

Effects of uncertainty on the governance of external technological innovations

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Summary

Background

Traditionally, in firms, the process of achieving innovation was made through internal corporate venturing (Van de Vrande et al. 2006). However, nowadays, even the largest firms are intensively looking for external sources of *technological innovations* (Vanhaverbeke et al. 2002). Nevertheless, identifying and choosing the best partner when establishing an external-technology relationship is not sufficient. In fact, deciding which type of governance mode will manage the inter-firm relationship is crucial (Sabidussi et al. 2008). There is a continuous and increasing effect of alliances on the firm's total sales (Hoffmann, 2005), an impressive failure rate of alliances (between 50 to 70% at the end of 1980`s) and a huge growth of the total transaction value of M&A, from \$1 to \$4 trillion, reported in a period of 5 years (1995-1999) (de Man and Duysters, 2005). Consequently, firms are increasing their attention to improve the management of their alliance portfolios (Mahnke and Overby, 2005). The uncertainty factors influence extensively in the governance mode chosen to manage the innovative process (Santoro and McGill, 2005; Van de Vrande et al. 2009). Most of the studies focus on the effects of uncertainty on investment decisions excluding extensive research of its effects on governance (Van de Vrande et al. 2006).

Objectives

The main goal of this research is to find out *how uncertainty affects the innovation performance of a firm through the analysis of the influence of uncertainty factors in the selection of organizational structures chosen to manage external technology innovations*, which is divided in the next two following specific objectives: 1) *To review the uncertainty factors, their sources and their effects on the decision to choose governance structures to manage external technological innovations and 2) To indentify the uncertainty criteria and the assessment methodology considered by decision makers to decide for a governance modality and their effect on the whole portfolio and on the firm's innovation performance.*

Research Model

In Figure 1 is depicted the research model with the aim of offers a clear idea regarding the types of uncertainties categorized and assessed in order to decide for a type of governance structures, with the aim of achieving innovation. Less integrated forms of governance (strategic alliances) and more integrated forms of governance (M&A) are included as the governance modes assessed in this research. The effect of the portfolio of alliances is included through synergies and risk diversification as mediators between uncertainty factors and governance modes.

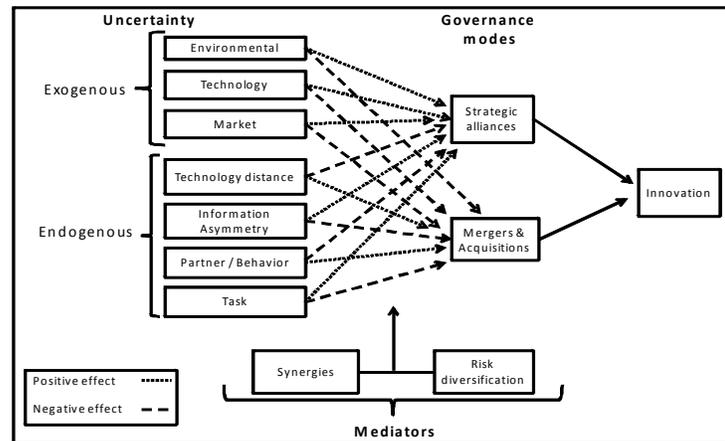


Figure 1 Research model

Materials and Methods

A qualitative and small scale approach is chosen to carry out this study with the aim of gaining more in depth than in breadth knowledge and comprehension about the uncertainties and their effects on the choice of organizational structures. In this sense, a theoretical research based on a desk research (operated by extent literature review) and an empirical research based on a case study (operated by an interview conducted to decision makers and based on an interview protocol) are the two research strategies selected in order to gain in depth knowledge about the topic. The unique criterion to select participating firms was that firms possess an alliance portfolio or hold external relationships with innovation purposes. From 40 companies invited, 19 answered the invitation but only 6 accepted and confirmed their participation (6.6%). Companies represent three industries (chemicals, biotechnology and agro-food) and vary in the size from very small local companies which to very big multinational firms. Participating firms mainly support their strategic orientations in *customer intimacy* and *operational excellence* strategies. All the participating companies are oriented to continental and global markets. In average 68% of their total sales are at continental level, while 32% are obtained by products delivered globally.

Results

- For all participating firms of this study consider innovation as a crucial component of their competitive success. Most of the firms are embedded in highly competitive industries and most of them have a high level of innovativeness. Therefore, although participating firms are embedded in turbulent environments with high level of competition, most of the firms are willing to develop innovations showing a strong position as risk taker in industries with high environmental uncertainty.
- The necessity of technological capabilities given the increased complexity of technological developments, not available inside of the firms is the main motive to look for innovation. In second place financial motives based on the reduction of the substantial development costs

of innovations is also one of the main reasons to look for external sources of innovation. In third place, the involvement of external partners with the aim of assuring the access of innovation to new potential markets and/or as an internationalization strategy are together with the reduction of time to market, in the same level of importance to source innovation externally.

- Technological distance of the partner with respect to the core competences of the firms as well as the partner intentions regarding the control over the developed technology are the most important endogenous sources of uncertainty that decision makers consider when deciding to make innovations internally or by M&A. In the same context the level of technological uncertainty is also a high score motive when innovations are made in-house or by M&A. However, these motives are less important when firms decide to develop innovation externally by creating alliances. Motives regarding market uncertainty and financial aspects are the most important criteria when firms decide to make alliances and less important criteria when firms develop innovation in-house or by M&A.

Conclusions

- A preference for less integrated forms of governance, such as alliances is identified in the participating firms of this research, giving conditions of high level of environmental uncertainty.
- Less integrated forms of governance, such as alliances, instead of more integrated forms of governance, such as M&A are preferred when the level of technological uncertainty is high.
- High levels of market uncertainty push companies to choose more flexible forms of governance, such as alliances instead of M&A.
- High level of partner uncertainty and short technological distance influence positively the choice of total integrated forms of governance such as M&A
- Higher information asymmetries between partners motivate the use of less integrated forms of governance at least until partners get known each other concerning its values and capabilities.
- Although the reliability of a potential partner's capabilities is considered when firms decide to establish a partnership, from the results of this study, it is not possible to establish a clear influence of task uncertainty in the choice of a specific kind of governance.
- Strategic aspects of the firms like their internationalization strategy, growth strategy and the opportunity to increase market share are important factors that apart from uncertainty factors, firms take into account, when deciding to acquire a whole company.
- Financial aspects and the size of the firms are, apart from uncertainty factors, important aspects which influence the choices and decision regarding the type of governance that firms choose to achieve innovation externally. Big companies with a strong financial position tend to prefer more integrated forms of governance than more flexible organizational structures as their better option when they are sourcing innovation externally.

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Glossary of Terms

JV	Joint Venture
M&A	Mergers and Acquisitions
SA	Strategic Alliances
CVC	Corporate Venture Capital
R&D	Research and Development
RBV	Resource Base View
TCE	Transaction Cost Economics
NT	Network Theory
ROR	Real Options Reasoning
DPT	Dynamic Portfolio Theory

CHAPTER 1. INTRODUCTION

1.1 INTRODUCTION

1.1.1 WHAT IS INNOVATION AND WHY IS IT IMPORTANT?

Innovation refers to radical, incremental and revolutionary changes in products, in processes, in organizational structures or in services (Mckeown, 2008). It is generated by inventions based on new knowledge, translated in practical applications and then introduced into the market (Mckeown, 2008). Moreover, innovation is known as one of the main forces which has driven the economic growth of industrialized countries and their companies through the 20th century (Franko, 1989; de Man and Duysters, 2005) and is the basis to keep the firm's competitive and market positions on a long term (de Man and Duysters, 2005). Consequently, improving a firm's innovation performance has become an important strategic top management concern.

1.1.2 EXTERNAL VERSUS INTERNAL SOURCES OF TECHNOLOGICAL INNOVATION

Traditionally, in firms, the process of achieving innovation was made through internal corporate venturing (Van de Vrande et al. 2006), which is the development of innovative capabilities by each firm's own research and development (R&D) department. However, nowadays, even the largest firms are intensively looking for external sources of *technological innovations* (Vanhaverbeke et al. 2002) through the establishment of inter-firm relationships to support their long-term growth strategies (Van de Vrande et al. 2006). There are several reasons to search for these external sources: (1) the increasing speed of technological changes and technological complexity (Van de Vrande et al. 2006); (2) the reduction of uncertainty (Hagedoorn, 1993; Harrigan, 1988); (3) the reduction of costs in R&D projects (Hagedoorn, 1993; Harrigan, 1988); (4) the limited resources to invest in R&D (Vanhaverbeke et al. 2002); and (5) the need to: (a) find complementary technology; (b) reduce the time to achieve innovation; and (c) gain access and influence into the market (Hagedoorn, 1993).

Nevertheless, identifying and choosing the best partner when establishing an external technology relationship is not sufficient. In fact, deciding which type of governance mode will manage the inter-firm relationship is crucial (Sabidussi et al. 2008). This sometimes entitles the company to sacrifice part of their ownership and administrative control over the inventions and even to take the risk of failure in their goals due to a possible opportunistic behavior of the partner (Folta, 1998).

1.1.3 FACTORS DETERMINING THE CHOICE OF GOVERNANCE MODE

There is different governance modes used intensively with the aim of acquiring external technological capabilities. These are: (1) Strategic Alliances (SA) such as joint ventures, licensing agreements, and other forms of collaborative alliances; (2) Mergers and Acquisitions (M&A); (3) Corporate Venture Capital Investments (CVC); and technology exploration with research labs and universities (Van de Vrande et al. 2006). They enables the company to compete in turbulent changing economies (de Man and Duysters, 2005), to manage competitors and to get market advantages (Makhija and Ganesh, 1997). However, it is not clear which of the governance modes is best in enhancing the innovative capabilities of the firms involved in the inter-firm relationship (de Man and Duysters, 2005) nor what is the impact of different types of uncertainty on the choice of a governance mode (Van de Vrande et al. 2009; Mahoney, 1992; Santoro and McGill, 2005; Sutcliff and Zaheer, 1998). Moreover, the industrial and technological environment, the firm-specific conditions (Hagedoorn and Duysters, 2002) as well as the synergies and risk diversification interactions at the alliance portfolio level (Mahnke and Overby, 2005) leading the decision-maker to chose for a specific or combined form of governance is unknown.

1.1.4 THEORIES ASSESSING THE DECISION OF A CERTAIN GOVERNANCE MODE

There are mainly four theories used to assess the choice of a governance mode to deal with external technological innovations. These are: Resource Based View (RBV), Transaction Costs Economics (TCE), Network Theory (NT), and *Real Options Reasoning (ROR)* (Sabidussi et al. 2008). ROR is the only one that is able to assess the decision considering uncertainty factors. This is because ROR has a framework based on the level of uncertainty (Sabidussi et al. 2008; Van de Vrande et al. 2006) and it is intensively used to deal with high levels of uncertainty (Sabidussi et al. 2008; Van de Vrande et al. 2006; Folta, 1998).

In addition to the above theories, the *Dynamic Portfolio Theory (DPT)*, which is an adaptation of the Financial Portfolio Theory (Markowitz, 1952), is also used to choose a governance mode. This theory differs from previous theories because it takes into account an integrated framework to support the governance mode chosen (Sabidussi et al. 2008). Moreover, it considers the risk-return profile, the interactions and the mechanisms of synergy and diversification between governance decisions and the effect of time on the dynamic environment that technological innovations are immerse (Sabidussi et al. 2008) as the main criteria to choose between governance modes.

1.2. PROBLEM DEFINITION

Usually collaborative portfolios consists of a disordered growth of a random mix of inter-firms relationships, leading to the achievement of a firm`s corporate and business goals, without performance measurements to assess their effectiveness (Mahnke and Overby, 2005). There is a continuous and increasing effect of alliances on the firm`s total sales (Hoffmann, 2005), an impressive failure rate of alliances (between 50 to 70% at the end of 1980`s) and a huge growth of the total transaction value of M&A, from \$1 to \$4 trillion, reported in a period of 5 years (1995-1999) (de Man and Duysters, 2005). Consequently, firms are increasing their attention to improve the management of their alliance portfolios (Mahnke and Overby, 2005).

Since it is impossible neither to guarantee the successful application of a new technology nor to assure the new technology`s future business potential in the market (Van de Vrande et al. 2006), external technological innovations are investment decisions (Van de Vrande et al. 2009) which are uncertain by nature. The uncertainty factors determining the investment decision, influence extensively and result in the governance mode chosen to manage the innovative process (Santoro and McGill, 2005; Van de Vrande et al. 2009). Most of the studies focus on the effects of uncertainty on investment decisions excluding extensive research of its effects on governance (Van de Vrande et al. 2006). Other studies (with specific exceptions) (Santoro and McGill, 2005; Folta, 1998; Van de Vrande et al. 2009) do not give clear reasons to prefer, depending on the uncertainty confronted, a certain type of governance.

With the exception of DPT, limits arise in the use of the rest of the above mentioned theories. This is because: (1) they analyze each governance choice as an independent decision from the other governance modes in which the firm is implicated, (2) they only partially consider the effects of "time dynamics" on the governance decision, and (3) they use different frameworks (i.e. TCE is focused on the reduction of transaction cost) (Sabidussi et al. 2008). These frameworks, except ROR, do not use uncertainty as the criteria to analyze the choice of a governance mode.

In order to analyze the effects of uncertainty on governance and at the same time take into account all the above considerations, the combination of ROR and DPT can be used. Both theories take into account uncertainty, from different but related perspectives, as the main criteria to analyze this decision. This combination has not been previously evaluated by literature as a mechanism to assess the decision of choosing a particular governance mode.

Therefore, considering the importance of the effects of uncertainty on governance in order to improve the firm`s innovation performance, it could be interesting, from an academic and economic point of view, to carry out an in-depth study on the relation among uncertainty, governance and innovation.

1.3 RESEARCH OBJECTIVE

The main goal of this research is to find out how uncertainty affects the innovation performance of a firm through the analysis of the influence of uncertainty factors in the selection of organizational structures chosen to manage external technology innovations.

Accordingly, the study will focused on the following specific objectives:

- To review the uncertainty factors, their sources and their effects on the decision to choose governance structures to manage external technological innovations.
- To identify the uncertainty criteria and the assessment methodology considered by decision makers to decide for a governance modality and their effect on the whole portfolio and on the firm's innovation performance.

1.4 RESEARCH QUESTIONS

Studies which focus on integrated governance structures categorize the uncertainties in three types: *primary*, *competitive* and *supplier*, supporting the theory that the first two categories have a negative impact on vertical integration while supplier uncertainty has a positive effect on it (Sutcliffe and Zaheer, 1998).

