaboration relationship (Kang & Kang, 2009; Traitler et al., 2011), and the extent of knowledge stock will influence the depth, resources and absorptive capacity of the relationship (OECD, 2018).

Relationship complexity arises from the asymmetry of the relationship (Hogenhuis et al., 2017), making it difficult for parties to establish aligned communication channels, expectations and effective network ties. Incompatibilities on the source R&D capacity, corporation absorptive capacity, gatekeeper's engagement and stability, and formality of the network ties, raise the relationship complexity and demand higher management efforts.

Similarly, *Knowledge Stock* emerges from scope and depth of the knowledge to be exchanged, being related with the extent of the knowledge stock of the source. More complex knowledge or information demand higher translation capabilities, competencies and resources from the exchanging partners (Wilhelm & Dolfsma, 2018), thus, influencing the collaboration structures.

To deal with the behaviour of *Relationship Complexity* and *Knowledge Stock*, corporations must harmonize these balancing factors defining the least complex relationship approach that sustains the higher required knowledge stock exchange. The fine balance of these factors, as well as the knowledge exchange task, lies on the gatekeeper's relationship management and skills.

Gatekeepers personify the knowledge exchange, drawing on iterative flows of inputs and feedbacks to translate and transfer the knowledge from the source to the organization, managing the relationship. (*Figure 9* details the complete framework with the balancing and managerial components).

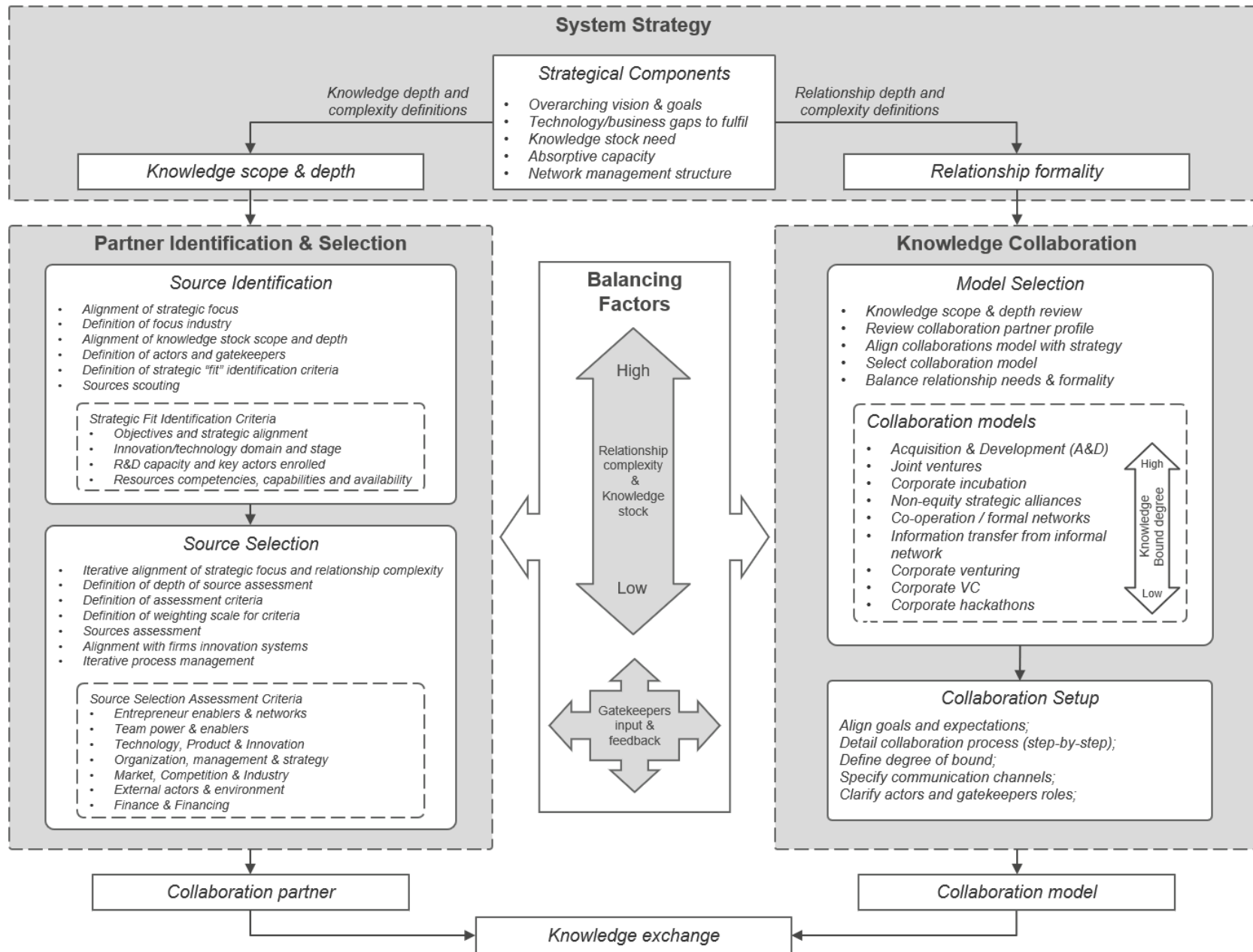


Figure 9 - Complete Framework overview

The *Balancing Factors* are responsible for providing the management structures of the framework, thus requiring special attention. The factors *Relationship complexity*, *Knowledge stock* and *Gatekeepers input and feedback* must be managed by gatekeepers to enable effective translation and transference knowledge and, consequently, *Knowledge Exchange* between the corporation and Start-up.

4 Chapter: Framework validation

4.1 Company background and overview

As introduced, KAG is a German technology companies holding with five Business Areas: Medipak Systems, Tissue, Tobacco, Körber Digital and Logistics Systems, counting with over 10.000 employees and 140 companies worldwide. The Group outstanding technological innovations opened way to leading market positions in different industries such as tobacco and tissue. (Figure 10 presents the corporate organigram)

Placed in the middle of a large ongoing digital transformational process, KAG aims to strategically distinguish itself by technology leadership and by fostering adoption of new technologies within its companies.

Aligned with the Group's vision, the branch of logistics systems KLS established the strategic focus on "shape the digital supply chain solutions of the future", thus making adoption of new digital technologies one of the main drivers of the BA. Within the strategical transformation, KLS is looking to design a more open model of technology development, that considers further external stakeholders (e.g. HEI, R&D labs, Tech Labs, suppliers, incubators & accelerators, among others).

With the focus driven towards technology Start-ups and the opening of KLS innovation system to these ventures, the main tasks of how to identify, select and collaborate with relevant Start-ups was posed.

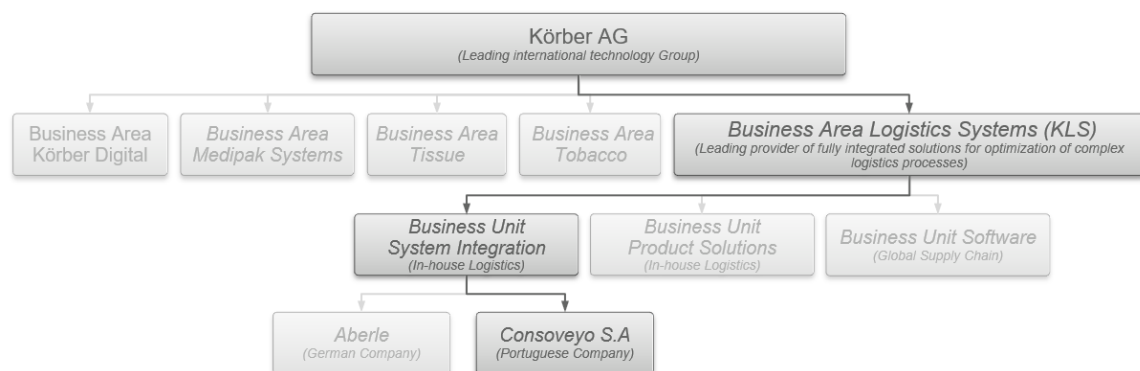


Figure 10 - Körber Group Organogram

In accordance with the higher corporate strategical directives, Consoveyo S.A., was chosen to host two KLS new technology initiatives: the Technology Companies Scouting and the Additive Manufacturing Technology Coordination. This 250 employees

Portuguese subsidiary of the Group operates in the warehousing sector, manufacturing automated systems for indoor logistics.

Due to the close relationship of KLS and CVY the framework validation was provided by key stakeholders from the two entities.

4.2 Validation methodology

The present research aimed to design a framework to identify, select and collaborate with Stat-ups, with the main focus on providing structured guidelines for corporations to complete these tasks. The unit of analysis was the process of building collaboration relationships with Start-ups. This unit provides insights into stages, criteria and recommendations to build the relationships.

To obtain insights on the collaboration relationships building, one-hour semi-structured interviews, with support of survey forms, were conducted with 9 representatives of the hosting company, including heads of departments, managers and team members. The hosting company represents the segment of large corporations.

Semi-structured interviews explored the levels within the framework stages, the components of assessment criteria and the framework balancing factors. In order to generate insights of the model practical application on the context of the hosting company, interviews aimed to validate the construct through the representatives' perception of the framework components' degree of importance.

4.2.1 Observation unit characterization

The observation unit selection approach intended to cover the perception of multiple actors involved in the process of adopting innovations and technologies in the hosting company, capturing representatives' perspectives on the process of building collaboration relationships with the Start-ups.

Observation unit was defined aiming to include two dimensions of representatives:

- individuals from areas closely related with innovation and new technologies within the hosting company, namely: R&D, Program Management, Technology Management and Digitization departments;
- individuals from the 3 organizational levels: Strategic, Tactical and Operational.

An observation unit of 9 interviewees was assembled, counting with 2 representatives for strategical level (Head of Technology Management and Head of R&D); 4 representatives for tactical level (Additive Manufacturing Technology Coordinator, Digital Transformation Officer, Product Management Engineer and Service Portfolio Management Engineer); and 3 representatives of operational level (Digital Ideation Designer, Program Management Office Analyst and Technical Assistant). The observation unit included representatives from both entities CVY and KLS.

Table 8 provides information about the interviewed company representatives job position, entity and organizational level.

Table 8 – Company representatives interviewed

Hosting Company representative	Entity	Organizational Level
Additive Manufacturing Technology Coordinator	KLS	Tactical
Digital Ideation Designer	CVY	Operational
Digital Transformation Officer	KLS	Tactical
Head of R&D	CVY	Strategic
Head of Technology Management	KLS	Strategic
Product Management Engineer	CVY	Tactical
Program Management Office Analyst	CVY	Tactical
Service Portfolio Management Engineer	CVY	Operational
Technical Assistant	KLS	Operational

Organizational levels are defined as follows:

- **Strategic:** Heads of department (e.g.: Head of R&D). Individuals responsible for defining and fostering implementation of company strategy (e.g.: company strategic targets or new technologies adoption policies).
- **Tactical:** Department or Operational managers, Division or Initiative coordinators (e.g.: Technology Coordinator, Digital Transformation Officer and Management Engineers). Individuals responsible for translating the strategy into actions and execution plans (e.g.: the innovation process workflow or the technology adoption pipeline).
- **Operational:** Execution teams (e.g.: Assistants, Analysts and Designers). Individuals responsible for operationalizing the tactical execution plans and workflows (e.g.: inputting ideas and operating the innovation workflow or experimenting and implementing new technologies).

In this research, Strategic organization level representatives are referred as “Strats”, Tactical organization level representatives are referred as “Tacts” and Operational organization level representatives are referred as “Opes”.

4.2.2 Interview preparation

Previously to the realization of interviews a support form and an informed interview consent form were built to guide and officialise the interviews.

The support form was constructed contextualizing the interview and depicting each of the framework components into a unit of analysis to be rated according to a scale of importance degree. The support form presented the following structure:

- Framework contextualization: overview of research objectives and core concepts of the framework;
- Validation interview form:
 - Identification of the interviewee and date of interview;

- Framework components decomposed;
- Importance scale;
- Complementary fields:
 - Fields to input descriptive comments regarding framework components and overall perception;
 - Collaboration model order table;
- Image of the framework.

Support forms were employed to facilitate the understanding of the framework and structure the process of assessment of the topics to be analysed. Detailed form used in the interviews is provided at *Appendix 5*.

Additionally, Informed Interview Consent forms were assembled to formalize the participation of the hosting company representatives in the research. All interviewees were asked to provide the interview consents in order to have their results considered.