Other authors, who research uncertainty on strategic alliances, recognize two kinds of uncertainties: *relational* and *performance* risk (Das and Teng, 2001). The first is the result of an unpredictable opportunistic behavior of the firms involved in the alliance, and the second is the uncertain possibility that the goals of the alliance can not be accomplished. The reduction of these uncertainties could be obtained by managing trust and control factors within the alliance. (Das and Teng, 2001).

In other studies, *partner*, *task*, and *technological* uncertainties as well as the interactions of these with the asset co-specialization, are considered the main types of risks that biotechnology industry faces within strategic alliances (Santoro and McGill, 2005). Higher levels of partner and task uncertainty are related to more integrated forms of governance, while higher levels of technological uncertainty guide firms to consider more flexible ways of governance. (Santoro and McGill, 2005).

When considering the effect of uncertainty on different kinds of governance within the pharmaceutical industry, researchers identified *turbulent environment* and *quick technological changes* surrounding the firm as exogenous forms of uncertainty, while *previous cooperation* and *cognitive distance* between firms were categorized as endogenous (Van de Vrande et al.

2009). Higher levels of exogenous and endogenous uncertainties show a trend to choose equity alliances like Corporate Venture Capital (CVC), which give flexibility and at the same time some degree of control to the relationships, but without discarding M&A as an option to obtain technological knowledge depending on specific factors like the size of the firm that would potentially be acquired (Van de Vrande et al. 2009).

As seen above, there is no clear definition of the uncertainty factors that allows us to determine the possible sources of uncertainty and/or their effects on the choice of governance mode.

Therefore, the first research question follows:

RQ1: What are the uncertainty factors that affect the choice for a governance mode?

Based on the general categorization made in previous studies, we will consider two big groups of uncertainty factors: (1) *exogenous*, which are those not controlled by the firm and could decrease during the life of the projects; and (2) *endogenous*, which are those associated with the relationships between partners and could be influenced by actions of the firms (Folta, 1998, Van de Vrande et al. 2006, 2009).

Consequently, a classification of the uncertainties will be made according to the main factors found in the scientific literature. This classification follows.

1. Exogenous uncertainty factors

- *Environmental uncertainty*

It is the external uncertainty that surrounds the firm and depends on the type of *industry or sector* and the *level of technology development* (high, medium, low) in which the firm is embedded (Hagedoorn and Duysters, 2002). Within this uncertainty, the study will include the primary uncertainty categorized by Sutcliffe and Zaheer, (1998), which involves changes in law and government regulations regarding tax and tariffs. It will also include the environmental turbulence factor present in high-tech industries and identified by Van de Vrande and co-authors (2009). It is noteworthy to point out that it has been determined that higher levels of environmental uncertainty are better managed with strategic alliances than M&A (Hagedoorn and Duysters, 2002). This is because it gives flexibility to firms involved and a low level of financial commitment, making them able to face unpredictable environmental changes (Hagedoorn and Duysters, 2002).

- *Technological uncertainty*

This uncertainty mainly refers to the unknown success in the potential market of the *technological features* and the *grade of technological innovation or technological novelty* (Van de Vrande et al. 2009; Sabidussi et al. 2008). Higher levels of technological uncertainty are

related to less hierarchical modes of governance in order to give, as in the environmental uncertainty, more flexibility and a low level of financial commitment to the relationship (Van de Vrande et al. 2009). However, the presence of assets co-specialization among firms is required in more integrated forms of governance, even with a high technological uncertainty (Santoro and McGill, 2005). Strategic alliances create the option, from a Real Options (RO) perspective, to delay the decision to proceed with more integrated forms of governance once the business potential of the new technology has been proven in the market. (Vanhaverbeke et al. 2002).

- *Market uncertainty*

Market uncertainty is related to *market factors* such as the potential demand and price of products (Mahnke and Overby, 2005), the size of the market and the market strategies the firm will follow to reach the potential customers (MacMillan and McGrath, 2002). Consequently, it refers to the evolution of the market conditions (Sabidussi et al. 2008). Market uncertainty is close related to technological uncertainty because the market can vary depending on the type of technological exploration or exploitation projects and the technology life cycle that the firms deal with (Sabidussi et al. 2008; MacMillan and McGrath, 2002).

2. Endogenous Uncertainty factors

- *Behavioral uncertainty*

This uncertainty refers to the *opportunistic behavior*, the *secret intentions* (Santoro and McGill, 2005) and the *information asymmetry* that the companies could have and could face when they do not know each other (Van de Vrande et al. 2009). This, in turn, affects the governance mode chosen (Van de Vrande et al. 2009). According to Anderson and co-authors (2006), “relational risk” (Das and Teng, 2001) also called “partner cooperation risk” is a form of uncertainty that causes most of the failures in alliances. Previous studies suggest that higher levels of partner uncertainty are faced with more integrated (hierarchical) forms of governance, avoiding high costs of alliance monitoring (Santoro and McGill, 2005). At the same time, “prior cooperation” (Van de Vrande et al. 2009) between firms reduces partner uncertainty and shows a preference for more integrated forms of governance (minority holding and joint ventures) but not necessarily to complete integrated governance modes (M&A) (Van de Vrande et al. 2009). Supplier uncertainty is also part of behavioral uncertainty and it has a positive effect on the decision to choose for a vertical integrated mode of governance in order to prevent an opportunistic behavior of the partner (Sutcliffe and Zaheer, 2005).

- *Task uncertainty*

Task uncertainty refers to the *capabilities* and *contributions* that the partners give in the relationship (Santoro and McGill, 2005) in order to achieve the common goal. It is related to the technological development stages, having higher uncertain early stages than final ones (Santoro and McGill, 2005; Rothaermel, 2001). Therefore, the more uncertain, the more hierarchical governance modes are required (Santoro and McGill, 2005). There is a relationship

between task uncertainty with technology distance, which is called “knowledge base dissimilarities” among partners (Van de Vrande et al. 2009) which may affect the governance mode chosen to manage the projects. Even with a high technological distance between firms, there is not a clear preference for the use of more integrated forms of governance as well as strategic alliances. However, Corporate Venture Capital (CVC), which is an equity governance modality in the middle of the continuum, is used more (Van de Vrande et al. 2009).

In conclusion, there is not enough understanding about how the types of uncertainty are related between each other and how they affect the governance modes chosen. Accordingly, the following two research questions have been proposed:

RQ2: What is the effect of exogenous and endogenous uncertainty on the decision to choose a governance mode?

RQ3: How are the endogenous and exogenous uncertainties empirically managed in order to assess their effect on the choice of the governance forms?

In addition to the effect of uncertainty factors on a single governance mode, the effects of the interactions among governance modes to the entire portfolio of alliances are very important in order to increase returns and reduce the risk involved in alliances (Sabidussi et al. 2008). Previously, companies did not take into consideration these correlations, growing up a portfolio of alliances in which governance modes were randomly selected (Mahnke and Overby, 2005; McKinsey, 2002). However, in specific cases, like when considering a high level of demand uncertainty, companies hedged their position by creating a “spider web of horizontal ventures” (Harrigan, 1988), keeping demand and supply in line (Harrigan, 1988).

Firms recognize that their business and corporate strategies cannot be accomplished if they do not consider a group of alliances managed by clear “portfolio strategies” (Gomes-Casseres, 1996) to coordinate the interactions between alliances, and at the same time have access to external knowledge resources and capabilities (Hoffmann, 2005; Gomes-Casseres, 1996).

Inside of a portfolio, synergies and risk diversification are the most important interactions between governance modes because of their impact increasing returns and reducing risks of the firms, respectively (Mahnke and Overby, 2005).

Mahnke and Overby (2005) identify two sources of synergism: multiple alliances with the *same* partner in *different business*, and multiple collaborations with *different* partners in the *same R&D area*. The first one is created by prior collaboration and iterative cooperation between firms which create new business opportunities to explore and exploit new technologies in different businesses. This iterative cooperation also has a positive influence in the reduction of the transaction and coordination cost (Gulati et al. 2000). The second synergy is based on the

alliances with partners in the same or complementary business activities (Mahnke and Overby, 2005; Richardson, 1972) and gives companies the opportunity to develop a core technological competence based on the research of the same business from different partner`s perspectives.

Additionally, Mahnke and Overby (2005) identify that *technological capability and market* are the main uncertainties the companies could reduce, diversifying the risk by establishing alliances with multiple partners. In this regard, companies see the need to be part of multiple external strategic alliances with companies (even with competitors) in order to develop alternative technologies that will allow them to access new emerging knowledge and also save their position ensuring that they will reach the technology capabilities with more business potential reducing technological capability and market uncertainties (Mahnke and Overby, 2005).

Mahnke and Overby (2005) and Hoffmann, (2005) agree that managing alliance portfolios diversifies the risk of failure in different alliances, compensating negative with positive outcomes. It is even suggested to make small investments on risky alliances on different than their existing exploited core technologies in order to reduce the general risk at portfolio level (Mahnke and Overby 2005).

Although firms know that a bigger number of alliances with the same business demands more managerial attention in order to avoid possible conflicts, they prefer to deal with their occurrence with the aim of reducing the risk of failure because it depends on one single alliance (Hoffmann, 2005).

Based on the above and considering the types of interactions and their effects, the following research questions are formulated:

RQ4: What kind of synergies and risk diversification between governance structures are recognized inside the portfolio?

RQ5: If synergies and risk diversification have an effect on governance structures, are they being considered by decision makers?

Nowadays, firms involved in strategic alliances are paying more attention to the efficient management of their entire portfolio of alliances, considering the increased effect of the alliances on their sales (Hoffmann, 2005). Firms are not considering so important the success or failure of one single alliance nor the concentration of their efforts in a single high profile alliance in order to reach their goals (Gomez-Casseres, 1996). They consider very important to reach their strategic goals based on the whole group of alliances (Hoffmann, 2007), synchronized by a clear alliance portfolio strategy (Gomez-Casseres, 1996; Hoffmann, 2007).

Previous studies establish a difference between *cohesive* and *sparse* alliances considering both are necessary to increase the firm's innovations performance because of their synergistic and complementary effect (Padula, 2008).

Cohesive alliances are cooperative agreements, established with close partners, connected with strong ties (i.e. cluster alliances) in order to develop exploitation activities. In another dimension, sparse alliances are collaborative agreements set up with distant partners (i.e. shortcuts) in order to promote exploration activities (Padula, 2008).

While sparse alliances are sources of novel ideas and new knowledge which keep the firms in a constant update of possible future technology patterns, cohesive alliances are the basis to develop practical applications of those novel ideas (Padula, 2008).

The results suggest that cohesive as well as sparse alliances are required to enhance the innovation performance of the firms, showing higher innovation performance in companies in which the alliance portfolio consists of both types of alliances when compared to those that make use of only one type of alliance (Padula, 2008).

Considering that synergies and risk diversification have an effect on the firm's innovation performance and taking into account the positive results of the previous studies, the last research question follows.

RQ6: Companies which consider the effects of synergies and risk diversification on governance modes have better innovation performance compared to those which do not consider these effects?

1.5 DEFINITION OF CONCEPTS

- *Innovation*

It refers to radical, incremental and revolutionary changes in products, processes, organizational structures or service. It is generated by inventions based on new knowledge, translated into practical applications and then introduced into the market (Mckeown, 2008).

- *Uncertainty and risk*

While risk is the probability of occurrence of an event with a probability distribution, uncertainty is the unknown likelihood of an event without a probability distribution (Hagedoorn, 1993). For the purpose of this research, in line with the studies of Van de Vrande and co-authors (2006, 2009) and Sabidussi and co-authors (2008), risk and uncertainty are used and considered under the definition of uncertainty as the difference between the two is not to be taken into account.

- *Strategic alliances*

Including equity as well as non equity alliances (Sabidussi et al. 2008; Osborn and Hagedoorn, 1997), strategic alliances are collaborative agreements established by two or more independent organizations in order to “share reciprocal inputs, while maintaining their own corporate identities” (de Man and Duysters, 2005; Sabidussi et al. 2008). The term “strategic” refers to alliances which “contribute significantly to the strategies pursued by the partner companies” (Dussauge and Garrette, 1999; Sabidussi et al. 2008).

- *Mergers and Acquisition (M&A)*

Referring to total integrated forms of governance, including vertical and horizontal integration (Hagedoorn and Duysters, 2002), M&A are forms of governance in which two independent companies combine their operations to form a new entity (de Man and Duysters, 2005). In both cases the acquirer company takes over the acquired firm but in mergers, as a difference from acquisitions, the latter company leaves off to exist (Sabidussi et al. 2008).

- *Alliance portfolio*

For the purpose of this research, an alliance portfolio refers to the group of alliances consisting of different forms of governance. This includes a range from less integrated forms of governance (different forms of strategic alliances) to total integrated forms of governance (M&A) which are organized in a portfolio.

1.6 RESEARCH MATERIALS AND METHODS

The study will be divided into two complementary parts:

- *Part I: Theoretical research*

It consists of a desk research (literature review) about uncertainty factors, governance modes and innovation, found in previous studies from scientific articles and books available on Wageningen UR digital and non digital library, and other internet sources. This will lead to the identification, from a theoretical perspective, of the uncertainty factors, their causes, their effects on the choice of governance modes, and the interactions between governance modes.

- *Part II: Empirical research*

The empirical research will be carried out from a qualitative perspective by the development of case study consisting of the research of at least two firms that manage a portfolio of external technological innovations.

The following chapter (Chapter 2) will include an extensive literature analysis review based on the evaluation of previous research and will be divided into three parts: 1) the categorization of uncertainty factors and their effects on the choice of a governance mode and 2) the

categorization of the interactions between governance modes and their effect on the choice of a governance mode from a portfolio perspective. In Chapter 3 the procedure in which the case study will be carried out will be described, as well as the interview protocol and the interviews including methodology to choose the companies and to assess the information obtained. In Chapter 4, the results will be presented and will be used to make the discussion and conclusion in Chapter 5.

CHAPTER 2. THEORY ANALYSIS

2.1 INTRODUCTION

The following chapter will cover the literature review of this study. First, in section 2.1, a categorization of the uncertainties which affect the governance decision will be included. Following, information about the effects of exogenous and endogenous uncertainties over the choice of a governance mode will be included in section 2.2 and 2.3 respectively. The next section (2.4) will contain a categorization of the interactions between the governance modes. Finally, the last section (2.5) will give detailed information about the effects of these governance modes interactions on the governance decision.

2.2 CATEGORIZATION OF UNCERTAINTY FACTORS

For the purpose of this research, uncertainty will be classified into two factors based on the categorization made by Folta (1998). Exogenous uncertainty consists of the external factors beyond the control of the firms which are closely related to market and technological aspects that surround the firms and affect their external innovative processes (Folta, 1998; Van de Vrande et al. 2006, 2009). Normally, this type of uncertainty decreases during the time of the innovation process (Folta, 1998). On the other hand, endogenous uncertainty includes factors which depend on the relationships between partners. Therefore, they can be controlled by the firm's actions and could be reduced with positive iterative experiences between the partners (Folta, 1998; Van de Vrande et al. 2006, 2009). Depending on the type of industry (mature or emerging) and the type of innovation (explorative or exploitative), different kinds and proportions of uncertainties affect the innovation process (Folta, 1998). In industries facing high endogenous uncertainty with explorative innovations, the firm's actions could reduce the uncertainty by doing sequential investments with "transitional" (Folta, 1998) forms of governance. This is a better option to manage external innovations, considering the choice of a governance decision as a sequence of the future actions, and not only as one single decision (Folta, 1998).

2.2.1 EXOGENOUS UNCERTAINTIES

Exogenous uncertainty comes from the uncertain future successful introduction of the new technology in the market (Van de Vrande et al. 2006) and the lack of a defined legislation and industry infrastructure of the new technology (Folta, 1998). To commit early to R&D technology projects with a high level of this uncertainty (specifically referring to the type of industry) is a high risky investment because although this uncertainty is reduced with time, it is external to the firms; consequently, it is not affected by their actions (Folta, 1998).

The first stages of New Business Development (NBD) are characterized by higher levels of uncertainty, because of the lack of information about market and technological aspects of the new technology (Van de Vrande et al. 2006). Following an ROR, it is recognized that a step-gate process (Van de Vrande et al. 2006) is a good option to face this high uncertainty because it allows companies to add new information in each stage and decide if they continue or not supporting the innovation. In the first stages, companies proceed with small R&D investments that give them access to new market and technological information. Major investments will follow when they get positive information which could guarantee the successful introduction of the new technology in the market (Van de Vrande et al. 2006).

In stages of high uncertainty, “strategic flexibility” is required to allow the addition of new technological ideas which were not considered in previous stages of the step gate process as well as the outsourcing of technology that does not fit anymore in the business model and strategy of the firms (Van de Vrande et al. 2006).

Various authors agree that when industrial uncertainty is high, alliances are preferred over acquisitions. Once the uncertainty declines, more integrated forms of governance are used to manage the relationship (Van de Vrande et al. 2006; Lambe and Spekman, 1997).

In this study, the effect of three types of exogenous uncertainty on the governance mode chosen to manage external technology innovations is assessed. These are: Environmental, Technological and Market uncertainty and an in depth literature analysis of them follows.

2.2.2 ENDOGENOUS UNCERTAINTIES

Endogenous uncertainty is embedded and caused by the inter-firm relation between partners (Van de Vrande et al. 2006). It is based on the lack of information and knowledge which is needed to assess the value of the objective firm and its technology as well as the unknown amount of resources and effort required to create a new product with the partner's emerging technology (Folta, 1998). To face high levels of this uncertainty, the innovation process is required to be divided in several stages. This division allows the firms to make sequential investments which give the opportunity to investing firms to decide whether to continue or to stop the next investment depending on the assessment of the new available information about the endogenous uncertainty factors that vary during the innovation process (Folta, 1998). High levels of endogenous uncertainty are incentives to consider sequential investments (Folta, 1998).

Under conditions of high endogenous uncertainty and in the early stages of NBD, high reversible and flexible forms of governance are better chosen to manage innovations in these stages (Van de Vrande et al. 2006). However, in the next stages, the level of endogenous uncertainty decreases because of past investments (Van de Vrande et al. 2006). Therefore, more hierarchical forms of governance could take place, increasing the level of commitment and confidence with the partner (Van de Vrande et al. 2006).

In this study, two sources of uncertainty (technology distance and information asymmetry) and two types of endogenous uncertainty (partner and task) are considered to assess their effect on the type of governance. An in depth literature analysis of them follows.

2.3 EFFECTS OF EXOGENOUS UNCERTAINTY FACTORS ON THE CHOICE OF GOVERNANCE MODE BY TYPE OF UNCERTAINTY

2.3.1 ENVIRONMENTAL UNCERTAINTY

According to Milliken (1987), cited by Buchko (1994), the inability to predict future changes in the environment as well as the lack of knowledge about the interactions among different components of the environment create an uncertainty which is perceived by the decision makers as environmental uncertainty.

Environmental uncertainty is a type of exogenous uncertainty which concerns the environment (context, conditions) that surrounds the firm. It depends upon *the type of industry or sector-specific features* in which the firm is embedded. It is closely related with *the level of technological developments and the rate of technological changes* that the firm faces (Hagedoorn and Duysters, 2002) and causes uncertain conditions. For example, industries immerse in “turbulent environments” (Van de Vrande et al. 2009) which consist of high technological developments with unexpected technological changes based on radical innovations, deal with high environmental uncertainty (Van de Vrande et al. 2009). Volatile industries (high competitive) are also immerse in highly uncertain environments with a high risk of technological obsolescence due to frequent technological changes (Balakrishnan and Wernerfelt, 1986). In the same context, emerging-knowledge industries with high options to grow consist of more explorative innovations and consequently higher environmental uncertainty than mature industries (Van de Vrande et al. 2006).

These environmental conditions bound the possible organizational structures that could be preferred by decision makers to manage external technology innovations (Hagedoorn and Duysters, 2002). Therefore, they are leading to select less integrated forms of governance such alliances (Eisenhardt and Schoonhoven, 1996; Lambe and Speakman 1997; Garette and Dussage, 2000) or “transitory alliances” (Duysters and de Man, 2003) in order to maximize flexibility (Hagedoorn and Duysters, 2002) and to reduce the level of financial commitment (Van de Vrande et al. 2006, 2009). At the same time, this form of governance keeps open the access to new emerging technologies and the options to divest or to reverse the investment if the conditions are not favorable (Van de Vrande et al. 2006), reacting fast to unexpected environmental changes (Van de Vrande et al. 2009) with quick strategic responses (Hagedoorn and Duysters, 2002).

Oster 1992 (cited by Hagedoorn, and Duysters, 2002) proposes that environmental conditions of high tech industries which demand high level of flexibility and learning are managed by strategic alliances as means of governance, while more integrated forms of governance as M&A

are used in environments of low tech industries which imply low levels of flexibility and learning. In the same context, higher levels of environmental uncertain conditions make less attractive the use of more integrated forms of governance (Balakrishnan and Wernerfelt, 1986). However this choice could be changed if the innovative capabilities, which are the reason of the inter-firm relationship, are closely related to the core competences of the firm. In this perspective, M&A is preferred over an alliance in order to protect the core capabilities of the investing firm (Hagedoorn and Duysters, 2002).

Environmental uncertainty is also broadly considered by other authors as part of “primary uncertainty” (Sutcliffe and Zaheer, 1998) which is exogenous to the firm and consists of the lack of knowledge about the occurrence of natural events, changes in consumer`s preferences and governmental regulations (tariffs) and legislation (Folta, 1998) as well as the uncertainty created by the unexpected and quick technology changes. Based on these factors, more integrated forms of governance, specifically referred to vertical integration, are less preferred as form of governance, because of their lack of flexibility to quickly respond to these unexpected changes (Sutcliffe and Zaheer, 1998).

In conclusion, alliances are preferred over M&A in highly uncertain environments in which the knowledge is widely distributed, while M&A are better governance choices under low levels of environmental uncertainty and less required flexibility, whose objectives are to achieve economies of scale and scope (Vanhaverbeke et al. 2002).

Hypothesis:

Hp1: Higher levels of environmental uncertainty reduce the preference to use more integrated forms of governance like M&A and positively motivate the use of more flexible forms of governance like strategic alliances.

2.3.2 TECHNOLOGICAL UNCERTAINTY

Technological uncertainty involves the unknown business potential of a technology (Van de Vrande et al. 2009). It depends on its *technological features* (Van de Vrande et al. 2009), *technical problems* and *adaptations* to develop a new product or service (Van de Ende, 2003) and the *grade of technological innovation or technological novelty* for which the market viability is unknown (Van de Vrande et al. 2009; Sabidussi et al. 2008).

In this regard, technological uncertainty arises as a result of the complexity of the technology such as in the biotechnology industry. In this type of industry, innovations based on the use and application of a new technology might depend on the development of complementary technology which could be or not accessible to the firm on time (Santoro and McGill, 2005), or could not have the required standards (MacMillan and McGrath, 2002). This technological complexity could make the technology inapplicable in industries facing fast technological changes (Santoro and McGill, 2005; Folta, 1998).

A link among technological uncertainty, the technology life cycle in the NBD (Van de Vrande et al. 2006) and the use of different forms of governance (strategic alliances or acquisitions) has been established and varies depending on the stage of the life cycle and the level of uncertainty (Vanhanverbeke et al. 2002). Based on the categorization made by Utterback (1994) (cited by Van de Vrande et al. 2006), "the technology life cycle consists of four stages: "fluid, transitional, mature and discontinuous". Even though new business opportunities increase at early stages of the cycle, these phases involve also high uncertainty concerning product and market feasibility of the new technology (Van de Vrande et al. 2006). This makes it difficult to predict the success of the innovation based on this technology (Van de Vrande et al. 2009). This uncertainty is even bigger in "pioneering technologies" (Ahuja and Lampert, 2001) which do not have previous experience about the use and applications in the development of successful innovations (Ahuja and Lampert, 2001).

Given the conditions of higher levels of this uncertainty, less integrated and more reversible forms of governance (such as strategic alliances) are required to manage external technological innovations (Van de Vrande et al. 2006). Following an ROR perspective, specifically in the adoption of new technologies, higher levels of integration are less preferred, mainly due to the high cost of formation, organization and dissolution of the relationship among firms (Santoro and McGill, 2005). Therefore, firms emphasize in the use of governance modes which are highly flexible and reversible, adopting the option to wait as strategy (Folta, 1998) or making small sequential investments considering the option to grow of explorative investment and the reduction of commitment (Van de Vrande et al. 2009; Folta, 1998; Vanhanverbeke et al. 2002). These sequential investments begin with small "learning investments" (Van de Vrande et al. 2009) in order to make a market and technology feasibility analysis of the new technology; therefore, reducing uncertainty levels (Van de Vrande et al. 2009).

Higher levels of technological uncertainty are found in a Discontinuous Technology Change (DTC) scenario where new technologies are emerging and they are competing against each other and against the old technology (Mahnke and Overby, 2005). Under these circumstances, external sources of technology are preferred over internal development of the desired technology (Lambe and Spekman, 1997). However, the lack of knowledge about the future value of the technology, increases the risk to commit an early to obsolete technology or a technology with no future value (Mahnke and Overby, 2005). Consequently, flexibility and reversibility are the key criteria to decide for a form of governance to manage the external relationships. Thus, alliances with firms that have relevant technologies, are preferred over M&A (Lambe and Spekman, 1997), and several collaborative relationships are established in order to diversify the risk of betting for the wrong technology (Mahnke and Overby, 2005).

In this regard, when comparing different strategic alliances (i.e. equity forms and M&A) in order to manage external technological innovations, equity alliances hedge the position of the investing firm against negative technological changes, reducing its financial commitment and at the same time keeping the options open to acquire the technology until their future business value is resolved (Folta, 1998). These alliances also give the investing firm an advantage over

the rest of the companies (which could be interested in the technology of the target firm), because they usually include agreements of “the right to buy or to sell equity” or “the right to first refusal” of the technology (Folta, 1998; Pisano, 1989; Chi, 1994).

Hypothesis:

Hp2: Higher levels of technological uncertainty discourage the use of more integrated forms of governance such as M&A and motivate the use of more flexible forms of governance such as strategic alliances.

2.3.3 MARKET UNCERTAINTY

Market uncertainty is defined as the lack of knowledge of: (1) the future trend of a given market (Hoskisson and Busenitz, 2002); (2) the evolution of market conditions (Sabidussi et al. 2008); (3) the way in which a technology could be successfully commercialized in a given market (Mahnke and Overby, 2005); (4) the customer's preference, demand and willingness to pay for a technology (MacMillan and McGrath, 2002; Beckman et al. 2004); and (5) the actions and behavior of the competitors (Beckman et al. 2004) and customers which are related to the development of similar technologies introduced in the markets (Loury, 1979; Van de Ende, 2003).

This type of uncertainty is even bigger regarding new technology because it is very difficult to predict the acceptance by the market and the implementation of a new innovation or invention (Hoskisson and Busenitz, 2002). The level of uncertainty varies depending on the phase of the technology life cycle in which the technology is located (Van de Ende, 2003). This is because each stage is characterized by differences in the nature and rates of product innovations as well as by market fluctuations and tendencies (Roberts and Liu, 2001; Van de Vrande et al. 2006).

In highly technology industries, the fluid phase (first phase) of the technology life cycle, is characterized by high levels of product and market uncertainty (Robert and Liu, 2001; Van de Ende, 2003) because it is not clear which technology will be accepted and preferred by the market. Therefore, companies which have developed and possess the new technology, make strategic alliances in order to promote their technology with the aim of this technology becoming a dominant design in the industry. At the same time, companies which are interested in new attractive technologies, use strategic alliances with several companies in order to obtain access to the most relevant technologies, reducing commitment to a specific technology with the aim of hedging their position in the market (de Man and Duysters, 2005). Strategic alliances are considered important in order to gain critical competitive technologies which are difficult to create internally, and at the same time, be considered as transitional forms of governance that build managerial and operational inter-firm relations which could lead to subsequent acquisitions (Roberts and Liu, 2001).

In the second stage of the technology life cycle (transitional phase), the market uncertainty decreases quickly, mainly because there is more information about the dominant design that is used in the industry, the size and demand of the market and the preferences of the consumer

(Van de Ende, 2003; Steensma and Corley, 2000). In this stage, companies join efforts by R&D collaborations in order to improve the dominant design and enlarge the possible applications of the new technology (Roberts and Liu, 2001). This involves the use of more or total integrated forms of governance which evolve from a higher level of commitment (i.e. corporate venture capital) to total control and commitment of the investing firm over the target firm and their technology in order to hold the leadership on the competition (Roberts and Liu, 2001). However, more integrated forms of governance could result in a high vulnerability to obtain poor outcomes when there are unexpected changes on the technological pattern or there is low acceptance for related products (Steensma and Corley, 2000). Companies which own the dominant design keep a competitive advantage over the other companies in the industry. This advantage and their big financial capacity, mainly due to the positive increments of their stock prices, reduce the technology and market uncertainty and allow them to make strategic acquisitions of other companies with complementary technology or a strong customer portfolio (Roberts and Liu, 2001).