The consent forms contained information about: Scope of the research; Author and supervisor of the research; Title and context of the research; Confidentiality and data collection methods of the interviews; Results access contacts; and Participation consent. Example of interview consent form used in the research and signed consent forms are available at *Appendix 6*.

Personal meetings were pre-scheduled and support forms were made available to all representatives at least three days before the interview. Personal interviews were preferred to enable higher degree of interaction between interviewee and interviewer. In the situations where personal meetings were not possible, as in the case of representatives located in Germany, video calls were scheduled using the same procedure applied for the personal meetings.

4.2.2.1 Validation questions

The key questions to be answered by the interviews were:

- How important are each of the framework stages for the design of the collaboration relationships?
- How important are the strategical components for the definition of system strategy?
- How important are the components and criteria of source identification and selection for the definition the collaboration partner?
- How important are the components and criteria of model selection and setup for the definition of the collaboration model?
- How important are the components of the balancing factors for the knowledge exchange?
- What additional stages of the relationship might be considered?
- What additional components might be considered?
- What is the perception of the overall framework to support building the collaboration relationships with Start-ups?
- Which collaboration models enable higher degree of knowledge bound?

These questions were transformed into unit of analysis to be assessed by interviewees in the support form. Further details of interview are provided below.

4.2.3 Data collection interviews

Before start of each interview, full review of the support form was performed by interviewer, providing: contextualization of research and explanation of interview objectives; overview of the overall framework and the its components; overview of the units under analysis and complementary fields.

Any interviewee doubts regarding the research, validation topics, interview process or framework were clarified at the beginning or during the development of the interview.

The semi-structured approach allowed, on one hand, to capture the perception of the representatives on the degree of importance of each component of the Framework for the design of knowledge exchange relationships with Start-ups; and on the other hand, to deeper explore the representatives' perception of adequacy of the Framework the task of support corporations design knowledge exchange relationships with Start-ups.

Additional insights on the level of understanding and awareness of knowledge collaboration relationships processes and structures by the company representatives were also observed.

The framework validation form was structured listing each component of the framework as an “*Unit under analysis*” and the company representative perception of importance as a scale of the degrees considering:

- Very important: high degree of importance of the unit under analysis;
- Important: moderate degree of importance of the unit under analysis;
- Not important: low degree of importance of the unit under analysis.

4.3 Data analysis preparation

Once in possession of interview results, systematization of the information was done compiling the fragmented interview results into one single table. (Full results of interviews are available at *Appendix 7*).

Additionally, to organize and prepare the interviews data for analysis, two data standardization coding's were established regarding the identification of the company representative and the degree of importance. The hosting company representatives were tagged in alphabetical code (available at *Table 9*) and the degree of importance was numerically coded in descending order (available at *Table 10*), as follows:

Table 9 - Hosting company representatives codes

Hosting company representative	Code
Additive Manufacturing Technology Coordinator	A
Digital Ideation Designer	B
Digital Transformation Officer	C
Head of R&D	D
Head of Technology Management	E
Product Management Engineer	F
Program Management Office Analyst	G
Service Portfolio Management Engineer	H
Technology Analyst	I

Table 10 - Degree of importance codes

Degree of importance	Code
Very important	3
Important	2
Not important	1

Interview coding's were applied to summarise information and enable easier visualization of result patterns and correlations. Application of coding is better observed in the next section.

4.4 Data analysis, findings & discussion

Complying with the validation methodology, assessment of all framework components was performed depicting each one of its building blocks. Following the proposed roadmap, segmentation of the framework building blocks was performed and results of the hosting company representatives' perception of the components' degree of importance is provided.

4.4.1 Framework Stages importance

The first validation topic approached is the importance of the framework stages for the design of knowledge collaboration relationship, as shown in *Table 11*.

Literature argues that structured processes are required to build collaboration relationships but processes over-complexity may jeopardize performance. Thus, validation of the framework stages supports the perception of a well-balanced structure-complexity ratio.

Table 11 – Framework Stages importance results

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Framework Stages for the design of the collaboration relationship									
System Strategy Stage	3	3	3	3	3	3	3	3	3
Partner Identification & Selection Stage	2	3	3	3	3	3	2	3	2
Knowledge Collaboration Stage	2	3	3	2	2	2	3	2	2
Balancing Factors	3	2	2	2	2	3	2	3	3

As expected, the stages System Strategy and Partner Identification & Selection are perceived as highly important in the design of the relationship with Start-ups, since they relate with the definition of an overarching vision and of the partner for the collaboration.

However, the stage Knowledge Collaboration is seen with a moderate degree of importance by the representatives, especially amongst Strats and Tacts.

Interviewees attributed this behaviour to the fact that collaborations are likely to change, thus investing time on deeper and complex setups will not pay off since the shape of the collaboration will probably need to be re-structured. As response, the representatives argued that a minor setup considering broad outlines (such as the goals, expectation and communication channels) added to an iterative process management will be sufficient to enable the knowledge exchange.

In the same way, Balancing Factors were perceived with moderate importance. Even though this component focusses on the management between the complexity of the relationship and the knowledge to be exchanged, two relevant variables according to literature, the importance of the component is undervalued by interviewees. Observations considering unclarity about its elements and the actual application of Balancing Factors lead to uncertainty on the value of the component to the management of the relationship.

Still, management of relationship complexity in accordance with the knowledge stock to be exchanged remain a key aspect of the relationship success. Gatekeepers were recognized as valuable assets for the good development of collaboration. Thus, including the crucial management of these Balancing Factors variables as gatekeepers' responsibility may be valid response.

4.4.2 Strategic Components Importance

The second validation topic approached is the importance of the Strategic Components for the definition of System Strategy stage, as shown in *Table 12*.

Clarity of overarching vision, organizational structures and capabilities, and knowledge stock needed are considered important elements to define the collaboration relationship strategy. Thus, validation of Strategic Components supports the perception that strong structuring the strategy variables are important to good development of the system strategy and consequently of the knowledge exchange relationship.

Table 12 – Strategic Components importance results

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Strategic Components for the definition of the system strategy:									
Overarching vision & goals	3	3	2	3	3	3	3	3	3
Technology/business gaps to fulfil	3	3	3	3	3	3	3	3	2
Knowledge stock need	2	3	3	2	2	2	3	3	2
Absorptive capacity	2	3	3	2	2	2	3	2	2
Network management structure	2	2	2	1	1	3	2	2	1
Knowledge scope & depth	3	3	1	3	2	3	3	3	2
Relationship formality	2	1	2	2	2	2	2	2	1

The three first components on *Table 12*, related with establishing the vision and knowledge gap/need to be addressed by the collaboration, were perceived as important or very important by interviewees, thus in alignment with expected results.

However, Absorptive capacity, Network management structure and Relationship formality presented results sensibly below expectations, especially for Strats and Tacts perspectives. These components are related with the company ability to understand knowledge, relationship management structures and definition of the degree of knowledge bound.

This behaviour was attributed to the understanding that defining these last four strategic components are not relevant in the first stage of strategy design. Representatives highlighted that the components are considered significant but should be approached in later stages, avoiding overcomplexity of the system from the beginning.

A suitable response to this possible system overcomplexity is to consider increasing the stages components according to the degree of development or type of relationship, thus offering guidelines to increase the process complexity according to needs of specific cases.

4.4.3 Source Identification Components Importance

The third validation topic approached is the importance of the source identification components and strategic fit criteria for the identification of the knowledge collaboration partner, as shown in *Table 13*.

This level of the framework considers that the fit between the company overarching vision and the source competencies is crucial for identifying which source to collaborate with. This fit is considered to be an alignment of parties: strategy, knowledge stock/need scope and depth, actors enrolled and scouting process.

Table 13 – Source Identification Components & Fit Criteria importance results

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Source Identification Components for the identification of collaboration partner									
Alignment of strategic focus	3	3	2	1	3	1	1	3	2
Definition of focus industry	3	3	1	1	2	2	1	2	1
Alignment of knowledge stock and depth	2	3	2	2	2	3	3	3	2
Definition of actors and gatekeepers	3	3	3	1	2	2	3	2	1
Definition of strategic fit criteria	3	3	3	3	3	2	2	3	3
Sources scouting	2	2	3	2	3	3	3	3	3

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Strategic Fit Criteria for the identification of the collaboration partner:									
Objectives and strategic alignment	3	3	2	1	3	2	1	3	2
Innovation/technology domain and stage	3	3	3	2	3	3	3	3	3
R&D capacity and key actors enrolled	2	2	3	2	2	3	3	2	2
Resources competencies, capabilities and availability	2	2	3	3	2	2	2	3	1

As expected, the components of *Strategic Fit Criteria* were perceived as important or very important for the knowledge source identification, only the first component, Objectives and strategic alignment, presented minor variation from the expectations.

This slight variation was explained by the perception that strategy of Start-ups is likely to change, thus alignment of this variable would be fallacious. Nevertheless, majority of representatives, from all organization levels, perceived such alignment as very important. The behaviour of the component Alignment of strategic focus is explained similarly.

The Source Identification Components on the other hand presented much more controversy results. Although it was clear for all interviewees that the components defining fit criteria and performing the scouting are highly important for source identification, the other topics of this level present a large variation of the perception of importance.

As predicted, the components Alignment of knowledge stock and depth, Definition of strategic fit criteria and Sources scouting were perceived as of moderate to high importance for knowledge source identification, once they account for the specification of type and extent of the knowledge intended, the establishment of parameters to identify the sources and the task to search for the sources.

Although Definition of actors and gatekeepers component was perceived as moderate to high importance, insights of Starts regard that employees constantly change companies, thus importance of actors should be reduced once they are likely to change, on both parties, during the relationship.

Alignment of strategic focus and Definition of focus industry, on contrary, was perceived as moderate to low degree of importance for source identification. It was explained considering that the alignment of strategy between company and Start-up is not highly significant once the relationship focus is knowledge exchange. Hence, even though the parties strategies diverge, if the knowledge is relevant it can be exchanged. Reduced importance perception of Definition of focus industry was explained arguing that this component is too related with the operational task of scouting and that the importance lies on the knowledge need not on the industry focus, thus the component is likely to be organically defined during the scouting process.

As a response to the controversy behaviour of this level an approach similar to the one applied to prevent overcomplexity seems adequate. In the first moment of the source identification, focus on the components considered of high importance, and then add other components according to identification process.

4.4.4 Sources Selection Components importance

The fourth validation topic approached is the importance of the source selection components and assessment criteria for the selection of the knowledge collaboration partner, as shown in *Table 14*.

This level of the framework considers that there are no standardized assessment criteria and complexity is harmful for the good development of the process. As such, one must build the assessment process according to the strategic focus of the relationship and the intended knowledge scope and depth, reducing complexity to the least possible degree.

Table 14 – Sources Selection Components & Assessment Criteria importance results

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Source Selection Components for the selection of the collaboration partner:									
Iterative alignment of strategic focus and relationship complexity	3	2	2	1	3	2	1	3	2
Definition of depth of source assessment	3	2	2	2	2	3	1	2	2
Definition of assessment criteria	3	3	3	2	2	3	2	2	3
Definition of weighting scale for criteria	3	2	3	2	1	2	2	1	2
Sources assessment	2	2	3	2	2	3	3	3	3
Alignment with firm's innovation systems	1	3	2	1	1	1	1	2	1
Iterative process management	2	3	2	2	1	3	2	3	2
Importance of the Assessment Criteria for the selection of the collaboration partner:									
Entrepreneur enablers & networks	2	3	1	2	2	3	2	1	3
Team power & enablers	3	3	2	3	2	3	1	3	2
Technology, Product & Innovation	3	3	3	3	3	3	2	3	3
Organization, management & strategy	1	3	2	2	2	1	2	2	2
Market, Competition & Industry	3	2	2	2	3	1	1	2	2
External actors & environment	2	2	2	1	1	2	2	2	2
Finance & Financing	2	2	2	2	3	2	2	3	2

Similarly to the previous stage, this level of the framework also presented a controversy behaviour of the results. Diverging from the expectations, most of the components were perceived to be of moderate importance. The component Technology, Product & Industry was the only topic considered of high importance for the large majority of interviewees.

The few items considered of higher importance on the Source Selection Components level were Definition of assessment criteria and Sources Assessment, showing that according to representatives' perspective these are the actual important tasks to be performed in this level.

Additional components such as Iterative alignment of strategic focus and relationship complexity, Definition of depth of source assessment, Definition of weighting scale for criteria and Iterative process management were perceived to have moderate to low degree of importance.

This behaviour was explained by the representatives' perception that these components actually support clarifying the core topics for the selection of the source and occasionally end up increasing the complexity of the selection process. Thus, application of these additional components must be pondered according to strategic need.