In the third phase of the technology life cycle (mature stage), there is a change in focus of innovation from product to process, always based on the dominant design (Roberts and Liu, 2001). However, this process is expensive and time demanding, which results in companies facing higher costs and uncertainty with relation to the internal development of these innovations. Therefore, the companies decide to share their exposure to these factors by doing strategic alliances in R&D, even with competitors (Roberts and Liu, 2001).

During the discontinuity stage of the technology life cycle (last phase), the current technology is going to the obsolescence because of the introduction of new advanced technology or market convergence (Roberts and Liu, 2001). Therefore, the technology and market uncertainty is high. The technology life cycle is in the last stage, turning to the first stage again. Firms establish marketing alliances to trade the new technology in order to capture premium rents being the first to get to the market, reducing the market uncertainty related to the demand, and guaranteeing the new technology to customers (Roberts and Liu, 2001). In this phase, horizontal mergers are common. Therefore, there is a reduction in the total number of firms in the market. Solid and financially strong companies merge with competitors and establish strategic alliances with firms that are working in the development of the new technologies in order to support their technological goals and assure their permanence in the market (Roberts and Liu, 2001).

Higher levels of market uncertainty guide firms to prefer less integrated forms of governance (Sutcliffe and Zaheer 1998) and show a tendency to reinforce existing relationships and establish relationships with past well know partners, considering that this uncertainty makes it difficult to assess the quality of the partner (Beckman et al. 2004; Podolny, 1994; Gulati, 1995).

To manage this kind of uncertainty, as well as the environmental and technological uncertainty, decision-makers follow a ROR perspective (Steensma and Corley, 2000). They manage higher levels of uncertainty by a strategy of sequential investments, using first flexible and reversible forms of governance (strategic alliances) which could be considered as transitional forms of

governance towards more integrated structures (M&A) (Duysters and de Man, 2003). Strategic alliances give companies the option to delay commitment to technologies with an uncertain future value, and at the same time explore different sources and types of technologies at lower cost and risk (Folta, 1998; Kogut, 1991). This form of governance also keeps open the option to increase the level of commitment when there is more clearness and certainty about the potential value creation of the technology. At this point, the level of market uncertainty has decreased and more integrated forms of governance are adopted in order to obtain total control over the technology (Steensma and Corley, 2000).

However, depending on the amount of competitors searching in the same technological area, equity alliances does not give enough security and control of the new technology when compared to an acquisition. In this regard, depending on the number of competitors, an acquisition is preferred over an equity alliance in order to avoid the risk of preemption by competitors about the new technology (Folta, 1998).

Hypothesis:

Hp3: Higher levels of market uncertainty influence negatively the choice of more integrate forms of governance such as M&A, and incentive the choice of less integrated forms of governance such as strategic alliances.

2.4 EFFECTS OF ENDOGENOUS UNCERTAINTY FACTORS ON THE CHOICE OF GOVERNANCE MODE BY TYPE AND SOURCE OF UNCERTAINTY

2.4.1 TECHNOLOGICAL DISTANCE

Technological distance refers to the differences in knowledge-base between the investing and the target firm which influence the governance decision used to manage external sources of technology innovations (Noteboom, 2004; Van de Vrande et al. 2006; 2009; Folta, 1998).

This source of endogenous uncertainty reduces the capacity to absorb the new emerging knowledge of the investing company, reaching its highest level when the new technology is far different to the core competences of this investing firm (Van de Vrande et al. 2006, 2009). At the same time, the knowledge-base differences increase the probability of confronting relational uncertainty (opportunistic behavior between firms) which motivates the use of safeguards (Van de Vrande et al. 2009). Inter-firm relations are affected in the long term because of the reduction of trust and confidence between companies.

Although acquisitions and equity alliances offer similar advantages to manage external innovations facing a high rate of this source of endogenous uncertainty, the choice of the governance mode is based on the organizational structure that offers a more efficient and quickly transferable knowledge (Folta, 1998). Acquisitions are preferred over equity alliances when the knowledge-base is strongly similar in both firms, in other words, the technological distance is short and the cost of transferring knowledge internally is low (Folta, 1998; Vassolo et

al. 2004). Moreover, acquisitions are preferred in companies when there is a short technological distance between their core competences and their sources of technological innovations (Hagedoorn and Duysters, 2002). These will protect their core capabilities against the opportunistic behavior of the partner (Hagedoorn and Duysters, 2002).

When the knowledge capabilities of both firms are different and distant between each other, the transfer of knowledge is slow. In this case, an acquisition will commit greater amount of resources in the long term until seeing the growth benefits of the acquisition (Folta, 1998; Van de Vrande et al. 2009). More flexible governance structures (equity alliances) are required to allow the investing firm: (1) to learn and get information from the target firm (Folta, 1998; Van de Vrande et al. 2006, 2009); (2) to explore and diversify their innovations in distant technologies at low cost (Noteboom, 2004); and (3) to stop the investments if the investing firm does not visualize a good business opportunity in the future (Van de Vrande et al. 2006; Folta, 1998). When the level of technological distance decreases, new information about a more precise valuation of the assets of the target firm is available (Folta, 1998) together with the probability to increase commitment. Therefore the use of more integrated forms of governance is higher (Van de Vrande et al. 2006).

However, more hierarchical forms of governance are preferred over less integrated forms of governance to increase the efficiency and efficacy of transferring knowledge when both companies are technologically distant (Mowery et al. 1996). Following the same trend, under a TCE perspective (Williamson, 1975), larger technological distance between companies implies difficulties to include contingencies in the written agreements of alliances, against all possible unpredictable situations as the occurrence of opportunistic behavior. Therefore, total integrated forms of governance are more suitable under these conditions (Williamson, 1975).

Hypothesis:

Hp4a: Shorter technology distance between firms encourages the use of more integrated forms of governance such as M&A, affecting negatively the use of more flexible forms of governance such as strategic alliances.

Hp4b: Larger technological distance between firms motivate the choice of more integrated forms of governance like M&A, affecting negatively the use of more flexible forms of governance such as strategic alliances.

2.4.2 INFORMATION ASYMMETRY

Information asymmetry is a source of endogenous uncertainty and originates from the lack of access to relevant information between partners which is needed to make investment decisions (Van de Vrande et al. 2006, 2009). It is a very important factor which influences the choice of governance mode (Folta, 1998).

Flexible and reversible forms of governance are used to decrease the uncertainty due to information asymmetry, giving investing firms the opportunity to learn about the partner's values and capabilities (Van de Vrande et al. 2009; Barakrishna and Koza, 2003). These forms of governance are considered the starting point of a sequential series of increased investments towards more integrated governance structures (Van de Vrande et al. 2009). They create the option to postpone major investments until more information about the partner and its technology is obtained and therefore until information asymmetries are reduced (Folta, 1998; Kogut and Zander, 1992; Vanhaverbeke et al. 2002). This allows firms to protect the investing firm against opportunistic behavior of the target firm which could overestimate the value of its assets and technology (Barakrishna and Koza, 2003), creating a problem of "adverse selection" (Folta, 1998; Akerlof, 1970). Inter-firm relationships with new partners, which initially have weaker ties than previous established relationships, are very important for firms in order to recover unique-novel information that previous relationships do not have (Beckman et al. 2004) and could be used to avoid the adverse selection.

Previous cooperation between partners reduces the uncertainty due to information asymmetry (Van de Vrande et al. 2006) and could lead to an increase in the level of commitment driving companies to decide for more integrated forms of governance (Vanhaverbeke et al. 2002; Van de Vrande et al. 2009). However, this reduction in information asymmetry based on positive past experiences might motivate the growth of a trust-based relationship, which will in turn decrease the necessity of control and protection against opportunistic behavior of the partner and consequently incentive the use of less integrated forms of governance (Villalonga and McGahan, 2005) like non equity alliances (Van de Vrande et al. 2009, Gulati and Singh, 1998).

Hyphotesis:

Hp5a: Higher levels of information asymmetry affect negatively the choice of more integrated forms of governance such as M&A and motivate the use of less integrated forms of governance such as strategic alliances.

Hp5b: Prior cooperation between firms reduces the level of information asymmetry between firms, leading firms to choose more integrated forms of governance such as M&A

2.4.3 PARTNER UNCERTAINTY

Partner uncertainty and behavior uncertainty (Santoro and McGill, 2005) or relational risk (Das and Teng, 2001) refers to the firm's values, attitudes and culture which guides the actions and behavior of the firms inside of the inter-firm relationship. This uncertainty is based on the difficulties to predict the future actions of a partner firm as well as possible unknown purposes and hidden agendas inside the alliances (Das and Teng, 2001). This type of uncertainty mainly arises due to the unpredictable and possible opportunistic behavior of one of the partners (Sutcliffe and Zaheer, 1998).

Literature has shown that previous collaborations between firms reduce partner uncertainty because repeated interactions permit a continuous exchange of information about the partner's past behavior and intentions (Gulati, 1995; Casciaro, 2003; Santoro and McGill, 2005). Based on positive previous experiences of successful alliances, the threat of an opportunistic behavior decreases together with partner uncertainty. This leads to a decrease in the preference for more integrated forms of governance (Santoro and McGill, 2005; Gulati, 1995). The change in the choice of governance structures from high hierarchical and more integrated forms to more flexible with less explicit contractual mechanisms of control is driven by a prior collaboration between firms (Gulati, 1995). This enables firms: (1) to built inter-firm relations based more on a strong and solid trust relationships (Das and Teng, 2001; Casciaro, 2003); (2) to increase the likelihood of establishing new future ventures with the same partner or reinforcing existing alliances (Podolny, 1994); and (3) to reduce the transaction costs between firms (Sutcliffe and Zaheer, 1998).

Under higher levels of partner uncertainty, it is recognized that integrated forms of governance are preferred over equity investments and these are also preferred over non equity alliances to deal with the possible opportunistic behavior of the partners (Folta, 1998). This is considered the main motive to establish a vertical integration (Sutcliffe and Zaheer, 1998). This preference is due to the lack of a centralized administration which increases the administrative and monitoring costs in the joint activities (Folta, 1998). Following the same trend, Santoro and McGill (2005) support that under higher levels of partner uncertainty, firms use more integrated forms of governance which protect firm's capabilities against a possible opportunistic behavior of the partner. Companies whose external sources of innovation are closely related to their core competences, face a high level of partner uncertainty. Therefore, they prefer total integrated forms of governance (M&A) in order to avoid the potential opportunistic behavior of the partner regarding the disorder transference of technology (Hagedoorn and Duysters, 2002).

In order to avoid the opportunistic behavior of a partner in external technological innovations which embed shared investments in co-specialized assets (Santoro and McGill, 2005) as well as high specific assets (Sutcliffe and Zaheer, 1998), more hierarchical forms of governance such as vertical integration are preferred in order to protect and guarantee shared investments (Santoro and McGill, 2005; Sutcliffe and Zaheer, 1998).

Hypothesis:

Hp6: Higher levels of partner uncertainty lead firms to choose more integrated forms of governance such as M&A or vertical integration, discouraging the use of less integrated forms of governance such as strategic alliances.

2.4.4 TASK UNCERTAINTY

Task uncertainty has been defined by Casciaro (2003) as the capability to foresee the behavior of the elements in the task. It has also been included in the literature as part of performance uncertainty (Das and Teng, 2001), which refers to the lack of competences and capabilities of

the partner (Das and Teng, 2001) as well as its level of commitment and efforts to allocate and contribute with knowledge and resources inside of the partnership (Santoro and McGill, 2005). From this, it is possible to conclude that higher levels of uncertainty increase the likelihood that alliances fail in achieving the common goals and objectives of the partners (Santoro and McGill, 2005).

Prior studies find that task uncertainty is associated to strategic uncertainties and the activities developed inside of the alliance have strong influence in the shape of the governance structure chosen to manage the relationship (Casciaro, 2003).

Different from partner uncertainty (which is specific and characteristic for each inter-firm relationship), target uncertainty is present in all strategic relations (Das and Teng, 2001) as its scope is more related to the nature of the activities and their functional base in order to reach specific objectives and goals inside of an alliance (Casciaro, 2003).

This type of uncertainty increases in high technological industries like the biotechnology industry, where novel specialized technologies and the tacit nature of the knowledge transferred, make it difficult to assess a partner's competences and the quality of its collaborations (Santoro and McGill, 2005).

To manage higher levels of task uncertainty, more integrated and hierarchical forms of governance are used in order to increase the control and reduce contracting and monitoring costs of alliances (Santoro and McGill, 2005). The preference for more hierarchical forms of governance is more salient when higher levels of task uncertainty are mixed with the development of assets co-specialized investments (Santoro and McGill, 2005). Integrated forms of governance reduce the threat of wrong allocation of strategic knowledge (Santoro and McGill, 2005).

Prior cooperation reduces the level of task uncertainty because partners with past experiences could better define their roles, contributions and performances inside of the relationship (Santoro and McGill, 2005). This, at the same time, reduces contracting costs because partners could anticipate possible differences by informal mechanisms (Santoro and McGill, 2005).

Hypothesis:

Hp7: Higher levels of task uncertainty affect positively the choice of more integrated forms of governance such as M&A, discouraging the choice of less integrated forms of governance such as strategic alliances.

2.5 CATEGORIZATION OF INTERACTIONS BETWEEN GOVERNANCE MODES

Given the positive impact that alliances have on firm performance (Anand and Kahnna, 2000), based on the abnormal returns and the growth in revenues that firms can obtain from their alliances (Duysters et al. 2004), it is important to identify and manage the sources of these positive effects not only at the alliance level but also at the portfolio level. This is such also considering the interactions that could exist among alliances inside of a portfolio. It is argued that the features of the portfolio drive the improvements on a firm's financial and innovation performance (George et al. 2001).

Synergies and diversification are two salient effects as a result of the existing correlations among governance modalities inside of an R&D alliance portfolio (Mahnke and Overby, 2005). Similar than financial portfolios, in which the outcome correlations are used with the aim of reducing return variability, managing alliances portfolios pursue to look for outcomes correlations between alliances in order to reduce risks and get synergies (Mahnke and Overby, 2005; Sabidussi et al. 2008). Previous studies revealed that these correlations were not considered by decision makers who established external partnerships, building an alliance portfolio consisted of different forms of governance haphazardly selected (Mahnke and Overby, 2005; McKinsey, 2002). However, nowadays, given the potential benefit of these effects on the firm's performance and their positive influence on the creation of a firm's competitive advantages (Dyer et al. 2001), the administration of an alliance portfolio has turned into an important area of interest at top corporate strategic management level (Hoffmann, 2005). Under this perspective, some companies have created a "dedicated strategic alliance function" (Dyer et al. 2001) which is in charge of the inter-coordination among alliances and their orientation in line with the firm's top corporate strategies (Dyer et al. 2001).

2.5.1 SYNERGIES

Synergy is an effect that appears when the application of one strategy positively enhances the performance of other strategies raising their marginal return (Belderbos et al. 2006), which is bigger than the obtained from any single collaboration (Mahnke and Overby, 2005). Depending on the number of collaborations and the type of governance used to manage these partnerships, the synergistic effect among collaborations could be diminished by the increasing monitoring and coordination costs and difficulties to properly establish the property rights on the outcomes (Belderbos et al. 2006).

Synergies between firms are created by the interconnection of their activities or the complementation of their assets (Sabidussi et al. 2008). This effect could be achieved in two ways: (1) by establishing several collaborations with a specific partner such as Disney and HP alliance, which successful prior collaborations make it possible to establish in 2003 a long term

strategic alliance in order to develop R&D technology projects (Mahnke and Overby, 2005); or (2) by combining alliances with different partners, like the simultaneous collaborations established by DoCoMo with Sony and SEGA, in order to complement their resources with the aim of developing new capabilities (Mahnke and Overby, 2005).

2.5.2 DIVERSIFICATION

Diversification is another effect obtained by the interaction of cooperative agreements within an alliance portfolio. It is achieved when firms establish simultaneous unassociated and dissimilar relationships (Sabidussi et al. 2008). Previous studies show that diversification through M&A has been used by companies as a strategy to face exogenous uncertainties related to unexpected technological changes (Reed, 1986). Moreover, it also has been used to support growth schemes when the current technology has reached the last stages of its technology life cycle (Reed, 1986).

The reduction and sharing of uncertainty in R&D is one of the main reasons to establish alliances with external partners in high-tech firms (Hagedoorn, 1993). Therefore, diversification as a means to reduce and share risk by an appropriate combination of alliances, helps to reduce the risk of the overall portfolio (Mahnke and Overby, 2005). Previous studies show that this effect is focused on the reduction of exogenous uncertainties (mainly technological and market types) (Mahnke and Overby, 2005; Sabidussi et al. 2008).

2.6 EFFECTS OF INTERACTIONS ON THE CHOICE OF GOVERNANCE MODE

2.6.1 INCREASING RETURNS THROUGH SYNERGIES

When identifying and exploiting synergies between alliances at a portfolio level; firms can increase their returns by the creation of relational rents (Mahnke and Overby, 2005; Dyer and Singh, 1998). A synergistic effect is enhanced by more similar R&D alliances (Mahnke and Overby, 2005). R&D alliances between firms which are far distant regarding the firm's capabilities, involve high levels of market and technological uncertainty but also great opportunities to learn new competences (Mahnke and Overby, 2005). However, under this situation, the synergistic effect between alliances could be diminished (Mahnke and Overby, 2005). Therefore, a balance between synergies and uncertainty is required in order to take advantage of positive and negative correlations between alliances (Mahnke and Overby, 2005). In this context, firms which are closely related in their products, markets or technologies, pursue establishing alliances in order to obtain: (1) control of a technology; (2) access to markets; and (3) achieve synergies of scope and scale (Wilcox et al. 2001).

2.6.1.1 SYNERGIES FROM SPECIFIC PARTNER

Synergies could be obtained from new collaborations or long term relationships as the result of successful prior collaborations with the same partner (Mahnke and Overby, 2005; Dyer and

Singh, 1998). Previous experiences could pave the road to establish new alliances in order to develop new business opportunities (Mahnke and Overby, 2005).

Trust relationships build up from repeated valuable cooperation allow the development of inter-firm routines (Dyer and Singh, 1998) or specific patterns of interaction (Mahnke and Overby, 2005) which could guide partners to more efficiently solve the occurrence of unforeseen inter-firm conflicts (Mahnke and Overby, 2005). At the same time, inter-firm routines permit the more efficient transfer of knowledge and the development of a partner-specific absorptive capacity (Dyer and Singh, 1998) which offers a synergistic advantage in the establishment of diverse R&D collaborations (Dyer and Singh, 1998; Mahnke and Overby, 2005). Partner-specific absorptive capacity improves the transference and assimilation of tacit knowledge and know-how, enhancing the application of this knowledge in the development of mutual beneficial projects with commercial purposes (Dyer and Singh, 1998).

Synergies are also obtained by the development of specific asset collaborative investments (Dyer and Singh, 1998). Investments in the development of human resources dedicated to specific partners which pursue to learn about partner's activities, systems and procedures, increase the transaction of specific knowledge-reducing communication problems (Dyer and Singh, 1998). Similarly, co-investments in fixed assets such as the construction of specific facilities or specialized machinery are synergistic efforts with the aim of reducing stages in the transference of products and increasing the product's quality standards and differentiation (Dyer and Singh, 1998). The commitment to these mutual benefit investments has a synergistic effect which increases the returns of the firms involved in the relationship enhancing their performance (Dyer and Singh, 1998).

Another source of synergies is the combination of complementary assets and resources between partners (Sabidussi et al. 2008), which is considered a crucial source of abnormal returns (Dyer and Singh, 1998). The lack of specific resources, competences or capabilities which are required by firms to complement their products or processes are one of the main reasons to establish alliances (Hagedoorn 1993). The results of the combination of complementary capabilities give firms products or processes with a competitive synergistic advantage hard to imitate by competitors and difficult to accomplish by each firm working separately (Dyer and Singh, 1998). In this context, firms which are closely related in their products, markets or technologies are interested in combining their assets and resources, establishing alliances in order to obtain control over a technology, access to markets, and achieve synergies of scope and scale (Wilcox et al. 2001). Moreover, the synergistic effect obtained by the combination of the research capabilities of US biotechnology firms and the market-knowledge capabilities of their partners abroad has been the reason to establish international strategic alliances in this industry (Dyer and Singh, 1998). Following the same trend, the total integration of Air France and KLM generated synergisms achieving an important market share in the North American market, by the complementation of resources based on previous alliances that each of them possessed (Sabidussi et al. 2008).

Synergies obtained by the development of several collaborations with a specific partner, involving specific asset co-investments or the combination of complementary resources, are not only difficult to imitate, but are also not easy to obtain (Dyer and Singh, 1998). These synergies emerge from trust relationships based on previous successful alliances (Mahnke and Overby, 2005). The strong relations are built on repeated interactions between firms, requiring considerable time to take place (Dyer and Singh, 1998) and including coordination in operational activities and the harmonization of “information and control systems, decision process and culture” (Dyer and Singh, 1998).

2.6.1.2 SYNERGIES FROM SEVERAL PARTNERS

Besides synergies that could be obtained combining and sharing resources and knowledge with a specific partner, the establishment of simultaneous alliances with different partners in similar or complementary fields is also a source of synergies (Mahnke and Overby, 2005). In fact, coexistent alliances with different partners promotes the development of learning capabilities increasing a firm`s absorptive capacity (Cohen and Levinthal, 1990) which converges in a strategic relational advantage to manage alliances and to absorb partner`s knowledge (Mahnke and Overby, 2005). Firms which have developed learning capabilities by their previous collaborative experiences are better prepared to take advantage of their current cooperative relationships by learning faster and more efficiently than firms which do not have those capabilities (Dyer and Singh, 1998).

On the other hand, linking and sharing knowledge and technologies from different partners permits firms to increase their expertise level in a specific field, obtaining strategic know-how, which enhances innovations and which is difficult to achieve in a single relationship (Mahnke and Overby, 2005). In this context, firms embedded in learning networks have a competitive advantage to develop innovations considering that the most salient source of innovative ideas and knowledge are their partners inside of the network (Dyer and Singh, 1998).

These synergies are salient in industries like biotechnology in which the development of innovations involves different kinds of organizations, complementing their capabilities in order to achieve new technologies (Dyer and Singh, 1998). In this industry, innovations are the result of cooperative agreements among institutions instead of individual isolated efforts (Powell et al. 1996). Similarly, technological alliances in the telecommunication industry are basically developed with several partners in related fields looking for synergies with the aim of obtaining new technological innovations (Wilcox et al. 2001).

2.6.2 REDUCING RISK THROUGH DIVERSIFICATION

When setting an alliance portfolio by establishing multiple alliances simultaneously, companies pursue to manage the risk reducing the exogenous uncertainties, while at the same time increase their returns obtaining the required resources and capabilities from their partners (George et al. 2001). In this regard, dividing the R&D financial resources in several

collaborations diminishes the total risk at portfolio level (Mahnke and Overby, 2005). At the same time, any negative change in one individual alliance could be cancelled by a positive result of others relationships. Not all the outcomes of a firm expected from their external partners are based on a single alliance (Mahnke and Overby, 2005).

Based on previous studies, there are two kinds of uncertainties that are reduced by risk diversification: 1) technological risk and 2) market risk (Mahnke and Overby, 2005).

2.6.2.1 TECHNOLOGICAL RISK

Establishing alliances with several partners is a way to reduce the technological risk related to the adoption of a technology with an uncertain value (Mahnke and Overby, 2005). The quick technological changes and short technology life cycles, mainly in high tech industries, bring out a continuous race among new emerging technology which competes with existing technologies in order to become the dominant design of the industry (Roberts and Liu, 2001). Technological uncertainties/risks arise in the lack of information about which could be the winner of this race as well as the lack of knowledge about the sufficient and superior partner's capabilities available to conduct the creation of a valuable technology (Mahnke and Overby, 2005). Companies confronting these uncertainties divide their R&D budget in various alliances, establishing multiple collaborations with different partners in order to develop and acquire new technologies (Mahnke and Overby, 2005). In this way, companies keep open their access to emerging technologies and at the same time diversify among their partners the technological risk of being involved in worthless technology (Mahnke and Overby, 2005). In turbulent environments this strategy allows firms to expand their explorative investments in a broader range of technological competing fields reducing the risk to be limited to only one field with uncertain value creation (Van de Vrande et al. 2009). Companies like Microsoft and Intel follow this strategy establishing small equity investments in start-up companies in order to catch a wide range of market opportunities instead of making a particular investment in a single prominent one (MacMillan and McGrath, 2002).

The allotment of a small portion of the R&D budget in risky alliances, focused on keeping open the access to novel and emerging technologies, diversifies and reduces the risk at portfolio level when these technologies belong to different technological cycles from the current technology that firms exploit (Mahnke and Overby, 2005). However, extensive explorative investments on new technologies could guide the firms to confront the excess of information reducing their absorptive capacity to catch the knowledge from their partners and affecting negatively their value creation (Ahuja and Lampert, 2001).

2.6.2.2 MARKET RISK

Market risk refers to uncertainties concerning the demand and price that the customers are requiring and willing to pay for a certain product or technology (Mahnke and Overby, 2005). These uncertainties also are related to how effectively a new product or technology with even

better performance than the competitor's technology is introduced into a desired market which does not know the new technology (Mahnke and Overby, 2005). High technological industries consist of turbulent environments with fast technological changes and involve a high market uncertainty. Therefore, establishing alliances with several partners is a way to reduce the market uncertainty increasing the probability of the successful introduction of a new technology into a desire market (Mahnke and Overby, 2005).

CHAPTER 3. MATERIALS AND METHODS

3.1 INTRODUCTION

This study consists of a theoretical and an empirical research. The theoretical research is based on a literature review which has been developed in the second chapter of this document. It explains the theoretical framework of the study on how different uncertainties affect the decision to choose a governance structure to manage external technological innovations. This chapter specifically explains the methodology used to carry out the empirical research which is based on interviews conducted to decision makers who are in alliance management positions. The section 3.2 presents the research strategy followed in the study. The next section explains the research methodology used including the interview strategy and a detailed analysis of the interview protocol concerning the purpose and contribution of each question to the objectives of the study. Section 3.4 explains the data sample, including the selection procedure of the companies and a description of them. To finish the chapter it is the last section (3.5) explaining the methodology used to analyze the data.

3.2 RESEARCH STRATEGY

This section introduces the strategies that this study follows in order to obtain the information that will be used to answer the research questions. The choice of a research strategy is decided, taking into consideration the nature and features of the topic, the purpose of the study and the limiting time framework in which the research is conducted.

A qualitative approach is chosen to carry out this study considering that the interpreting approach (Verschuren and Doorewaard, 2005) better fits with the nature of the subject. This is considering the qualitative features of the managerial practices that decision makers follow to choose a governance structure. A quantitative approach is not selected based on the lack of quantitative information and the difficulties to obtain it from the companies.

A small scale approach is chosen and conducted in order to gain more in depth than in breadth knowledge and comprehension about the uncertainties and their effects on the choice of organizational structures. This choice is based on the advantages that this size of the approach offers with the aim of achieving knowledge with small number of uncertainties (Verschuren and Doorewaard, 2005). At the same time, it allows an exploration within more detail of the insights, complexity and foundations of the managerial aspects under study, although the results could be only be generalized in a limited extension.

Considering the purpose of this research and the complexity of the topic, a theoretical as well as an empirical perspective are required. This, with the aim of obtaining a clear understanding of the theoretical as well as empirical background behind the managerial practices applied in

strategic business decisions. In this context a desk research and a case study are the two research strategies selected in order to gain in depth knowledge about the topic as well as to cover it from a theoretical and an empirical perspectives.

The desk research as is defined by Verschuren and Doorewaard (2005) is a type of research which is conducted literally behind a desk. It is based on the existing literature and previous studies done by others researchers. In this investigation a desk research is carry out in order to build the theoretical framework of the study and from this perspective the background information of what is already known regards to the topic and the managerial aspects, from literature, currently used by decision makers. This is done by an extent literature review of existing studies published in scientific journals, monographs and books concerns to management and innovation. It is developed in the second chapter of this document.

Given the newness of the topic reflected in the small number of scientific studies focused on uncertainties as decision criteria to choose organizational structures to manage external innovations, this study takes also into consideration scientific studies which explore different than uncertainty criteria as motivation to decide for a governance structures.