For instance, when selecting a source from a highly competitive industry finely define the depth of source assessment and the weighting scale for criteria must be required. On contrary, when selecting a source to fulfil an unclear or flexible need, the iterative process management must be essential.

The major divergence from the expectations was posed by the component Alignment with firm's innovation systems, as it was perceived to be of low importance for most company representatives. This condition was explained by the perception that since the relationship is focused on knowledge exchange, the corporation innovation system is not directly linked to this task, thus the alignment of the source to the corporation innovation system does not account for the good or poor development of the relationship.

Regarding the Assessment Criteria a moderate perception of importance is observed with slightly variations to both sides of the spectrum (very important and not important). The criteria Team power & enablers, Market, Competition & Industry and Finance & Financing were considered to have moderate to high degree of importance, while Organization, management & strategy presented moderate perception of importance and Entrepreneur enablers & networks, External actors & environment showed moderate to low perception importance.

This behaviour exposes the perception that all criteria are significant for the assessment of the source, but also reiterates the perception that overcomplexity must be avoided from the beginning. Thus, the framework components and criteria should be lighter on a first stage and more specific as the process unfolds and demand more detail.

4.4.5 Model Selection Components Importance

The fourth validation topic approached is the importance of the collaboration model selection and collaboration setup components for the selection and structuring of the knowledge collaboration model, as shown in *Table 15*.

This level of the framework considers that networks mutually influence each other and complexity is harmful for the good development of the process. As such, one must build the collaboration process according to the strategic focus of the relationship and the intended knowledge scope and depth, reducing complexity to the least possible degree.

Table 15 – Model Selection Components & Collaboration Setup importance results

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Model Selection Components for the selection of the collaboration model:									
Knowledge scope & depth review	3	3	3	2	2	3	2	3	3
Review collaboration partner profile	3	3	2	3	2	1	2	2	2
Align collaboration model with strategy	3	3	3	2	2	2	1	3	2
Select collaboration model	2	3	3	2	2	3	3	3	2
Balance relationship needs & formality	2	1	3	1	2	2	3	3	3
Importance of the Collaboration Setup Components for the structuring of the collaboration model:									
Align goals and expectations	3	3	3	3	3	3	3	3	3
Detail collaboration process (step-by-step)	3	3	3	2	2	2	2	2	2
Define degree of bound	3	3	2	3	1	3	1	2	2
Specify communication channels	3	3	3	2	2	2	2	3	1
Clarify actors and gatekeepers' roles	2	3	3	2	3	3	2	3	2

As expected, majority of the components presented perception of moderate to high degree of importance. Interesting results, though, raised from the perception of Strats. These representatives rated most of the components to be of moderate importance for selection and setup of the collaboration model, while Tacts and Opes rated components as of high importance.

The variation was explained by the more practical aspect of the components, thus being considered more important by Tacts and Opes. For instance, the component Specify communication channels, that supports the actual definition of the channels' actors will use to exchange knowledge, is considered of high importance for Tacts and moderate importance for Strats.

In comparison, the component Align goals and expectations, that encompass an overall alignment of the parties and the collaboration strategy, is perceived as highly important to all representatives. This importance perception was justified by interviewees expressing the relevance of the strategical content for the component.

However, two components presented results below expectations: Balance relationship needs & formality and Define degree of bound. Although perception of importance is still considered to be moderate to high, results exposed the difficulty to understand the role of these balancing components. Representatives argued that the level of complexity organically arises from the type of collaboration model selected, as well as the degree of knowledge bound. Hence, the focus should lie on the good alignment of the model to the collaboration strategy and expectations.

Literature, on the other hand, claims that knowledge exchange comes from well-established flows and links between exchange partners, and that the degree of formality and bound of the relationship influence the extent of knowledge exchange. Therefore, it is of importance to account for these two low rated components.

As a response to this misalignment of components importance, change the components application approach was considered. Instead of pose Balance relationship needs & formality and Define degree of bound as topics to be defined, an approach that considers the description of the collaboration model already including the degree of formality and knowledge bound entailed by the model seems to be more appropriate. In this approach gatekeepers selecting and setting the collaboration model would see the degree of formality and knowledge bound as conditions/recommendations of each model.

4.4.6 Balancing Factors importance

The Fifth validation topic approached is the importance of the balancing factors for the mediation of the knowledge exchange, as shown in *Table 16*.

As posed in the literature, asymmetric partnerships, such as knowledge exchange collaborations between large corporations and Start-ups, are likely to face challenges due to misalignments of roles, linkages, goals, expectations and communication. Thus, gatekeepers' mediation of the relationship components is required to fine balance the least formality/complexity required to exchange the necessary knowledge stock.

Table 16 – Balancing Factors importance validation

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Balancing Factors for the mediation of the knowledge exchange:									
Relationship complexity	3	3	3	2	2	3	1	3	3
Knowledge stock	2	3	3	3	2	3	2	3	2
Gatekeepers input & feedback	3	3	2	2	2	3	3	3	3

In alignment with expectations, the factors were perceived to be from moderate to highly important for majority of interviewees. Thus, confirming the perception of importance of these factors.

However, although the factors were perceived as mediation tools to balance the relationship, representatives expressed unclarity about the actual functioning of the balancing factors and how to perform the balancing of the framework components.

As a response to the unclarity of the balancing factors expressed by representatives, provisioning of a manual detailing how the factors function and offering recommendations of how to apply them, seems to be suitable to leverage comprehension of factors use.

4.4.7 Collaboration Models bound degree validation

The Sixth validation topic approached is the degree of knowledge bound of the collaboration models, as shown in Table 17.

Knowledge bounds refer to linkages and ties created between collaboration partners to enable knowledge exchange. The knowledge bounds present a dual behaviour: on one hand, bounds influence the linkages of the relationship facilitating or jeopardizing knowledge flows; on the other hand, bounds entail the formality of the relationship accounting to increase or decrease of the knowledge collaboration complexity. Thus, the higher the bound degree, more complex knowledge can be exchanged and more difficult to make the exchange; the lower the bound degree, less complex knowledge can be exchanged and easier to make the exchange.

Table 17 – Collaboration Models Degree of Knowledge Bound

Unit under analysis s	Hosting company representatives									Reference results
	A	B	C	D	E	F	G	H	I	
Collaboration models Degree of Knowledge Bound										
Acquisition & Development (A&D)	9	6	9	9	9	9	9	8	9	9
Co-operation / formal networks	2	8	6	5	3	6	6	4	5	5
Corporate hackathons	3	1	3	1	2	3	5	2	1	1
Corporate incubation	7	2	4	7	6	7	7	6	7	7
Corporate VC	5	7	1	3	7	5	4	1	2	2
Corporate venturing	4	9	5	2	5	4	8	9	3	3
Information transfer from informal network	1	3	2	4	1	1	2	3	4	4
Joint ventures	8	4	8	8	8	8	3	7	8	8
Non-equity strategic alliances	6	5	7	6	4	2	1	5	6	6

Match with reference results



Divergent of reference results



On contrary to expectations, knowledge bound degrees were rated in completely different ways by representatives, exposing a strong lack of alignment of the characteristics present by collaboration models, especially when considering weak ties collaboration models.

Accurately perceive and recognize the knowledge exchange models' characteristics are relevant requirements for selection of the suitable model to embody the knowledge exchange relationship. Mediating relationship and knowledge complexity are key to define the least formal collaboration model to be applied. Thus, distinguish between the different bound degrees and requirements of each collaboration model is significant to support effective selection of the knowledge exchange approach.

As a response to the misalignment of the collaboration models' degree of knowledge bound, build a summary of the collaboration models encompassing: model description, key components, requirements, strengths and weakness; and provide the information embedded within a framework manual, seems to be the appropriate to clarify the collaboration models.

4.4.8 Results overview

Table 18 provides the complete overview of validation interview results according to company representatives' perception.

Table 18 - Validation results overview

Unit under analysis	Hosting company representatives								
	A	B	C	D	E	F	G	H	I
Importance of the Framework Stages for the design of the collaboration relationship									
System Strategy Stage	3	3	3	3	3	3	3	3	3
Partner Identification & Selection Stage	2	3	3	3	3	3	2	3	2
Knowledge Collaboration Stage	2	3	3	2	2	2	3	2	2
Balancing Factors	3	2	2	2	2	3	2	3	3
Importance of the Strategical Components for the definition of the system strategy:									
Overarching vision & goals	3	3	2	3	3	3	3	3	3
Technology/business gaps to fulfil	3	3	3	3	3	3	3	3	2
Knowledge stock need	2	3	3	2	2	2	3	3	2
Absorptive capacity	2	3	3	2	2	2	3	2	2
Network management structure	2	2	2	1	1	3	2	2	1
Knowledge scope & depth	3	3	1	3	2	3	3	3	2
Relationship formality	2	1	2	2	2	2	2	2	1
Importance of the Source Identification Components for the identification of collaboration partner									
Alignment of strategic focus	3	3	2	1	3	1	1	3	2
Definition of focus industry	3	3	1	1	2	2	1	2	1
Alignment of knowledge stock and depth	2	3	2	2	2	3	3	3	2
Definition of actors and gatekeepers	3	3	3	1	2	2	3	2	1
Definition of strategic fit criteria	3	3	3	3	3	2	2	3	3
Sources scouting	2	2	3	2	3	3	3	3	3
Importance of the Strategic Fit Criteria for the identification of the collaboration partner:									
Objectives and strategic alignment	3	3	2	1	3	2	1	3	2
Innovation/technology domain and stage	3	3	3	2	3	3	3	3	3
R&D capacity and key actors enrolled	2	2	3	2	2	3	3	2	2
Resources competencies, capabilities and availability	2	2	3	3	2	2	2	3	1

Importance of the Source Selection Components for the selection of the collaboration partner:									
Iterative alignment of strategic focus and relationship complexity	3	2	2	1	3	2	1	3	2
Definition of depth of source assessment	3	2	2	2	2	3	1	2	2
Definition of assessment criteria	3	3	3	2	2	3	2	2	3
Definition of weighting scale for criteria	3	2	3	2	1	2	2	1	2
Sources assessment	2	2	3	2	2	3	3	3	3
Alignment with firm's innovation systems	1	3	2	1	1	1	1	2	1
Iterative process management	2	3	2	2	1	3	2	3	2
Importance of the Assessment Criteria for the selection of the collaboration partner:									
Entrepreneur enablers & networks	2	3	1	2	2	3	2	1	3
Team power & enablers	3	3	2	3	2	3	1	3	2
Technology, Product & Innovation	3	3	3	3	3	3	2	3	3
Organization, management & strategy	1	3	2	2	2	1	2	2	2
Market, Competition & Industry	3	2	2	2	3	1	1	2	2
External actors & environment	2	2	2	1	1	2	2	2	2
Finance & Financing	2	2	2	2	3	2	2	3	2
Importance of the Model Selection Components for the selection of the collaboration model:									
Knowledge scope & depth review	3	3	3	2	2	3	2	3	3
Review collaboration partner profile	3	3	2	3	2	1	2	2	2
Align collaboration model with strategy	3	3	3	2	2	2	1	3	2
Select collaboration model	2	3	3	2	2	3	3	3	2
Balance relationship needs & formality	2	1	3	1	2	2	3	3	3
Importance of the Collaboration Setup Components for the structuring of the collaboration model:									
Align goals and expectations	3	3	3	3	3	3	3	3	3
Detail collaboration process (step-by-step)	3	3	3	2	2	2	2	2	2
Define degree of bound	3	3	2	3	1	3	1	2	2
Specify communication channels	3	3	3	2	2	2	2	3	1
Clarify actors and gatekeepers' roles	2	3	3	2	3	3	2	3	2

5 Framework review & Conclusions

A positive overall perception of the framework as a well-structured tool to support develop structured knowledge collaboration relationships was provided by company representatives.

The rich degree of detail provided by the broad range of components was considered to reinforce the power of the framework in support the design of relationships with Start-ups. Nevertheless, fill additional components were suggested by interviewees as complement to the framework:

- IP's: since the framework is focused on technology ventures, a component specially related to intellectual property rules and rights should be considered.
- Risk assessment: as ventures entail higher levels of uncertainty, a component dedicated to analysing the relationship risks would be relevant. (e.g.: technological risk, knowledge security risk, competition risk, etc.)

Even though majority of components importance were validated, the main considerations posed by company representatives was regarding the overcomplexity and full applicability of the framework.