A case study as is defined by Cooper and Schindler (2001) and Saunders and co-authors (2003) involves an empirical exploration of a phenomenon considering its real conditions, allowing to achieve an in depth analysis with a small number of events. For the purpose of this research, the case study operated by an interview allows the researcher to dig in the sources, motives and considerations in which decision makers based their decisions. Therefore, it permits to gain a profound insights from an empirical perspective about the current managerial practices which are used in the decision making process. At the same time, this type of research strategy is most used to obtain deep insights of a phenomenon which have limitations regarding time and space (Verschuren and Doorewaard, 2005) like is the case of this study. A survey is not considered because the study is more in depth and qualitative than in breadth and quantitative. In the same context, the information required is not as accurate and explicit as that which could be obtained by a survey. Therefore a semi-structured interview face to face or by telephone was conducted to companies' executives who manage firm`s alliances portfolios.

3.3 RESEARCH METHODOLOGY

In this section of the chapter, it is explained the methodology used to carry out the empirical, qualitative case study. This include: 1) a detailed explanation of the motives to choose an interview as a tool to gather the data, and the strategy used to obtain the information (3.3.1) and 2) a detailed explanation about the questions of the interview protocol regards to their purposes and the link of the information with the research questions (3.3.2).

3.3.1 INTERVIEW STRATEGY

As it is explained in section 3.2 the empirical data of this research is collected by an interview conducted to companies' executives who manage firm's partnerships portfolios. This methodology is chosen to obtain the data, based on the nature of the assessed variables. This is regarding to the difficulties to separate the effects of each variable and formulate close questions which could be organized in a questionnaire and send to the companies in order to be self-administered. Therefore, a face to face or telephone interview is chosen in order to guarantee the extraction of a detail and in-depth information about the current managerial practices used to decide for governance modalities to manage external sources of innovations.

The interview is semi-structured consisting of open questions and close questions. The open questions has specific purposes but at the same time, they give the opportunity to the respondent to develop his/her answers, which could be complemented with additional questions made by the interviewer with the aim of assuring the quality of the information (Cooper and Schindler, 2001.) The close questions have a fix answers based on a numerical scale, from 1 to 7 which is used to acknowledge the features of the company in front of specifics aspects. These questions also include answers with are specific quantitative information of the firm (i.e. the number of employees that the company have) or they are bounded to specific choices in a multiple choice options as well as a ranking format.

In order to prepare and conduct the interview, relevant information of each company was obtained by consulting their respective websites and by reviewing their annual reports available also in their website. The interviews took place between July 16th and August 15th of 2009. The elapsing time of each interview was approximately 1 hour. The interview was recorded on an MP3 player after the respondent agrees to be recorded. Afterwards a script of information based on the audio record was written and it was sent to the respondent with the aim of obtaining his/her acceptance concerning to the content of the interview. The respondent was free of add, reduce or modify the information given, and he/she sent back the script with the corrections in order to begin the analysis of the information.

3.3.2 INTERVIEW PROTOCOL

A semi-structure interview was developed based on a previous interview schedule developed in the Management Studies Group by Anna Sabidussi, Harry Bremmers and Onno Omta. Small additions were made based on the theoretical framework. This results in a final interview protocol which was used to gather the information (Appendix 1)

The interview protocol consists of 4 parts as follows:

- Part A: General information about the company and its innovation profile
- Part B: Specific information concerning to the motives to establish external relationships

- Part C: Specific criteria to choose different forms of organizational structures
- Part D: Specific information regarding the decision making process assuming specific circumstances (Cases)

3.3.2.1 PART A: GENERAL INFORMATION ABOUT THE COMPANY AND ITS INNOVATION PROFILE

This section of the interview protocol is a description of the company and its innovation profile. These questions pursue to extract relevant information which will be used to categorize the companies by its innovation features in order to establish a contextual framework and parameters to make a comparative analysis.

A1 and A2: The total number of employees (A1) which work in the company as well as those who works specifically in the R&D (A2) give a contextual information regarding the amount of resources firms invest in internal human capital with the aim of developing innovation. Answering these questions the respondents give a broad idea about the level of innovativeness of the firms and the possible sources of their innovation (internal vs. external). A firm with a small number of employees working in R&D with the respect to the total size of the firm could imply a low level of innovativeness and/or probably high dependence of external sources of innovation.

The next questions are closely related between each other. In both cases the aim of the questions is to categorize the level of innovativeness from the strategic and competitive perspectives in the firms.

A3 and A4: The third question intends to define the company regards on how important innovation is perceived to firm`s competitive success. The level of importance is linked with how much firm`s competitive success depends on innovation. A higher level of importance implies that the firm could face high levels of exogenous uncertainty (**Hp 1, 2 and 3**) when the source of innovation is internally and high level of exogenous and endogenous uncertainties when pursuing to achieve innovation externally (**Hp 1, 2, 3, 4, 5, 6, and 7**).

The fourth question aims to categorize the firms concerning how much of their strategic orientation is based on the development of innovations. A high score regarding the level of innovativeness shows that companies intend to create or develop innovation and consequently, they face higher levels of risk from all types of uncertainty regarding the success of their entrepreneurs. These companies are more risk takers than risk adverse. A low score indicates that the strategic orientation of the company is more based on the application of innovations developed by others and it is not based on the development of innovation. In this sense these companies are more risk adverse than risk takers, facing low levels of risk when developing their innovation (**Hp 1, 2, 3, 4, 5, 6 and 7**).

A5: This question aims to identify the type of strategic orientation which is followed by the company in order to develop their innovation. Strategic orientation based on customer intimacy implies that these companies face higher levels of endogenous uncertainties than firms following the other strategic orientations. This is because, the origin of this type of uncertainties are inside of the inter-firm relationships.

A6, A7 and A8: These 3 questions are related to the size and market features of the firms and the industry in which they are involved.

Questions 6 and 7 are related to market features of the company, while question 8 is focused on industry features. These questions have a contextual base in order to their market geographic influence (A6). Question A7 pursues to identify the origin of the competitors and question A8 intends to categorize the competition level of the industry in which firm operates. These questions offers important information concerning how turbulent is the environment of the industry; therefore, it is also related to the level of environmental, and market uncertainty that surrounds the firm (**Hp 1 and 3**). Firms which are at global level regarding their sales and competitors with high level of competition in their industries face higher level of environmental and market uncertainty when developing innovation than firms with local sales and local competitors.

A9: This question is aiming to identify the firm`s source of innovation. This is done by dividing the possible origins in two groups: internal and external. Internally there is only one category referring the development of innovation exclusively in-house by the R&D department. From the external category, there are three sub-divisions referring to the grade of financial investments that the firms devote to develop or acquire innovations with external partners. Non equity alliances include any kind of contractual agreement without any financial investment in the partner company. Joint Ventures involve any equity alliances in which firms could make an investment buying part of the equity of other company or setting up a new company in which the investment and participation could be equal or less than 50% of the shares of the new company. M&A implies the acquisition or merge of one company by other in which the acquirer company takes over the acquired company completely. M&A implies higher levels of exogenous and endogenous uncertainties than JV and non-equity alliances (**Hp. 1, 2, 3, 4, 5, 6 and 7**). At the same time JV implies higher levels of uncertainties (**Hp. 1, 2, 3, 4, 5, 6 and 7**) than non-equity alliances or internal development. Internal development could involve high or low levels of exogenous uncertainty but this source of innovation is not influenced by any endogenous uncertainty (**Hp. 1, 2 and 3**)

3.3.2.2 PART B: SPECIFIC INFORMATION CONCERNING TO THE MOTIVES TO ESTABLISH EXTERNAL RELATIONSHIPS

This subsection aims to categorize the main motives to establish partnerships which pursue to obtain external innovations. At the same time, this part of the interview explores other reasons which the firm could consider in order to set up partnerships.

B1: intends to rank in a scale of importance, the main motives in which the firms could base their decision to establish partnerships with innovation purposes. These motivations are divided in technological, strategic, financial and market aspects

- Technological capabilities (B1 A)

The increasing complexity of the technology and the access to new knowledge which is crucial for the innovative value creation process is an important motivation (based on literature) that companies take into consideration in order to establish partnerships. In this sense this motive intends to assess in an empirical perspectives if decision makers consider this aspect like the main motives to source innovations externally. This motive implies high level of technological (**Hp. 2**), partner (**Hp. 6**) and task (**Hp. 7**) uncertainty.

- Strategic motives (B1 B, B1 D, and B1 F)

The reduction of risk in internal development (B1 B), the reduction of time to market (B1 F) and the exploration of new technological opportunities or the monitoring of environmental changes (B1 D) are strategic motivations. The aim of this question is to acknowledge how important these motives are perceived and considered by decision makers when they decide to set up a partnership to develop innovation. These options are close related to the strategy that the firms follow. Motive B1 B implies high levels of exogenous uncertainties (**Hp. 1, 2 and 3**) which are shared with another firm when establishing a partnership with the aim of innovating. Motive B1 F implies high level of market uncertainty (**Hp.3**). Motive B1 D implies a strategy of the firm with the aim of accessing relevant new technology and knowledge trends.

- Financial motives (B1 C)

This option tries to assess how important the financial reasons are, specifically regarding the reduction of costs in internal development, when deciding to set up a partnership to develop innovation. Inter-firms relationships which are established based on financial reasons could imply that firms are facing higher levels of exogenous uncertainties than endogenous uncertainties. Consequently, exogenous uncertainties (**Hp. 1, 2, and 3**) are more relevant than endogenous uncertainties (**Hp. 4, 5, 6, and 7**) when deciding for external sources of innovation.

- Market motives (B1 E)

This option involved market reasons to set up external relationships to source innovations. This option intends to assess how important the entry into new product market, market expansion or internationalization is perceived by decision makers as valid motives to establish partnerships. This includes higher levels of market and environmental uncertainty (**Hp. 1 and 3**)

B2: This is an open question which tries to collect information about other motives different from innovation reasons which are considered by decision makers in order to establish external

relationships. This information permit to accomplish a specific profile of the company regarding the types of partnership in which the firms are involved.

3.3.2.3 PART C: SPECIFIC CRITERIA TO CHOOSE DIFFERENT FORMS OF ORGANIZATIONAL STRUCTURES

This section of the interview protocol refers specifically to the motives and criteria which are considered by decision makers when choosing between internal and external source of innovation and the organizational structure which is preferred when the choice is an external source of innovation.

C1: This question aims to categorize the importance of the motives to choose between internal development and external sources of innovations (alliances or M&A). In alliances are included from non equity until equity alliances.

The motives are divided into internal and external firm`s factors as well as strategic and financial aspects which affect the decision to choose between internal and external sources of innovations.

- External firm factors:

External motives involves technological and markets aspects, which are indirectly related to the dynamics of the environment in which the firm is embedded. These aspects are: 1) the risk connected to the technology at process and product levels (**C1 C**) and 2) the risk connected to the market concerns to product differentiation and the business model of the companies (**C1 D**). The first is directly related to the environmental and technology uncertainty (**Hp 2**) and the second is related to the market uncertainty (**Hp 3**). Higher levels of importance in both aspects indicate a high level of environmental uncertainty (**Hp 1**).

- Internal firm factors

In the other hand, internal aspects are considered in the grade of confidence and trustiness in the partner attitudes and intentions (**partner uncertainty Hp 6**) concerning the control over the developed technology (**C1 A**) and concerns to the past experiences based on previous relationships with the same partner (**information asymmetry Hp 4**) (**C1 G**). In this context also the grade of cognitive distance of the partner concerns to the core competence of the investing firm is evaluated (**C1 B**) (**technology distance Hp 4**). The decision to choose a source of innovations based on the existing portfolio of alliances it is also considered in motive **C1 H** with the aim of assessing the use of the dynamic portfolio reasoning.

There are also included in this question strategic (time to market, **C1 F**) and financial (cost reduction, **C1 E**) motives to develop innovation internal or externally. The first is related specifically to high levels of market uncertainty (**Hp 3**), while in the second motive, exogenous uncertainties are more relevant (**Hp 1, 2 and 3**) than endogenous uncertainties when deciding

for a source of innovation (internal vs. external). At the same time, the aim of this question is to assess in what extent this motives influence the decision to choose more or less integrated forms of governance (alliance vs. M&A).

C2: This question refers to the management of the portfolio of external partnerships. It seeks to assess how often is monitored the composition of business relationships with the aim of acknowledge if managers apply the dynamic portfolio reasoning in their decision making process. This is concerning the periodical analysis of the composition of firm`s portfolio of partnerships under an specific schedule in which it is analyzed the evolution of the partnerships on time based on a global portfolio perspective.

3.3.2.4 PART D: SPECIFIC INFORMATION REGARDING THE DECISION MAKING PROCESS ASSUMING SPECIFIC CIRCUMSTANCES

Given the difficulties to make structured questions due to the complexity of the relationships among uncertainties and the impossibility to isolate the effect of each of them, this subsection is composed of open questions which intends to assess the effect of each source of uncertainty limiting as much as possible the effect of the others. This is done by given to interviewees specific assumptions in hypothetical situations which allow to asses each uncertainty individually avoiding bias produced by the influence of other uncertainties. At the same time, this format of questions (cases) gives the freedom to the respondent to develop completely he/she answer offering a detailed explanation regarding in what extent each condition is considered in the decision making process in order to choose an organizational structure.

D1. The first set of questions D1 are referred to the following set of assumptions which are kept constant in all the questions evaluated inside of the first item D1. This is in order to isolate the effect of each uncertainty. In this sense, the effect of exogenous uncertainties like technology and market aspects and the endogenous uncertainty concerning partner and task aspects are kept constant. At the same time, the motive to establish the external partnership in this case the modification or innovation of an existing product is kept constant.

D1.1. The purpose of this open question is to determine which other factors could affect the decision to do the innovation internally if all source of uncertainties are covered with the exemption of: environmental uncertainty (**Hp 1**) and the technological distance of the partner (**Hp 4**).

D1.2. This question assumes that the respondent has accepted the external partnership given the conditions previously explained. In this sense the purpose of this question is to assess which kind of organizational structure will be choose to manage the partnership and based on the answer assess which uncertainties and in which way could affect the decision to choose more or less integrated forms of governance.

D1.3. This question intends to assess if the decision to choose the previous organizational structure is influenced by other existing governance modalities in which the companies are involved, assessing indirectly the empirical use of the dynamic portfolio reasoning.