According to several interviewees (representatives code A, C, D, E and G) the development of innovations demands agile collaboration models and processes, that

allow actors to speed the decision-making towards the desired outcome. Thus, full implementation of the framework, meticulously attending to all stages, would reduce agility of the process.

Although speed and timing play relevant role in seize the innovation opportunity, it is critical to reinforce that such task requires structured process, relying on execution of the process stages to support actors' intuitions and perceptions. Hence, becomes clear that the actual implementation of the framework depends on the modulation of the tool complexity according to relationships' needs.

As a response to the concerns regarding the framework overcomplexity, the suitable approach seems to be the restructuring the tool into a more agile model, posing the core components to build the knowledge exchange relationship as central subject to be achieved and the additional components as a "tool boxes" of structuring components to be applied as needed (*Figure 11* details the restructured framework). In addition, development of a framework manual with use recommendations is also deemed necessary.

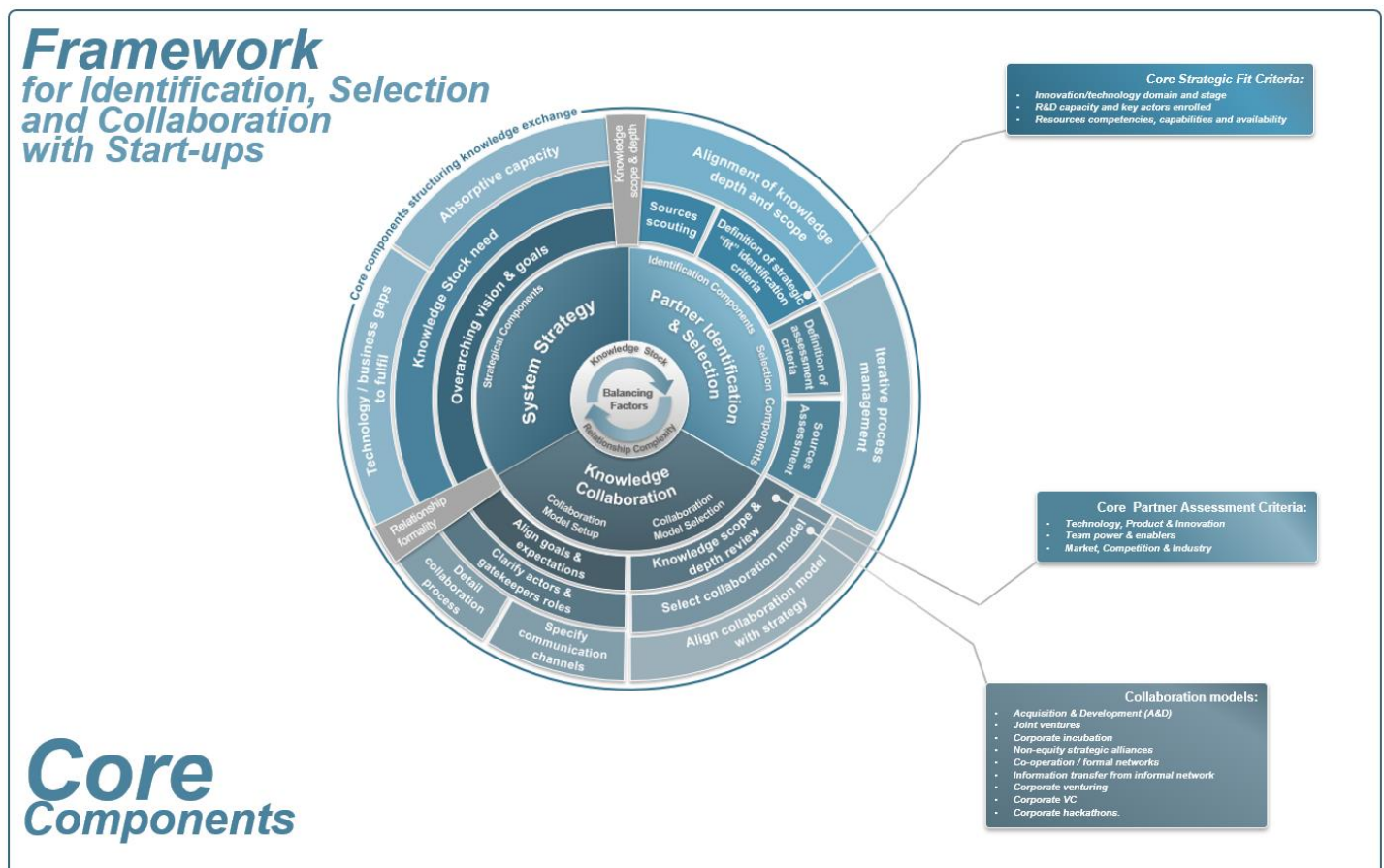
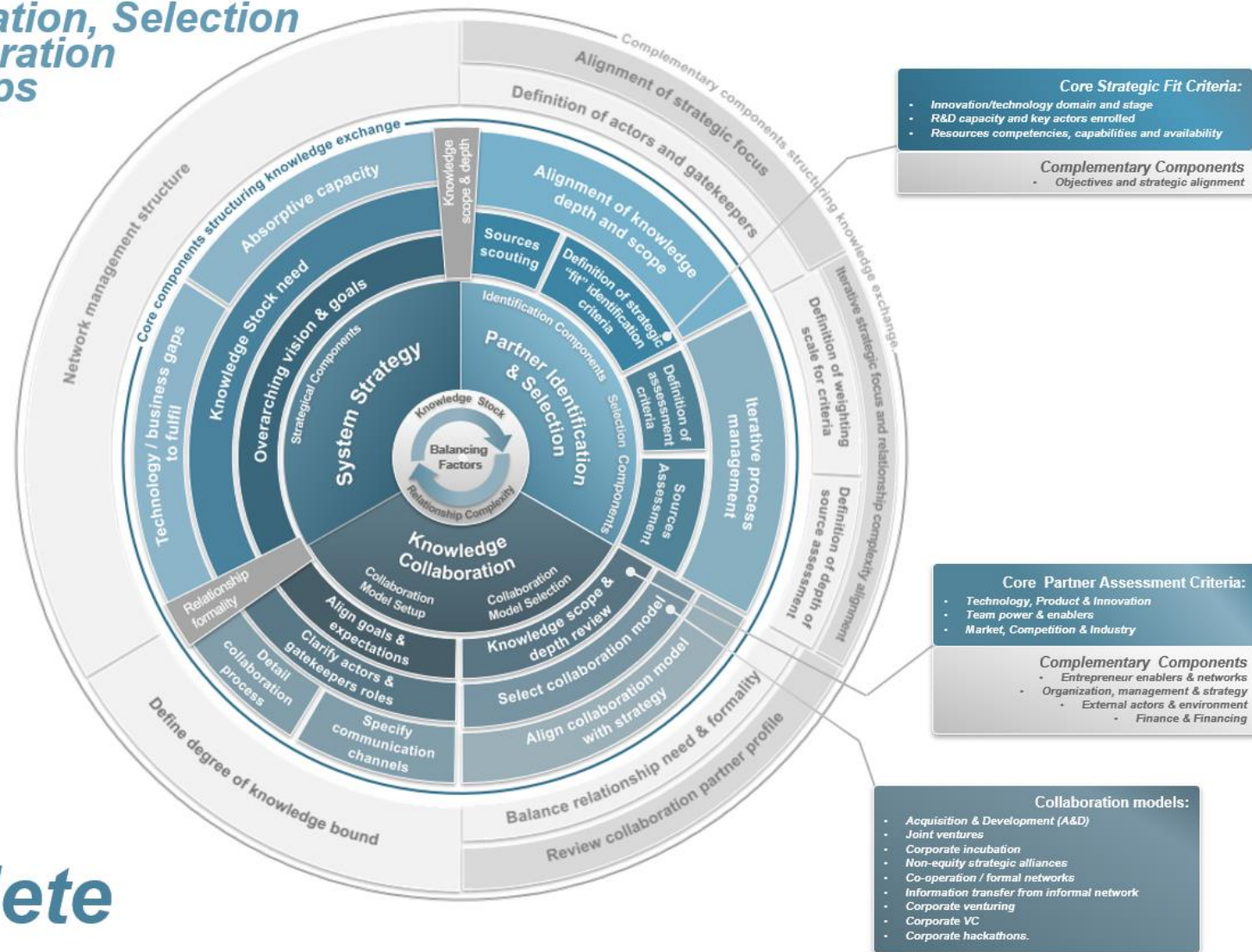


Figure 11 – Core components of restructured Framework

Recommendations: the Framework for Identification, Selection and Collaboration with Start-ups entail a sensible degree of complexity and relay on some expertise of the users. Thus, in an effort to facilitate the tool application, provide a practical manual with guidelines and recommendations for the framework implementation is a relevant topic to be approached for the full exploitation of the model.

Framework for Identification, Selection and Collaboration with Start-ups



**Complete
Model**

Figure 12 – Complete Restructured Framework

6 Limitations & Future Research

The research was developed in the context of the company Consoveyo S.A., focused on design a structured process to build knowledge exchange relationships between large corporations and Start-ups. The Framework for Identification, Selection and Collaboration with Start-ups was presented as the outcome of the investigation.

Even though the framework validation was provided by hosting company representatives, the model remains in a conceptual phase, thus requiring empirical application to fully validate its efficacy. Further, as the model conceptual validation was provided in a company-specific context, validity results cannot be generalized to other industries or segments. In this sense, conceptual and empirical validation in cross-company and cross-industry scenarios are relevant future topics to verify the universal validity of the framework.

The scope of the framework was aimed to address the construction of knowledge relationship with Start-ups. Although many similarities are perceived in the construction of knowledge collaboration relationships with other actors of the OI ecosystem (e.g.: Scale-ups, Technology Companies or Research labs) the extent of which OI actors are suitable for the framework structure are yet unclear. Hence, to extent application of the framework into other OI actors besides Start-ups and verify the model validity in these additional contexts are of relevance to clearly define capabilities and boundaries of the framework.

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Appendixes

Appendix 1 - Literature Review Systematization

		Battocchio A.; Minatogawa V.; L.F.; Anholon R. Berchicci L. Bigliardi B.; Galati F.; Verbano C. Böhmer A.L.; Lindemann U. Chen J.; Chen Y.; Vanhaverbeke W. Chesbrough H.W. Corvello V.; Gatto D.; Carlsson S.; Migliarese P. Fernandes S.; Cesário M.; Barata J.M. Ferrary M. Franke N.; Gruber M.; Harhoff D.; Henkel J. Herzog P. Hogenhuis B.N.; Van Den Hende E.A.; Hultink E.J. Kang K.H.; Kang J. Köhler T. Kruse P. Liu P. Malvar N.; Polishchuk V.; Sharkadi M.; Liakh I. Martin-de Castro G. Mendialdua J.C.; Iniesta P.M.O.; Lopez M.J. Milkova M.; Andreichikova O.; Andreichikov A. Minola T.; Giorgino M. Mutanov G.; Yessengaliyeva Z. Santamaria L.; Nieto M.J.; Barge-Gil A. Shepherd D.A. Silva C.; Algoritmi C.; Ramos I. Spaeth S.; Stuermer M.; Von Krogh G. Springer J.-C.; Corvello V.; Grimaldi M.; Rippa P. Stankeviciene J.; Znyte S. Terther B.S.; Tajar A. Tötting F.; Grillitsch M.; Höglinger C. Tomy S.; Pardede E. Trachana T.; Diakanastasi E.; Karagiannaki A.; Prai. Vanhaverbeke W.; Van de Vrande V.; Chesbrough Villasalero M. Walsh S.T.; Linton J.D. Wilhelm M.; Dollsma W. Wu W.-W.																									
Core subject approached by the literature																											
Innovation management & frameworks	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
OI & Startups				X					X		X		X														
Startups assessment framework	X		X						X		X				X	X		X	X								
Startups key components & elements									X						X	X		X	X								
Dominant optics of the literature																											
Corporations enhancement of innovation	X		X	X	X	X	X			X	X		X				X		X	X							
Startups evaluation of opportunity & capability	X		X														X										
VC / CVC / Public VC investment decision-making									X						X	X		X	X	X							
Actors considered in the analysis																											
Firms/Corporations			X	X	X	X	X		X	X		X					X		X	X							
Higher education systems & Public entities			X		X		X				X						X										
Knowledge organizations (R&D / Tech Labs)	X		X	X	X		X	X		X							X		X								
Startups	X	X	X		X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Venture Capital firms / Coporate Venturing / Public Venturing									X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Focus topics considered for analysis																											
Actors innovation processes	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Actors human component		X							X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Actors managerial capabilities	X				X				X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Actors network capabilities					X						X						X	X	X	X	X	X	X	X	X	X	X
Actors technology capabilities												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Knowledge flows & sources			X		X	X	X	X		X		X					X	X	X	X	X	X	X	X	X	X	X
Role & types of financing		X											X	X						X							