D1.4. The aim of this question is to assess the lack of knowledge about the technology which will be used to make the innovation (**technological uncertainty Hp 2**). In this sense, keeping constant market factors and partner confidence factors, the respondent will take into consideration only the technological aspect in order to take a decision. This decision will be guided to know until what extent the lack of knowledge regards to the technology uncertainty (exogenous uncertainty) affects the decision to establish an external source of innovation and the partnership modality.

D1.5. This question intends to assess the effect of the unknown market conditions giving a high level of market uncertainty (**market uncertainty Hp 3**). This assumption will guide to the respondent to decide if he/she will hold his/her decision to seek external sources of innovation and the type of organization structure to manage this relationship.

The next questions seek to assess exclusively the endogenous sources of uncertainty regards to partner aspects like its nature, its own relationships and the lack of previous experiences with the potential partner.

D1.6. This question assess the influence of the nature of the partner in the decision to establish a relationship with the aim of obtaining innovation and the organizational structure used to manage the relationship. Establishing a partnership with a competitor implies high level of risk regarding 1) the behavior of the partner (**partner uncertainty Hp 6**), 2) the inaccessibility of partner's crucial information (**information asymmetry Hp 5**) and 3) the looseness of confidential information of the investing firm due to the closeness to its core capabilities (**technological distance Hp 4**). Inter-firm relationships in which are involved a supplier or a customer implies lower levels of risk regarding the previous sources of uncertainty than a relationship with a competitor.

D1.7. The aim of this question is to find to what extent could be affected the decision of starting a partnership and the choice of a specific partnership modality, considering the threat or the potential damage that a firm could face due to the flow of confidential information to a competitor. This is based on the fact that the potential partner is already involved in a direct or indirect competitor of firm's respondent. An unpredictable behavior of the partner implies a high level of partner uncertainty (**partner uncertainty Hp 6**) and high level of risk regarding the success of achieving the goal of the partnership (**task uncertainty Hp 7**). This question also pursues to determine the accessibility and availability of information regarding the verification of partner's portfolio of alliances before making a decision of building the partnership. The lack of access to relevant information implies a bigger information asymmetry between firms and

consequently a higher probability of failure establishing a partnership (**information asymmetry Hp 5**)

D1.8. The last question of this section aims to assess if the lack of prior experiences with the potential business partner could affect the decision to establish the partnership and indeed, if this affects the type of organizational structure chosen to manage the relationship. The unpredictable behavior of the partner because of the lack of prior cooperation and the uncertainty regarding the reliability of its technological expertise imply high level of partner and task uncertainty (**Hp 6 and 7**)

The next set of questions (D2-D6) leave open the possible answers regarding the type of uncertainties influencing the choice of a specific organizational structure and the way in which they affects this decision. In this sense, each question has a different scenario regarding the goal of each inter-firm relationship and its level of uncertainty.

D2. This question refers specifically to the motives based on the developing of a radical new product. Based on literature, the development of radical new product or technology is a high uncertain scenario mainly because of exogenous sources of uncertainty (**technological Hp 2, market Hp 3, and environmental Hp 1**). The aim of this question is to assess if this group of uncertainties affects the decision to choose an external source of innovation and the choice of a partnership modality.

D3. This question assesses the establishment of a partnership based on the motivation of entering into a new market with an existing product. This question considers a high level of market uncertainty (**Hp 3**) assuming the lack of knowledge about the new market conditions.

D4. In this question the main motive to source innovation internal or externally is the development of a new process. In this case, the levels of technology uncertainty (**Hp 2**) could be higher than the other sources of uncertainty.

D5. This question assesses financial aspects of the innovation specifically in a higher development cost scenario. The aim of this question is asses in what extent a higher development cost affects the decision to choose between internal and external source of innovation and which kind of uncertainties are considered in order to decide for an specific kind of governance (**Hp 1, 2, 3, 4, 5, 6 and 7**).

D6. The reduction of time to market is a strategic motive when choosing between internal and external source of innovation. This question pursues to identify which uncertainties are relevant in this scenario and their effect in the choice of a specific kind of organizational structure (**Hp 1, 2, 3, 4, 5, 6 and 7**).

3.4 DATA SAMPLE

The process of data collection is a very important success factor in the development of a research because on it is base the validity and reliability of the results, conclusions and recommendations which could be obtained by the researcher. Therefore, the choice of the sample which represents the population is the first step to consider.

In this section of the chapter it is included: 1) the selection procedure followed to choose the companies which are part of the study (3.4.1) and 2) a description of each company (3.4.2).

3.4.1 SELECTION PROCEDURE OF THE SAMPLE

3.4.1.1 SELECTION CRITERIA

Taking into account that this study involves an empirical analysis of the influence of uncertainties on the decision making process, theoretically all companies which possess an alliance portfolio or hold external relationships with innovation purposes, could be part of this research. Being this the most important criteria to choose the companies which could participate in the study. However, in order to avoid the effect of the type of industry in the data analysis, the study is focused specifically in chemical, biotechnology and agro-food industries. Criteria different from the explained previously like i.e. the firm size, is taking into consideration to analyze the information but they are not so relevant to choose the company that could be part of this research. This is because i.e. in the biotechnology industry there are many star up's companies which are small in size but they have many inter-firms relationships as consequence of the dynamic environment of the industry in which they are embedded. The geographical localization of the firms was not criteria to choose them with the aim of participating in this research, however by chance, most of the firms are located in The Netherlands.

3.4.1.2 SELECTION PROCEDURE

Given time restrictions, a letter of invitation with a brief explanation about the research and its purpose was sent to executives, in alliance management positions, of 40 firms. The firms was chosen from: 1) databases available in internet, (www.transnationale.org and www.biotechnology-europe.com), 2) personal contacts of professors of Wageningen and information found in prior studies developed in the Management Studies Group of Wageningen University and 3) personal communication established with executives of biotechnology's firms met in the BCF carrier event organized in Amsterdam on May 2009.

From 40 companies, 19 answered the invitation but only 6 accepted and confirmed their participation (6.6%). Companies were contacted more than once by email and also in some cases by phone. However, being this research a qualitative study, it is important to remark that this number of firms offers information of quality enough to carry out the research. This is, achieving an in depth view of the reasons and motivations in which the interviewee base its decisions and at the same, avoiding personal bias from the respondent. It is important to

acknowledge that companies were free to decide about their participation in this research. Therefore, the sample in which was developed the study, in part was determined by chance. Different reasons, like privacy and confidentiality (even with a confidentiality agreement), global financial crisis, and imminent re-organizations were among others the motives that companies mention in order to reject their participation in this research.

The respondents are mainly in positions as Directors of Innovation and R&D Managers. This company's positions was chosen because the respondent in this positions could answer specific questions about the topic under study as well as general questions about the firm, which is required by the research.

3.4.2 DESCRIPTION OF PARTICIPATING COMPANIES

The interviews were conducted to 6 companies of different industries. General information obtained from the interview protocol as well as data achieve from the website of each company are use to make the description of each firm in order to explain the contextual situation of each company and industry. For confidentiality reasons the name of the companies and the name of the respondent are omitted. Therefore, companies are identified by using a numerical identity. An overview of this information is in the Table 3.1.

Table 3.1 Main features of the participating companies

Industry	Total size (employees in FTE*)	R&D size (employees in FTE*)	R&D size vs. total size (%)	Strategic orientation	Sales	Competitors	Position of the respondent
Chemical	450	50	11.11	Customer intimacy	Global	Global	Research and Development Manager
Chemical	52000**	2900**	5.57	Customer intimacy	Global	Global	Strategic Controlling and Innovation Management
Biotechnology	28	19	67.85	Customer intimacy	Continental and global	Global	Chief Executive Officer
Biotechnology	2	1	50.00	Customer intimacy	National, continental and global	Global	Director
Agro-Food	1300	50	3.84	Operational excellence	Continental and global	Global	Director of Marketing and Innovation
Agro-Food	35000	30	0.09	Operational excellence and product leadership	National, regional, continental and global	National, regional, continental and global	Manager of Research and Development

*FTE: Full time equivalent

**Data for the whole firm

- **Type of Industry**

Companies represent different industries including chemical, biotechnology, and agro-food industries.

Companies from chemical industry are multinational firms which are divided in different business units. For the purpose of this study, there is considered only one of these business units which are determined by the business unit which the respondent is part of.

In one of the companies, the business unit which is part of this research represent between 75-80% of the total business of that firm, while in the other company, the business unit of that company 30% of the total business of the company.

Companies of biotechnology industry involved in this research are local start-up (high growth and technology oriented) companies, with global sales. They are involved in the development of products with applications in human medicine, pharmacology and biotechnology industries.

From agro-food industries, there are two companies which are involved in this research. One of them is a local firm which operates globally producing and delivering products based on agricultural products as raw materials, with applications in many industries. The other company is a multinational firm which has production units and sales worldwide. This company produces and delivers products based on plants and animals as raw materials, including products to end consumers as well as products with applications in different industries.

- **Size of the companies**

The size of the companies in this research is based on the total number of employees and the number of employees directly related to R&D. These criteria are used with the aim of finding the relation between the percentage of human resources dedicated to research and development of new products or process and the innovative orientation of each firm, inside of the contextual situation of each industry. Companies participating in this research vary in the size from very small local companies which are part of the biotechnology industry to very big multinational firms like those which are involve in chemical and agro-food industries (Table 3.1). In this sense, small biotechnology firms show a relative high percentage (58.9%) of human resources working directly in research and development compare with companies in chemical and agro-food fields with less than 1% in one of the cases.

For the chemical industry this percentage (8.33%) is in average relatively lower than firms in biotechnology industry but higher than firms in agro-food industry. In this sense, in agro-food industry the percentage of human resources working directly in research and development is in average 1.96%, being the lowest percentage, considering the size of the companies.

- **Strategic orientation of the firms**

The strategic orientation of each participating firms is important in order to achieve a complete overview of the essential elements that companies takes into consideration in order to make strategic decisions regarding the development of innovation.

Participating firms mainly support their strategic orientations in *customer intimacy* and *operational excellence*.

Firms which base their strategic orientation in the *customer intimacy* show a clear orientation to develop their innovations by establishing partnerships and joint developments with intermediary customers and final consumers of their products. These companies emphasize the importance of keeping good, healthy and close relations with their customers with the aim of offering them tailor-made solutions in order to enhance their performance. Besides of that, these companies also combine the customer intimacy strategy with product leadership and operational excellence depending on the corporate strategy of the firm and the type of product or technology that they want to develop or improve. This is not only because of higher rates of innovation, but also due to the necessity of consumers and customers which could test and apply their new products and technologies.

Firms which follow an *operational excellence* orientation considers that this strategic orientation ensures to match with right answers the requirements and demands of the customers, taking into account at the same time a sustained cost reduction and efficient use of financial resources, in order to achieve a cost leadership position in the market. This orientation is also related to the type of industry in which the firms are involved and the type of product that the firms want to develop or to improve. In this sense firms in agro-food industry with products in the commodity market are focused in this strategic orientation. At the same time, this orientation in some cases is complemented with product leadership orientation which is included in the corporate strategy of the firms.

- **Market structure**

In this section is described the market structure of participating firms including the market orientation of their sales, the nature and source of the competitors and the level of competition in their industries.

All the participating companies are oriented to continental and global markets. In average 68% of their total sales are at continental level, while 32% are obtained by products delivered globally. Depending on the industry in which firms are involved this percentage varies. In biotechnology industry, in average 60% of the total sales are continental while 40% are global. In agro-food industry this percentage increases to 67.5% at continental level and decreases to 32.5% at global level. In the same way, in chemical industry the percentage of sales at continental level increases to 85% while at global level this orientation decreases to 15%.

Regarding the nature and source of competitors, all companies have the same opinion concerning that the main source of competitors are at global level. In biotechnology industry,

although there is not at the moment direct competitors in the same field of technology, there are few indirect competitors who are producing similar products based on different technologies and raw materials, which are competing in the global market like substitute products. In the same sense, in agro-food and chemical industries, considering the nature of their products which are oriented to the commodity market; although the production sites of the competitors could be located at continental level, most of them are multinational companies which trade their products at global level. Given the type of products and competitors features, all the companies are involve in markets with oligopolistic characteristics, with respect to the fact that the markets are dominated by a small number of companies which possess a large percentage of the market share.

Respondents of all participating companies rank the competition level in their respective industries with a high level of importance. However this answer differs in the source of this competition. Some respondents based their answer basically because their products are oriented to commodity and consumer goods markets. In this sense their products include raw materials or low value added products made and traded globally by competitors which manage economies of scale. Therefore, these companies are embedded in turbulent industries involving products with low profit margins and a continuous competition at price level.

Other respondents consider that although they do not have direct competitors in their specific technologies, they compete for financial funds and market share with other companies which made substitutive products. Also other respondents considers that although there is a high competition level in order to increase market share, direct competitors are willing to lose part of the volume of their sales even in economical recession periods; before to decide competing at level price.

- **Position and experience of the respondents**

Most of the respondents are in positions of R&D and innovation management with responsibilities bounded by specifics productions sites, business units or geographical regions in which the firms are divided. Therefore, considering the size of some of the companies and their internal organizational structures, in most of the cases the information obtained is also restricted to the specific position of the respondent and the business unit which the respondent belongs to; excepting biotechnology firms in which the respondents were the top management executives. In all companies the experience of the respondents is of at least 2 years in their actual position with a maximum of 14 years of experience.

3.5 DATA ANALYSIS

Through the interview conducted to decision makers of participating companies, based on the interview protocol (described in section 3.3.2.), specific as well as general information about each firm was collected. This information includes: 1) data concerning companies innovation profile, 2) data about specific motivations to choose external sources of innovation, 3) specific

information about the factors which are considered in order to decide for a type of governance, and 4) detailed information about the effect of uncertainty factors in the choice of external or internal sources of innovation as well as in the choice of a specific kind of partnership.

The interview protocol includes a mix of open as well as closed questions. Therefore, the data analysis will differ depending on the type of the question. Closed questions which answers include a numerical scale as well as a ranking of importance are analyzed using descriptive statistics. This is done by obtaining the average score of each question for the whole sample. Open questions which consist of an explanatory answer will be analyzed by doing a case study description. This description complements the results obtained by the closed questions and explains in more detail further results that it could surface. At the same time, it could give solutions to analyze controversy results.