Appendix 2 - Criteria observed in the reviewed literature

<i>Author</i>	Batocchio et al. (2017)	Bigliardi et al. (2013)	Liu (2011)	Malyar et al. (2016)
<i>Perspective of assessment</i>	Approach the assessment of the business model performance	Offers a model to identify factors that may impact new ventures performance	provides an index of systems and methods for assessment of venture investments	creates a fuzzy mathematics approach to evaluate Start-up projects
<i>Criteria considered</i>	<ol style="list-style-type: none"> 1. Financial 2. Customer 3. Internal business process 4. Learning & growth 	<ol style="list-style-type: none"> 1. founder's need for autonomy 2. founder's risk-taking responsibility 3. formal contacts between parent and spin-off 4. founder's career orientation 5. founder's motivation 6. financial involvement of the parent 7. competent staff in technology transfer offices 8. access to qualified entrepreneurial skills 9. professional training and education 10. relationships established with capital companies 11. seed and venture capital availability 12. regional infrastructure 13. University intellectual property policy 14. the industry characteristics 15. location of the spin-off 16. degree of innovativeness 17. stage of development of the technology 18. ability to patent or in general to protect the technology 	<ol style="list-style-type: none"> 1. Management venture 2. Technology venture 3. Finance venture 4. Exit venture 5. Entrepreneur quality 6. Enterprise management level 7. Product and technology specificity 8. Enterprise profit capacity 9. Market environment 10. Policy environment 	<ol style="list-style-type: none"> 1. Product type 2. Application field 3. Social importance 4. Power of the idea 5. Authors of the idea 6. Level of business experience 7. Experience of top management roles in the start-up's field 8. Quantity of hours of persona time invested in the start-up development 9. Main competitors (meeting the same need of customer) 10. Other start-ups in this field of the similar stage of development received venture financing in the amount 11. Commercial validity of idea 12. Strategic partners 13. Intellectual property 14. Presence of a business plan 15. Amount of own investments in a start-up 16. Availability of corporate lawyer 17. Availability of a specialist in intellectual property 18. Available sales and marketing plans

<i>Author</i>	Mendialdua (2014)	Milkova et al. (2018)	Minola and Giorgino (2008)	Mutanov and Yessengaliyeva (2013)
<i>Perspective of assessment</i>	Applies fuzzy logic although considering specifically the new venture idea and entrepreneur	Model to merge statistical and intuition to Start-ups evaluation	Determinants on Start-ups investment	Focus on the innovativeness and competitiveness of innovative projects,
<i>Criteria considered</i>	<ol style="list-style-type: none"> 1. Competency 2. Structure 3. General environment 4. Demand to fulfil 5. Physical resources 6. Financial resources 7. Expertise 8. Personal qualities 	<ol style="list-style-type: none"> 1. Expansion 2. Pleased clients 3. Quality environment 4. Investors attraction 5. Public relevance 6. Help for disadvantaged groups 7. Leader 8. Staff 9. Team professional satisfaction 10. Creativity 11. Website usability 12. Social networks 13. Another advertisement 14. Financial soundness 15. Market share 16. Efficiency 17. Innovation level 	<ol style="list-style-type: none"> 1. Technical experience 2. Education 3. Disposition to open the business 4. Stigma failure 5. IRR 6. Payback time 7. Time to market 8. Stage of investment 9. Urgency of financing 10. Technological content 11. Patents 12. Size of investment 13. Self financing 14. Intangible assets pledged as collateral 15. Ratio tangible/non tangible assets 16. Competition 17. Market maturity 18. Entrepreneurial background 19. Rich Commercial experience 20. Extra patent protection 21. Low Degree of novelty 	<ol style="list-style-type: none"> 1. Compliance of a project with the priority areas of industrial and innovation strategy 2. Relevance of research and product uniqueness (no analogues) 3. Scientific originality of the solutions proposed within the project 4. Technological level of the project (technology transfer, new technology) 5. Advantages of the project in comparison with analogues existing in the world 6. Economic feasibility of the project 7. Availability of markets and opportunities to commercialize the proposed project results 8. Level of competitive advantages of R&D results and opportunities to retain them in the long-run 9. Consistency with the existing sale outlets (distribution channels) 10. Patentability (possibility to defend the project by using the patent) 11. Availability of proprietary articles 12. Availability of scientific and technical potential of the project 13. Technical feasibility of the project 14. Project costs 15. Degree of project readiness 16. Availability of a team and experience in project implementation 17. Opportunities to involve private capital (investment attractiveness) 18. Scientific and technical level of project

<i>Author</i>	Shepherd (1999)	Stankeviciene and Zinyte (2012)	Tether and Tajar (2008)	(Toedtling et al., 2012)
<i>Perspective of assessment</i>	Assessment policies for new ventures	Valuation method in absence of accounting data	Evaluate innovation related links between firms And Specialist Knowledge Providers	Model for evaluation of Start-up location, pattern and knowledge sourcing mechanisms in innovation performance
<i>Criteria considered</i>	<ol style="list-style-type: none"> 1. Key success factor stability 2. Timing of entry 3. Lead time 4. Competitive rivalry 5. Educational capability 6. Industry-related competence 	<ol style="list-style-type: none"> 1. The founder of new business venture has previous top management experiences 2. The founder of new venture has previous start-up experiences 3. New venture's founder has relevant industry experience before founding the business venture 4. New business ventures are founded by a team rather than by one founder 5. New business ventures are with a functionally complete management team 6. The owner of the company is male or female 7. There is larger size of the new venture "ego network" 8. The new venture has external partners 9. There is higher product differentiation in an industry 10. There is higher demand growth rate of an industry 11. Investment period: medium 5 to 7 years 12. Investment period: long term up to 12 years 13. Equity linked investment 14. Debt or mixed forms of financing 15. Innovative / entrepreneurial firms 16. Risky promising / perspective venture 17. Young company 18. Growth-oriented venture 19. Private company 20. Unquoted in stock market 21. Future profit, future wealth, future cash flows 	<ol style="list-style-type: none"> 1. Size new firm 2. Group 3. Internal market 4. Exporter 	<ol style="list-style-type: none"> 1. Product innovation 2. Product innovation - new to market 3. Process innovation 4. 4. New/significantly changed strategy 5. New/significantly changed organisational structures 6. New/significantly changed market concept 7. Percentage of firms that have been granted a patent 8. Percentage of firms that have been granted a patent 9. Average number of patents median number of patents 10. Share of firms with an R&D department 11. Share of R&D employees of total employees 12. Median number of R&D employees

<i>Author</i>	Tomy and Pardede (2017)	(Traittler et al., 2011)	Walsh and Linton (2011)	Wu (2009)
<i>Perspective of assessment</i>	An opportunity evaluation model based in Uncertainties	Criteria for selection of co-development partners	Complex multi-criterial approach to assess managerial and technology capabilities on ventures	Proposes the assessment of competencies within new ventures.
<i>Criteria considered</i>	<ol style="list-style-type: none"> 1. Political environment 2. Government support 3. Employment laws 4. Taxation 5. Economy 6. Technological developments 7. Innovation speed 8. Software process and methods 9. Technological infrastructure 10. Alternate technological solutions 11. Competitive environment 12. Type of competition 13. Leading competitor 14. Share of market 15. Marketing strategy 16. Distribution channels 17. Alliances 18. Software licenses 19. Presence of substitute products 20. Potential market size 21. Segmentation 22. Living conditions 23. Customer needs 24. Purchasing power of potential customers 25. Purchase behaviour entrepreneur's education & experience 26. Social networks 27. Capital 28. Technological resources 29. Patents and copyrights 30. Skilled human resources 31. Innovation process in house and external 32. R&D expenditures 33. Operating expenses 34. Revenue streams 	<ol style="list-style-type: none"> 1. Leadership 2. Strategy 3. The consumer 4. The value chain 5. Internal experts and championships 6. Metrics 7. Ip 8. Culture 9. Academia 	<ol style="list-style-type: none"> 1. Offering types 2. Physical product 3. Service products / after sales service 4. Managerial emphasis 5. Complexity 6. Technology maturity 7. Type of innovation 8. Technology push/market pull 9. Generis engineering skills 10. Specific engineering skills 11. Specific technological skills 	<ol style="list-style-type: none"> 1. Analytical thinking 2. Business acumen 3. Client service orientation 4. Commitment to learning 5. Communication 6. Conceptual thinking 7. Order and quality 8. Developing others 9. Empathy 10. Expertise 11. Flexibility 12. Influence 13. Information seeking 14. Initiative 15. Innovation 16. Organizational awareness 17. Personal motivation 18. Relationship building 19. Results orientation 20. Self-confidence 21. Self-control 22. Team leadership 23. verbal and written communication

Appendix 3 - Overview collaboration strategies of reviewed literature

<i>Author</i>	<i>Collaboration Strategies</i>	
<i>Ferrary</i>	<i>Acquisition & Development</i>	Innovation strategy that considers acquisitions as outsourcing exploration in the search for new knowledge.
<i>Kang</i>	<i>Information transfer from informal network</i>	Information transfer from informal network does not require formal agreements or contracts and develops no organisational interactions between focal firms and external knowledge sources
	<i>R&D collaboration & technology acquisition</i>	R&D collaboration with formal network constructed by formal and specified agreement building strong and long-term organisational interaction networks
	<i>Technology acquisition</i>	Technology acquisition with formal network and agreement, but with weak and short-term organisational interaction network
<i>Kohler</i>	<i>Corporation supports pilot project</i>	Funding the development of innovative solutions and products by Start-ups to explore innovation prospects at a lower cost, in a shorter timeframe
	<i>Corporation becomes Start-up customer</i>	Interaction with multiple Start-ups during an acceleration program to learn about different solutions to the corporation business challenges
	<i>Corporation becomes distribution partner</i>	Channel partnerships can be mutually beneficial in that they provide a joint solution for both the corporation and the Start-up.
	<i>Corporation invests in Start-up</i>	Lower capital requirement and higher speed compared to internal R&D
	<i>Corporation acquires Start-up</i>	Acquiring Start-ups is a quick and impactful way to solve specific business problems and enter new markets
	<i>Corporate Hackathons</i>	Intense collaboration of diverse teams within a restricted time limit to solve a corporate innovation challenge
	<i>Business Incubators</i>	Company-supported flexible working space with additional value—added services such as centralized legal or marketing support
	<i>Corporate Incubation</i>	Provides a path to market for corporate noncore innovations
	<i>Corporate Venturing</i>	Permits corporations to participate in the success of external innovation and helps to gain insights into non-core markets and access to capabilities
	<i>Mergers & Acquisitions</i>	Quick and impactful way of buying complementary technology or capabilities that solve specific business problems and enter new markets
<i>Santamaría</i>	<i>External R&D</i>	Activity by which a client hires the services of an external organization to perform a specific piece of R&D
	<i>Technology Consultants</i>	Sourcing of external knowledge to solve technological problems arising in the firm
	<i>Hiring employee</i>	Acquire new knowledge embodied in new personnel
	<i>Joint Ventures</i>	Legal entities in which equity ownership is shared between firms that pool capabilities in order to develop common innovation activities
	<i>Non-equity alliances</i>	Collaborations in which shared equity ownership does not occur
<i>Silva</i>	<i>Outside-in</i>	External knowledge is achieved by consulting innovation forums, development of innovation initiatives with industry partners, the acquisition of ip or the investment in the creation of knowledge in collaboration with external actors
	<i>Inside-out</i>	Placement of ideas and technology developed internally in the market through the sale of ip and the availability of new technologies, transferring ideas and concepts to other companies
	<i>Coupled</i>	Combines the outside-in activities (get external knowledge) with the inside-out (put ideas and internal ip on the market) through alliances and collaborations with strategic partners' networks

<i>Author</i>	<i>Collaboration Strategies</i>	
<i>Spender</i>	<i>Corporate VC</i>	Programmes contribute to knowledge production and diffusion
	<i>Internal incubators</i>	Internal organization for creation of new knowledge and its transfer to and from Start-ups
	<i>Strategic alliances</i>	Alliances between Start-ups and other firms to merge their complementary skills impact on incremental and radical innovation performance
	<i>Joint ventures</i>	Alliance between Start-up and other firms to development knowledge within scope of a specific project
<i>Tödtling</i>	<i>Market relations</i>	Market-based channels often to buy existing knowledge, usually feature a lower degree of interactive knowledge transfer
	<i>Externalities / spillovers</i>	Informal static relations to absorb unstructured knowledge from external sources
	<i>Co-operation / formal networks</i>	Interactive mechanisms for more complex, dynamic and collective learning processes that also enable the transfer of tacit knowledge
	<i>Milieu / informal networks</i>	Unstructured ongoing relationship for enhancement of the knowledge base involved
<i>Vanhaverbeke</i>	<i>Corporate venturing</i>	Activity of Start-ups investments with increasing financial commitment on the part of the investing company

<i>Collaboration Strategies</i>		<i>References</i>
<i>Acquisition & Development (Mergers & Acquisitions)</i>	Innovation strategy that deploys acquisition of complementary technology or capabilities to solve specific business problems and enter new markets	<i>Ferrary Kang Kohler</i>
<i>Information transfer from informal network</i>	Informal information transfer from networks to exchange knowledge disregard of organisational interactions or formal agreements or contracts	<i>Kang Tödtling</i>
<i>Corporate Hackathons</i>	Intense collaboration of diverse teams within a restricted time limit to solve a corporate innovation challenge	<i>Kohler</i>
<i>Corporate Incubation</i>	Internal organization for creation of new knowledge and its transfer to and from Start-ups providing a path to market for corporate non-core innovations	<i>Kohler Spender</i>
<i>Corporate Venturing</i>	Strategy for corporations to participate in the success of external innovation and helps to gain insights into non-core markets and access to capabilities	<i>Kohler Spender Vanhaverbeke</i>
<i>Joint Ventures</i>	Legal entities in which equity ownership is shared between firms that pool capabilities in order to develop common innovation activities	<i>Santamaría Spender</i>
<i>Non-equity strategic alliances</i>	Alliances between Start-ups and other firms to merging their complementary skills to impact on incremental and radical innovation performance Collaborations in which shared equity ownership does not occur	<i>Santamaría Spender</i>
<i>Corporate VC</i>	Programmes for backing and supporting Start-ups to provide corporations' access to new markets and capabilities and at the same time, Start-ups benefit from favourable terms relative to traditional sources of venture capital	<i>Spender Kohler</i>
<i>Co-operation / formal networks Non-equity strategic alliances (E.g.: Corporation supports pilot project, Corporation becomes Start-up customer, Corporation becomes distribution partner, R&D collaboration)</i>	Formal networks mechanisms that enable the transfer of knowledge (including tacit), supported by specified agreements, interactively merging complementary skills to impact on more complex, dynamic and collective innovations	<i>Kohler Santamaría Spender Tödtling</i>

Appendix 4 - Overview of Start-ups assessment models

<i>Author</i>	<i>Assessment optics</i>	<i>Literature overview</i>
Batocchio et al. (2017)	Start-ups; VCs	Proposal for a method for business model performance assessment
Bigliardi et al. (2013)	HEI; VCs; Accelerators & Incubators	Propose a model of ex-ante evaluation of the spin-off companies' performance
Franke et al. (2008)	VCs; Start-ups	Proposes assessment of the venture capital decision criteria,
Liu (2011)	VCs	Provides an index of systems and methods for assessment of venture investments
Malyar et al. (2016)	VCs; CVC; Corporations	Design of technology of assessment and selection of efficient start-up projects by using fuzzy mathematics for those entities wishing to support and finance them
Mendialdua (2014)	HEI; Public innovation policies	Propose a fuzzy control model that can help to choose and filter the application for grants In business start-up programs run by public institutions
Milkova et al. (2018)	VCs	Applies Analytic Network Process (ANP) methodology to the comparative evaluation of four e-commerce Start-ups
Minola and Giorgino (2008)	Start-ups	Predictive model to determine the ideal financial strategy for a given entrepreneurial project
Mutanov and Yessengaliyeva (2013)	HEI; Corporations	Appraisal of scientific-innovative projects method and graphical model of project assessment
Shepherd (1999)	VCs	VCs' assessment policies of new venture survival
Stankeviciene and Zinyte (2012)	VCs; CVC	Propose an evaluation model which could help to choose the optimal new venture to fund
Tomy and Pardede (2017)	Start-ups; HEI; Accelerators & Incubators	Analyse the uncertainty factors related to the evaluation of opportunity
Tomy and Pardede (2018)	Start-ups; HEI;	Identification of uncertainties surrounding opportunities in the opportunity evaluation
Walsh and Linton (2011)	Start-ups; Corporations	Multi-dimensional decomposition-based model for evaluation of the appropriateness of an opportunity
Wu (2009)	VCs; Corporations; Start-ups	Proposes the assessment of competencies within new ventures.

Framework for identification, selection & collaboration with Start-ups

Contextualization

The *Framework for Identification, Selection & Collaboration with Start-ups* is a tool built to support corporations design knowledge exchange relationships with knowledge sources from outside the company, in this case Start-ups. The main objective of the tool is to provide guidelines and a structured process to build these relationships.

To support gatekeepers (managers) design these relationships the tool structures 3 main stages that cover entire process lifecycle, from the alignment of the collaboration objectives and goals with the company's strategy, to the selection and setup of the collaboration partner and model. Additional components, such as relationship balancing factors or knowledge bound degree, are presented to modulate the complexity of the relationship and the knowledge stock, to achieve the least complex scenario to enable knowledge exchange.

- **System Strategy Stage:** addresses the framework strategical component, establishing background outlines, creating a common overarching vision to all actors involved.
- **Partner Identification and Selection:** addresses the selection of collaboration partners by assessing their knowledge fit to the collaboration goals and the validity of the scope and depth of the knowledge to be exchanged.
- **Knowledge Collaboration:** addresses the definition of the collaboration model to be applied on the knowledge exchange relationship, encompass setting the environment and facilitators for knowledge exchange, creating transparency about the process, key actors enrolled and communication channels structure.

In order to manage the framework, *Balancing Factors* are introduced to mediate the extent of the knowledge stock to be exchanged with the complexity of the relationship required for the exchange.

- **Relationship Complexity:** encompass understanding the degree of formality required for the knowledge exchange. (e.g.: long term contractual partnership, informal meetings with partners, etc.)
- **Knowledge stock:** encompass understanding the degree of complexity of the knowledge to be exchanged. (e.g.: highly specific cutting-edge technologies or average technology application cases)
- **Gatekeepers input & feedback:** encompass the management role of gatekeepers translating knowledge and building flows between the relationship partners (corporation and Stat-up).
- **Knowledge bound degree:** encompass understanding the degree of knowledge bind required between the partners, where the higher the knowledge bind more formal the collaboration model. (e.g.: need of full incorporation of all knowledge of the Start-up tend the relationship towards Acquisitions or Joint Venture collaboration models, instead of informal meetings)

In order to assess the validity of the Framework Stages and Balancing Factors interviewees are asked, first, to provide the perception on the degree of importance of these components, and second, to rank the collaboration models according with the perception of the Knowledge bound degree.

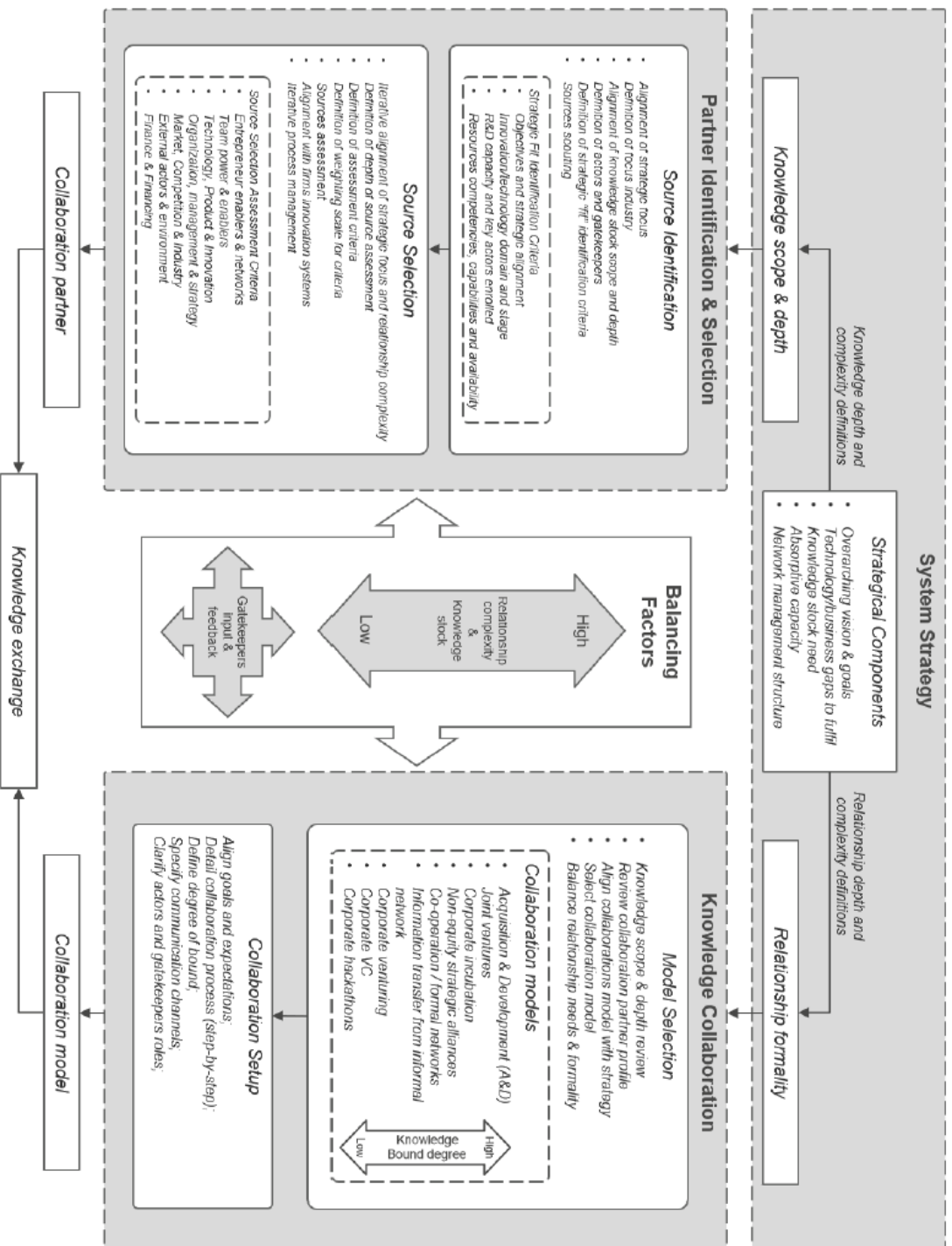
In annex the Framework is provided and the table below lists the topics to be assessed:

Validation interview

Interviewee job position:			
Date of interview:			
Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			
Partner Identification & Selection Stage			
Knowledge Collaboration Stage			
Balancing Factors			
<i>Importance of the Strategic Components for the definition of the system strategy:</i>			
Overarching vision & goals			
Technology/business gaps to fulfil			
Knowledge stock need			
Absorptive capacity			
Network management structure			
Knowledge scope & depth			
Relationship formality			
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus			
Definition of focus industry			
Alignment of knowledge stock and depth			
Definition of actors and gatekeepers			
Definition of strategic fit criteria			
Sources scouting			
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment			
Innovation/technology domain and stage			
R&D capacity and key actors enrolled			
Resources competencies, capabilities and availability			
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity			
Definition of depth of source assessment			
Definition of assessment criteria			
Definition of weighting scale for criteria			
Sources assessment			
Alignment with firm's innovation systems			
Iterative process management			
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks			
Team power & enablers			
Technology, Product & Innovation			
Organization, management & strategy			
Market, Competition & Industry			
External actors & environment			
Finance & Financing			

Unit under analysis	Not important	Important	Very important
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			
Review collaboration partner profile			
Align collaboration model with strategy			
Select collaboration model			
Balance relationship needs & formality			
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			
Align goals and expectations			
Detail collaboration process (step-by-step)			
Define degree of bound			
Specify communication channels			
Clarify actors and gatekeepers' roles			
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			
Knowledge stock			
Gatekeepers input & feedback			
Complementary fields			
What stages of the relationship might be additionally considered or disregarded?			
None			
What components of the stages might be additional considered or disregarded?			
None			
What is the overall perception of the framework to support building collaboration relationship with Start-ups?			
Well-structured and noticeable, it's possible to see all the strategy of the framework.			
Order the Collaboration Models according with the degree of knowledge bound built between the parties - 1 (lower bound degree) to 9 (higher bound degree) -			Order 1 to 9
Acquisition & Development (A&D)			
Co-operation / formal networks			
Corporate hackathons			
Corporate incubation			
Corporate VC			
Corporate venturing			
Information transfer from informal network			
Joint ventures			
Non-equity strategic alliances			

Framework for Identification, Selection & Collaboration with Start-ups



Informed Consent Form

Research within the scope of the Master in Innovation and Technology Entrepreneurship

Author: Caio Mendes Souza (Master Student)

The current research, entitled “*Framework for Identification, Selection and Collaboration of Corporations with Start-ups within Open Innovation*”, is inserted in the scope of the dissertation thesis of the Master in Innovation and Technology Entrepreneurship 2018/2019 of the Faculty of Engineering of University of Porto and present as objective proposition of a framework to support large corporations to build collaboration relationships with Start-ups.

To contribute on the creation of structured process for construction of collaboration relationships between corporations and ventures, it is necessary to contrast the conceptual framework with the perspective of the actual players involved in the process. Therefore, your contribution is crucial for the validation of the model and its components.

The results of the research supervised by Professor Maria Alexandra Neves Soares dos Reis Torgal Lobo Xavier (Coordinator of the Centre for Innovation, Technology and Entrepreneurship of INESC TEC), will be presented at the public act of the Master of Innovation and Entrepreneurship in June 2019.

This research does not imply any expense or risk to the interviewee. Information will be retrieved through semi-structured interview, using a support form and hand notes from a not recorded oral interview.

All information of the interviews is confidential and will not be shared with third parties or published with direct mentions to the interviewee. Interviewees will be referred exclusively by job position, with no direct relation to their names.

Participation on this research is voluntary and, if desired, detail of research results is granted through contact to author and supervisor by channels provided below.

I hereby declare to understand the interview conditions detailed above and agree to participate on the research.

Signature: _____ Date: _____

Author contact: up201700422@fe.up.pt

Supervisor contact: alexandra.xavier@inesctec.pt

Appendix 7 - Full results of interviews

Validation interview			
Interviewee job position:	Additive Manufacturing Technology Coordinator		
Date of interview:	30/05/2019		
Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage		X	
Knowledge Collaboration Stage		X	
Balancing Factors			X
<i>Importance of the Strategic Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need		X	
Absorptive capacity		X	
Network management structure		X	
Knowledge scope & depth			X
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus			X
Definition of focus industry			X
Alignment of knowledge stock and depth		X	
Definition of actors and gatekeepers			X
Definition of strategic fit criteria			X
Sources scouting		X	
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment			X
Innovation/technology domain and stage			X
R&D capacity and key actors enrolled		X	
Resources competencies, capabilities and availability		X	
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity			X
Definition of depth of source assessment			X
Definition of assessment criteria			X
Definition of weighting scale for criteria			X
Sources assessment		X	
Alignment with firm's innovation systems	X		
Iterative process management		X	
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks		X	
Team power & enablers			X
Technology, Product & Innovation			X
Organization, management & strategy	X		
Market, Competition & Industry			X
External actors & environment		X	
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			X
Review collaboration partner profile			X
Align collaboration model with strategy			X
Select collaboration model		X	
Balance relationship needs & formality		X	
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)			X
Define degree of bound			X
Specify communication channels			X
Clarify actors and gatekeepers' roles		X	
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			X
Knowledge stock		X	
Gatekeepers input & feedback			X
<i>Complementary fields</i>			
What stages of the relationship might be additionally considered or disregarded?			
None			
What components of the stages might be additionally considered or disregarded?			
<ul style="list-style-type: none"> The balancing factors should take into account the System Strategy fit as factor to influence the collaboration. There should be some factor related with the strategic vision. 			
What is the overall perception of the framework to support building collaboration relationship with Start-ups?			
<ul style="list-style-type: none"> The model is highly comprehensive, but must be agile, if too much focus and time is spent in Collaboration Models stage, it can brake the whole system. Knowledge collaboration must be simpler and agile. How to perform the balancing of the framework is not clear. The framework does not consider new IP's, business models or other types of outputs rather the knowledge. It can be used to create value chains, such as take advantage of Start-ups to access new market or technology transference within BA's. 			
Order the Collaboration Models according with the degree of knowledge bound built between the parties		Order 1 to 9	
- 1 (lower bound degree) to 9 (higher bound degree) -			
Acquisition & Development (A&D)		9	
Co-operation / formal networks		2	
Corporate hackathons		3	
Corporate incubation		7	
Corporate VC		5	
Corporate venturing		4	
Information transfer from informal network		1	
Joint ventures		8	
Non-equity strategic alliances		6	

Validation interview

Interviewee job position:	Digital Ideation Designer
Date of interview:	28/05/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage			X
Knowledge Collaboration Stage			X
Balancing Factors		X	
<i>Importance of the Strategical Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need			X
Absorptive capacity			X
Network management structure		X	
Knowledge scope & depth			X
Relationship formality	X		
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus			X
Definition of focus industry			X
Alignment of knowledge stock and depth			X
Definition of actors and gatekeepers			X
Definition of strategic fit criteria			X
Sources scouting		X	
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment			X
Innovation/technology domain and stage			X
R&D capacity and key actors enrolled		X	
Resources competencies, capabilities and availability		X	
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity		X	
Definition of depth of source assessment		X	
Definition of assessment criteria			X
Definition of weighting scale for criteria		X	
Sources assessment		X	
Alignment with firm's innovation systems			X
Iterative process management			X
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks			X
Team power & enablers			X
Technology, Product & Innovation			X
Organization, management & strategy			X
Market, Competition & Industry		X	
External actors & environment		X	
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			X
Review collaboration partner profile			X
Align collaboration model with strategy			X
Select collaboration model			X
Balance relationship needs & formality		X	
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)			X
Define degree of bound			X
Specify communication channels			X
Clarify actors and gatekeepers' roles			X
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			X
Knowledge stock			X
Gatekeepers input & feedback			X

Complementary fields

What stages of the relationship might be additionally considered or disregarded?

What components of the stages might be additional considered or disregarded?

What is the overall perception of the framework to support building collaboration relationship with Start-ups?

- Well-structured and noticeable, it's possible to see all the strategy of the framework.

Order the Collaboration Models according with the degree of knowledge bound built between the parties - 1 (lower bound degree) to 9 (higher bound degree) -	Order 1 to 9
Acquisition & Development (A&D)	6
Co-operation / formal networks	8
Corporate hackathons	1
Corporate incubation	2
Corporate VC	7
Corporate venturing	9
Information transfer from informal network	3
Joint ventures	4
Non-equity strategic alliances	5

Validation interview

Interviewee job position:	Digital Transformation Officer
Date of interview:	31/05/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage			X
Knowledge Collaboration Stage			X
Balancing Factors		X	
<i>Importance of the Strategic Components for the definition of the system strategy:</i>			
Overarching vision & goals		X	
Technology/business gaps to fulfil			X
Knowledge stock need			X
Absorptive capacity			X
Network management structure		X	
Knowledge scope & depth	X		
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus		X	
Definition of focus industry	X		
Alignment of knowledge stock and depth		X	
Definition of actors and gatekeepers			X
Definition of strategic fit criteria			X
Sources scouting			X
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment		X	
Innovation/technology domain and stage			X
R&D capacity and key actors enrolled			X
Resources competencies, capabilities and availability			X
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity		X	
Definition of depth of source assessment		X	
Definition of assessment criteria			X
Definition of weighting scale for criteria			X
Sources assessment			X
Alignment with firm's innovation systems		X	
Iterative process management		X	
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks	X		
Team power & enablers		X	
Technology, Product & Innovation			X
Organization, management & strategy		X	
Market, Competition & Industry		X	
External actors & environment		X	
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			X
Review collaboration partner profile		X	
Align collaboration model with strategy			X
Select collaboration model			X
Balance relationship needs & formality			X
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)			X
Define degree of bound		X	
Specify communication channels			X
Clarify actors and gatekeepers' roles			X
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			X
Knowledge stock			X
Gatekeepers input & feedback		X	
Complementary fields			
<i>What stages of the relationship might be additionally considered or disregarded?</i>			
<ul style="list-style-type: none"> Risk assessment should be addressed, even in terms to see if the technology is worthy. What is the risk behind the collaboration? Risk related with the technology competition, technological risk, knowledge loss risk. 			
<i>What components of the stages might be additionally considered or disregarded?</i>			
<i>What is the overall perception of the framework to support building collaboration relationship with Start-ups?</i>			
<ul style="list-style-type: none"> Assessment and Fit criteria will vary based the objective I have. The framework structure is good and very detailed, very embracing. A relevant topic is to have a hierarchization of the criteria, with different levels. Depending on the gatekeeper and the progress of the relationship with the Start-up I want to see different criteria. Which criteria are for each stage, the level of effort must be levelled with the degree of interaction. The decision must not be heavy and slow. 			
Order the Collaboration Models according with the degree of knowledge bound built between the parties			Order 1 to 9
1 (lower bound degree) to 9 (higher bound degree)			
Acquisition & Development (A&D)			9
Co-operation / formal networks			6
Corporate hackathons			3
Corporate incubation			4
Corporate VC			1
Corporate venturing			5
Information transfer from informal network			2
Joint ventures			8
Non-equity strategic alliances			7

Validation interview

Interviewee job position:	Head of R&D
Date of interview:	31/05/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage			X
Knowledge Collaboration Stage		X	
Balancing Factors		X	
<i>Importance of the Strategical Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need		X	
Absorptive capacity		X	
Network management structure	X		
Knowledge scope & depth			X
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus	X		
Definition of focus industry	X		
Alignment of knowledge stock and depth		X	
Definition of actors and gatekeepers	X		
Definition of strategic fit criteria			X
Sources scouting		X	
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment	X		
Innovation/technology domain and stage		X	
R&D capacity and key actors enrolled		X	
Resources competencies, capabilities and availability			X
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity	X		
Definition of depth of source assessment		X	
Definition of assessment criteria		X	
Definition of weighting scale for criteria		X	
Sources assessment		X	
Alignment with firm's innovation systems	X		
Iterative process management		X	
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks		X	
Team power & enablers			X
Technology, Product & Innovation			X
Organization, management & strategy		X	
Market, Competition & Industry		X	
External actors & environment	X		
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review		X	
Review collaboration partner profile			X
Align collaboration model with strategy		X	
Select collaboration model		X	
Balance relationship needs & formality	X		
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)		X	
Define degree of bound			X
Specify communication channels		X	
Clarify actors and gatekeepers' roles		X	
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity		X	
Knowledge stock			X
Gatekeepers input & feedback		X	

Complementary fields

What stages of the relationship might be additionally considered or disregarded?

What components of the stages might be additional considered or disregarded?

- Top management should be considered, it has to be accounted.
- The collaboration model side appears naturally, seems less important.

What is the overall perception of the framework to support building collaboration relationship with Start-ups?

- The human component is missing, the intuitive evaluation of the partner and what it can deliver.
- The framework should be seen as an evaluation of the "whole" complexity, separate parts can bring troubles to the result.
- It is not possible to reduce all the partnership in a "formula", it is not enough.
- The framework is very detailed.
- Collaborations models seem more related to relationship models.

Order the Collaboration Models according with the degree of knowledge bound built between the parties 1 (lower bound degree) to 9 (higher bound degree)	Order 1 to 9
Acquisition & Development (A&D)	9
Co-operation / formal networks	5
Corporate hackathons	1
Corporate incubation	7
Corporate VC	3
Corporate venturing	2
Information transfer from informal network	4
Joint ventures	8
Non-equity strategic alliances	6

Validation interview

Interviewee job position:	Head of Technology Management
Date of interview:	29/05/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage			X
Knowledge Collaboration Stage		X	
Balancing Factors		X	
<i>Importance of the Strategical Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need		X	
Absorptive capacity		X	
Network management structure	X		
Knowledge scope & depth		X	
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus			X
Definition of focus industry		X	
Alignment of knowledge stock and depth		X	
Definition of actors and gatekeepers		X	
Definition of strategic fit criteria			X
Sources scouting			X
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment			X
Innovation/technology domain and stage			X
R&D capacity and key actors enrolled		X	
Resources competencies, capabilities and availability		X	
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity			X
Definition of depth of source assessment		X	
Definition of assessment criteria		X	
Definition of weighting scale for criteria	X		
Sources assessment		X	
Alignment with firm's innovation systems	X		
Iterative process management	X		
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks		X	
Team power & enablers		X	
Technology, Product & Innovation			X
Organization, management & strategy		X	
Market, Competition & Industry			X
External actors & environment	X		
Finance & Financing			X
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review		X	
Review collaboration partner profile		X	
Align collaboration model with strategy		X	
Select collaboration model		X	
Balance relationship needs & formality		X	
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)		X	
Define degree of bound	X		
Specify communication channels		X	
Clarify actors and gatekeepers' roles			X
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity		X	
Knowledge stock		X	
Gatekeepers input & feedback		X	
Complementary fields			
What stages of the relationship might be additionally considered or disregarded?			
<ul style="list-style-type: none"> NDA's, IP's, rules for the property on the relationship. Who has the ownership the IP. 			
What components of the stages might be additional considered or disregarded?			
<ul style="list-style-type: none"> The IP of the start-up technology is missing. How well is the Start-up technology protected, do they have IP. 			
What is the overall perception of the framework to support building collaboration relationship with Start-ups?			
<ul style="list-style-type: none"> It's very detailed, very formalized. The challenge is to really implement it. I don't now if I'd go to all the entire list to set the relationship. Maybe it needs a simpler version to operationalization. 			
Order the Collaboration Models according with the degree of knowledge bound built between the parties			
- 1 (lower bound degree) to 9 (higher bound degree) -			Order 1 to 9
Acquisition & Development (A&D)			9
Co-operation / formal networks			3
Corporate hackathons			2
Corporate incubation			6
Corporate VC			7
Corporate venturing			5
Information transfer from informal network			1
Joint ventures			8
Non-equity strategic alliances			4

Validation interview

Interviewee job position:	Product Management Engineer
Date of interview:	03/06/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage			X
Knowledge Collaboration Stage		X	
Balancing Factors			X
<i>Importance of the Strategic Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need		X	
Absorptive capacity		X	
Network management structure			X
Knowledge scope & depth			X
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus	X		
Definition of focus industry		X	
Alignment of knowledge stock and depth			X
Definition of actors and gatekeepers		X	
Definition of strategic fit criteria		X	
Sources scouting			X
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment		X	
Innovation/technology domain and stage			X
R&D capacity and key actors enrolled			X
Resources competencies, capabilities and availability		X	
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity		X	
Definition of depth of source assessment			X
Definition of assessment criteria			X
Definition of weighting scale for criteria		X	
Sources assessment			X
Alignment with firm's innovation systems	X		
Iterative process management			X
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks			X
Team power & enablers			X
Technology, Product & Innovation			X
Organization, management & strategy	X		
Market, Competition & Industry	X		
External actors & environment		X	
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			X
Review collaboration partner profile	X		
Align collaboration model with strategy		X	
Select collaboration model			X
Balancing relationship needs & formality		X	
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)		X	
Define degree of bound			X
Specify communication channels		X	
Clarify actors and gatekeepers' roles			X
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			X
Knowledge stock			X
Gatekeepers input & feedback			X
Complementary fields			
<i>What stages of the relationship might be additionally considered or disregarded?</i>			
<ul style="list-style-type: none"> Strategic alignment is not that important, our strategy can be different from the start-up and still deliver the knowledge 			
<i>What components of the stages might be additional considered or disregarded?</i>			
<ul style="list-style-type: none"> Criteria for selection of gatekeepers would be a relevant topic, since a poor selection threatens the process Strategic focus on source identification seems to be not actually important. 			
<i>What is the overall perception of the framework to support building collaboration relationship with Start-ups?</i>			
<ul style="list-style-type: none"> All components seem valid. 			
Order the Collaboration Models according with the degree of knowledge bound built between the parties			
1 (lower bound degree) to 9 (higher bound degree)			Order 1 to 9
Acquisition & Development (A&D)			9
Co-operation / formal networks			6
Corporate hackathons			3
Corporate incubation			7
Corporate VC			5
Corporate venturing			4
Information transfer from informal network			1
Joint ventures			8
Non-equity strategic alliances			2

Validation interview

Interviewee job position:	Program Management Office Analyst
Date of interview:	31/05/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage		X	
Knowledge Collaboration Stage			X
Balancing Factors		X	
<i>Importance of the Strategical Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need			X
Absorptive capacity			X
Network management structure		X	
Knowledge scope & depth			X
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus	X		
Definition of focus industry	X		
Alignment of knowledge stock and depth			X
Definition of actors and gatekeepers			X
Definition of strategic fit criteria		X	
Sources scouting			X
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment	X		
Innovation technology domain and stage			X
R&D capacity and key actors enrolled			X
Resources competencies, capabilities and availability		X	
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity	X		
Definition of depth of source assessment	X		
Definition of assessment criteria		X	
Definition of weighting scale for criteria		X	
Sources assessment			X
Alignment with firm's innovation systems	X		
Iterative process management		X	
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks		X	
Team power & enablers	X		
Technology, Product & Innovation		X	
Organization, management & strategy		X	
Market, Competition & Industry	X		
External actors & environment		X	
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review		X	
Review collaboration partner profile		X	
Align collaboration model with strategy	X		
Select collaboration model			X
Balance relationship needs & formality			X
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)		X	
Define degree of bound	X		
Specify communication channels		X	
Clarify actors and gatekeepers' roles		X	
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity	X		
Knowledge stock		X	
Gatekeepers input & feedback			X
Complementary fields			
What stages of the relationship might be additionally considered or disregarded ?			
<ul style="list-style-type: none"> There is no need to define some of the topics, such as degree of bound, it is a consequence of the rest. It will naturally be set. 			
What components of the stages might be additional considered or disregarded ?			
What is the overall perception of the framework to support building collaboration relationship with Start-ups?			
<ul style="list-style-type: none"> Start-ups strategies change a lot, because of this strategic alignment should not be too much valued. 			
Order the Collaboration Models according with the degree of knowledge bound built between the parties			
1 (lower bound degree) to 9 (higher bound degree)			Order 1 to 9
Acquisition & Development (A&D)			9
Co-operation / formal networks			6
Corporate hackathons			5
Corporate incubation			7
Corporate VC			4
Corporate venturing			8
Information transfer from informal network			2
Joint ventures			3
Non-equity strategic alliances			1

Validation interview

Interviewee job position:	Service Portfolio Management Engineer
Date of interview:	29/05/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage			X
Knowledge Collaboration Stage		X	
Balancing Factors			X
<i>Importance of the Strategical Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil			X
Knowledge stock need			X
Absorptive capacity		X	
Network management structure		X	
Knowledge scope & depth			X
Relationship formality		X	
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus			X
Definition of focus industry		X	
Alignment of knowledge stock and depth			X
Definition of actors and gatekeepers		X	
Definition of strategic fit criteria			X
Sources scouting			X
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment			X
Innovation/technology domain and stage			X
R&D capacity and key actors enrolled		X	
Resources competencies, capabilities and availability			X
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity			X
Definition of depth of source assessment		X	
Definition of assessment criteria		X	
Definition of weighting scale for criteria	X		
Sources assessment			X
Alignment with firm's innovation systems		X	
Iterative process management			X
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks	X		
Team power & enablers			X
Technology, Product & Innovation			X
Organization, management & strategy		X	
Market, Competition & Industry		X	
External actors & environment		X	
Finance & Financing			X
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			X
Review collaboration partner profile		X	
Align collaboration model with strategy			X
Select collaboration model			X
Balance relationship needs & formality			X
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)		X	
Define degree of bound		X	
Specify communication channels			X
Clarify actors and gatekeepers' roles			X
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			X
Knowledge stock			X
Gatekeepers input & feedback			X

Complementary fields

What stages of the relationship might be additionally considered or disregarded?

- It lacks differentiation between the environments of the company and Start-up.
- It seems difficult to understand how all the stages and everything works.

What components of the stages might be additionally considered or disregarded?

- Weighting of the criteria can generate bias, once it is subjective to the perception of evaluator. It should not be considered in the framework.
- The components cannot be too bureaucratic, if it overcomplicated the definition of the collaboration, will not be used.
- Sources scouting, Sources selection e Select collaboration model are redundant the are already represented by the Levels themselves.

What is the overall perception of the framework to support building collaboration relationship with Start-ups?

- The framework provides a lot of inputs about what to do in each phase. That is good.
- It is extremely structured and complete but is too complex and require deeper explanation.

Order the Collaboration Models according with the degree of knowledge bound built between the parties - 1 (lower bound degree) to 9 (higher bound degree) -	Order 1 to 9
Acquisition & Development (A&D)	8
Co-operation / formal networks	4
Corporate hackathons	2
Corporate incubation	6
Corporate VC	1
Corporate venturing	9
Information transfer from informal network	3
Joint ventures	7
Non-equity strategic alliances	5

Validation interview

Interviewee job position:	Technical Assistant CTO
Date of interview:	03/06/2019

Unit under analysis	Not important	Important	Very important
<i>Importance of the Framework Stages for the design of the collaboration relationship:</i>			
System Strategy Stage			X
Partner Identification & Selection Stage		X	
Knowledge Collaboration Stage		X	
Balancing Factors			X
<i>Importance of the Strategical Components for the definition of the system strategy:</i>			
Overarching vision & goals			X
Technology/business gaps to fulfil		X	
Knowledge stock need		X	
Absorptive capacity		X	
Network management structure	X		
Knowledge scope & depth		X	
Relationship formality	X		
<i>Importance of the Source Identification Components for the identification of the collaboration partner:</i>			
Alignment of strategic focus		X	
Definition of focus industry	X		
Alignment of knowledge stock and depth		X	
Definition of actors and gatekeepers	X		
Definition of strategic fit criteria			X
Sources scouting			X
<i>Importance of the Strategic Fit Criteria for the identification of the collaboration partner:</i>			
Objectives and strategic alignment		X	
Innovation technology domain and stage			X
R&D capacity and key actors enrolled		X	
Resources competencies, capabilities and availability	X		
<i>Importance of the Source Selection Components for the selection of the collaboration partner:</i>			
Iterative alignment of strategic focus and relationship complexity		X	
Definition of depth of source assessment		X	
Definition of assessment criteria			X
Definition of weighting scale for criteria		X	
Sources assessment			X
Alignment with firm's innovation systems	X		
Iterative process management		X	
<i>Importance of the Assessment Criteria for the selection of the collaboration partner:</i>			
Entrepreneur enablers & networks			X
Team power & enablers		X	
Technology, Product & Innovation			X
Organization, management & strategy		X	
Market, Competition & Industry		X	
External actors & environment		X	
Finance & Financing		X	
<i>Importance of the Model Selection Components for the selection of the collaboration model:</i>			
Knowledge scope & depth review			X
Review collaboration partner profile		X	
Align collaboration model with strategy		X	
Select collaboration model		X	
Balance relationship needs & formality			X
<i>Importance of the Collaboration Setup Components for the structuring of the collaboration model:</i>			

Unit under analysis	Not important	Important	Very important
Align goals and expectations			X
Detail collaboration process (step-by-step)		X	
Define degree of bound		X	
Specify communication channels	X		
Clarify actors and gatekeepers' roles		X	
<i>Importance of the Balancing Factors for the mediation of the knowledge exchange:</i>			
Relationship complexity			X
Knowledge stock		X	
Gatekeepers input & feedback			X
Complementary fields			
<i>What stages of the relationship might be additionally considered or disregarded?</i>			
<ul style="list-style-type: none"> Absorptive capacity is not important to all models, we don't need to have the knowledge if we acquire, depends on the model Assessment criteria behaves the same way: Market & Finance, if you need specific knowledge they are not important, if its business and market related then its important. 			
<i>What components of the stages might be additional considered or disregarded?</i>			
<ul style="list-style-type: none"> After setup how you go? How do you do after setting up? Setup phase could give a remark the it is not static. 			
<i>What is the overall perception of the framework to support building collaboration relationship with Start-ups?</i>			
<ul style="list-style-type: none"> It's quite comprehensive. Saying that is not important doesn't mean it is not important, means its related with other conditions. 			
Order the Collaboration Models according with the degree of knowledge bound built between the parties			
1 (lower bound degree) to 9 (higher bound degree)	Order 1 to 9		
Acquisition & Development (A&D)	9		
Co-operation / formal networks	5		
Corporate hackathons	1		
Corporate incubation	7		
Corporate VC	2		
Corporate venturing	3		
Information transfer from informal network	4		
Joint ventures	8		
Non-equity strategic alliances	6		