CHAPTER 4. RESULTS

This chapter of the study includes the results of the data analysis, including the main findings obtained from the interview protocol obtained during the development of the research. It is divided in three parts. Section 4.1 and 4.2 includes the analysis of the contextual situation in which firms develop innovation and the analysis of the sources of their innovation, respectively. In both cases these results are obtained using a descriptive statistics analysis for the whole sample of the companies, including tables which summarize the findings of questions with numerical scale and those which includes a ranking of importance. The next section (4.3) consists of the case study description including the main findings obtained from the open questions of the interview protocol regarding the preference and reasoning of decision makers when they choose an organizational structure assuming specific circumstances. This chapter is the base to make further conclusions which are part of the next chapter.

4.1 FIRM'S CONTEXTUAL SITUATION

In this section of the chapter are presented the results based on a descriptive statistical analysis concerning the questions which include quantitative information regarding the contextual situation of the firms.

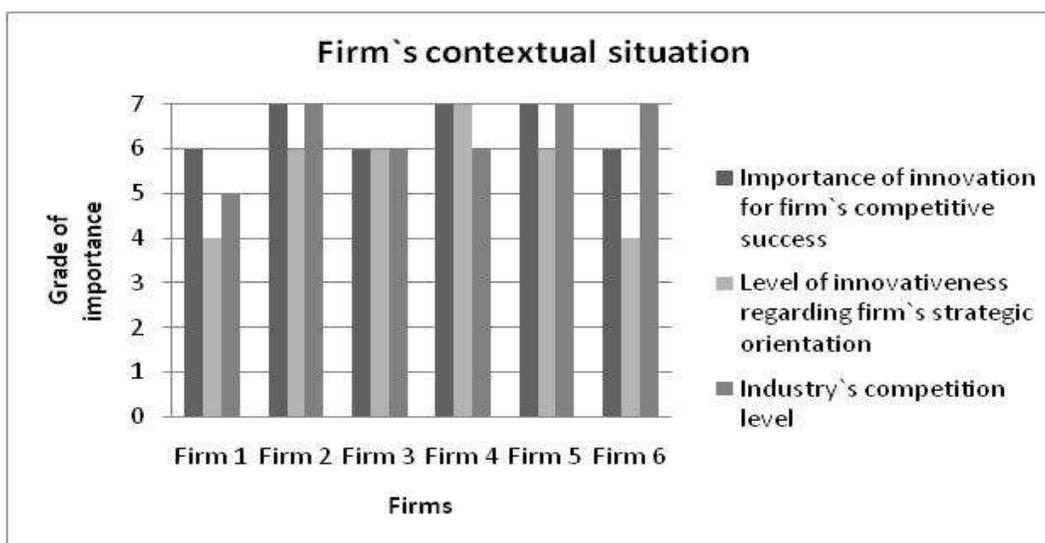


Fig. 4.1 Contextual situation per firm

4.1.1 INNOVATION AND FIRM'S COMPETITIVE SUCCESS

All firms which are part of this study answer this question, individually as well as collectively, with scores close to the highest possible level of importance. This is shown in the high average exposed in Table 4.1 and depicted in Figure 4.1 and 4.2. In this sense, all the firms considers innovation highly important for their firm's competitive success (mean of 6.5 and std. dev. of 0.55).

Question A3. On a scale from 1 to 7, with 7= very important, 4= neutral and 1= not important, how would you define the importance of innovation for your competitive success? **Mean: 6.50; Std Dev: 0.55; n=6**

# Firm	Explanation
1	Considering the global society trends regarding the use of environmental friendly products, which are imposed by law, innovation has a high level of importance for the competitive success of this firm. This is based on the increased necessity to create and develop new technologies which replace old non environmental technologies keeping at the same time the high quality standard of the existing product.
2	"Innovation has the highest priority for our firm". Therefore, the level of importance of innovation for the firm's competitive success is at the highest level
3	This firm is completely focused on research with the aim of obtaining radical innovations in firm's field of expertise. Consequently the importance of innovation for firm's competitive success is scored with a high level of importance..
4	"Our firm manufactures and sells products that are unique regarding to the technology used to develop them". Firm's products are not available in the market. Therefore, the level of innovations for the competitive success of the firm is highly important.
5	This company considers innovation very important for its competitive success. The reason behind this is the company is trying to reduce costs as much as possible and believes the only way to do this without decreasing revenues and competitive position is by having a nice innovative position.
6	Product and process innovation are very important for the competitive success of this firm. Product innovation is important in order to obtain specific and differentiated products with higher profit margin. Process innovation is important with the aim of reducing cost at production level.

Table 4.1 Importance of innovation for the competitive success of the firms

4.1.2 LEVEL OF INNOVATIVENESS REGARDING FIRM'S STRATEGIC ORIENTATION

All firms involved in this study are in or above the neutral position regarding their level of innovativeness with respect to their strategic orientation (mean of 5.5 and a std. dev. of 1.22) (Table 4.2 and Figure 4.1 and 4.2). In most of the cases, these firms are close to the highest possible level of the scale. Consistently, firms involved in biotechnology have a higher score than firms embedded in chemicals and agro-food industry. This is because biotechnology firms are ahead of competition concerning the completely innovative features of the technologies which they work with. Consequently, they show a higher level of innovativeness than firms in other industries. Firms scoring the level of innovativeness in a neutral position (4) are big companies which are consisted of different technologies and products with different levels of innovativeness, therefore with the aim of giving a valid and reliable score considering their average level of innovativeness, they decide for a neutral position.

Question A4. On a scale from 1 to 7, with 7= ahead of competition, 4= neutral and 1= follower, how would you define the strategic orientation of your firm? **Mean: 5.50; Std. Dev.: 1.22; n=6**

# Firm	Explanation
1	The firm also varies in the categorization of its strategic orientation, being <i>ahead of competition</i> in products oriented to specialties markets and <i>follower</i> in those oriented to commodity markets. Therefore, considering the whole business unit the category value of its strategic orientation is on average 4.
2	The strategic orientation of the firm is close to <i>ahead of competition</i> .
3	This firm is close to <i>ahead of competition</i> , because the firm is pioneer in the development of new novel

	innovative products in the field of personalized medicine and health care.
4	This firm is <i>ahead of competition</i> because all the products and technologies developed by the company are completely radical innovations. The products and technology are unique and the company is concentrated in this features. Therefore the level of innovativeness regarding firm`s strategic orientation is in the highest levels.
5	" <i>We are far ahead of competition with respect to our competitors</i> " This company is pioneer on the development of new products based on a continuous research in their field of expertise.
6	Innovation has an increasing importance regarding firm`s strategic orientation. In the past, this company was closer to a <i>follower</i> regarding its level of innovativeness. However, in recent years there is an increasing interest to improve the level of innovativeness of the firm by increasing R&D investments

Table 4.2 Level of innovativeness regarding firm`s strategic orientation

4.1.3 INDUSTRY`S COMPETITION LEVEL

Most of the participant companies are embedded in industries with high level of competition, but based on different sources (Table 4.3 and Figure 4.1 and 4.2). Firms with products oriented to commodity or consumer goods markets like those in agro-food and in chemical industries score the highest level of competition because the competitors are global and they compete for the lowest product prices. Industries with the lowest scores of competition are mainly because of products oriented to specific market segments with high level of product-specificity. This is based on the fact that although the competition level is high, the competitors are not willing to establish a fierce competition at price level.

Although firms in biotechnology industry don't have direct competitors concerning their core competences or technologies, the level of competition is high due to indirect competitors which manufacture substitutive products oriented to the same markets.

Question A8. On a scale from 1 to 7, with 7= very high, 4= neutral and 1= very low, how would you categorize the competition levels in the industry in which your company operates? **Mean: 6.33; Std. Dev.: 0.82 ; n=6**

# Firm	Explanation
1	The competition level of the industry is high, above the average, but quite far to highest level considering that even in periods of recession there is no competition at price level.
2	This firm is in the fast moving consumer goods industry, the level of competition and the speed of changes in the industry are very high.
3	There are many indirect competitors working in the same field of technology applications, so there is a high level of competition to obtain the financial and non financial resources in order to develop new product innovations.
4	There is a rather high level of competition from indirect competitors who manufacture substitutive products focused in the same market.
5	The level of competition in this firm`s industry is high because its main product could be obtained from different sources and most of the competitors play at global level with low production costs.
6	High part of the business of this company is based on products oriented to commodity markets. These kinds of products are characterized by their low profit margins and sometimes price governmental regulations. Therefore the level of competition in this industry is very high.

Table 4.3 Level of competition in the industry in which the firms are embedded

4.1.4 REBALANCING THE COMPOSITION OF BUSINESS RELATIONSHIPS

Most of the participating firms rebalance the composition of their business relationships when each relationship demands to make changes regarding the goals and objectives of the relationship or their organizational structures (Table 4.4). Different from firms of chemical and biotechnology industries, firms which are part of agro-food industry monitor or rebalance their business relationships more continuously. The frequency of this monitoring is mainly based on the size of their portfolio of inter-firm relationships and the continuous changes of firm's structure because of new relationships which are not only established with innovation purposes.

Question C2. *On a scale from 1 to 7, with 7= continuously, 4= sometimes and 1= on demand, how often do you monitor/rebalance the composition of business relationships? Mean: 2.66; Std. Dev.: 2.55; n=6*

# Firm	Explanation
1	In each inter-firm relationship there is established a certain period of time in which the relationship is assessed based on the achievement of the proposed tasks. There is not a continue monitoring of the portfolio of alliances.
2	The rebalancing of the composition of business relationships is done on demand. This firm has hundreds of partners and for it, there is not necessary to check the composition of the business relationships continuously.
3	Any change in the composition of firm's business relationships is done on demand, when it is required.
4	Changes in the composition of firm's business relationship are made on demand.
5	The monitoring of the composition of business relationships is continuous. Meetings are regular, in which all projects are checked and the monitoring is carried out either physically or by phone.
6	Considering the frequent changes in the industry and the internal structure of the firm, mainly due to new M&A, this firm monitors and rebalances the composition of its business relationships very often.

Table 4.4 Rebalancing the composition of firm's business relationships.

4.1.5 CONTEXTUAL SITUATION AT SAMPLE LEVEL

All participating firms of this study consider innovation as a crucial component of their competitive success (6.5 points on average in a scale with a maximum value of 7) (Figure 4.2) being innovation, in some cases, part of their firm's mission, vision and strategy. Most of the firms are embedded in highly competitive industries (6.33 points on average in a scale with a maximum value of 7) and most of them have a high level of innovativeness, being in most of the cases, closer to ahead of competition than followers (5.5 points on average in a scale with a maximum value of 7). Therefore, although participating firms are embedded in turbulent environments with high level of competition, most of the firms are willing to develop innovations showing a stronger position as risk taker than as risk averse in industries with high environmental uncertainty.

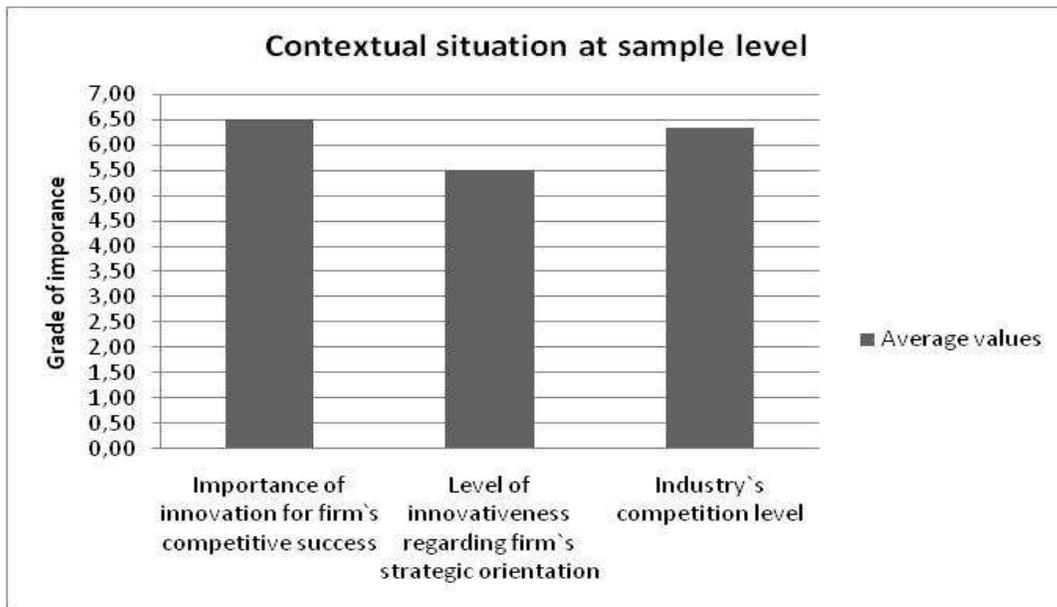


Fig. 4.2 Contextual situation at sample level

4.2 SOURCE OF INNOVATION

4.2.1 INTERNAL AND EXTERNAL SOURCE OF INNOVATION

The main sources of innovations during the last year by each firm are shown in table 4.5. All firms have established non-equity alliances as external sources of innovation but none of them has established JV or M&A for the same purposes during the last year. However, this doesn't imply that firms have not established JV or M&A with the aim of achieving innovation, in previous years than the horizon of time consider in this research. Therefore, further results regarding JV and M&A are based in that previous experience not consider in table 4.5. For firms 1, 3 and 5 in-house R&D is a very important source of innovation, while for firms 2 and 4 non-equity alliances are the main source of innovations. Firm 6 shows equilibrium between internal and external sources of innovation with the same percentage of innovation coming from in-house R&D and Non-equity alliances. There is not possible to establish a pattern by industry regarding the tendency of the percentage of innovation that comes from in-house R&D or non equity alliances because each firm inside of the same industry has different results regarding the main source of innovations.

Firm #	In-house R&D (%)	Non-equity alliances (%)	Joint Ventures (%)	Mergers and Acquisitions (%)
1	95	5	0	0
2	20	80	0	0
3	70	30	0	0
4	30	70	0	0
5	95	5	0	0
6	50	50	0	0

Table 4.5 Source of innovations of each firm

4.2.2 MOTIVES TO SOURCE INNOVATIONS EXTERNALLY

In Figure 4.3 are depicted the ranking of motives to source innovation externally. For most of the companies the most important motive to source innovation externally is the increasing complexity of technological developments and the access to new knowledge (B1A) with the highest grade of importance. Financial aspects like the reduction of costs in internal development (B1C) also have a high grade of importance when firms source innovation externally. On average internationalization (B1E) and the reduction of time to market (B1F) are ranked in the same grade of importance in third position. Reducing uncertainty in internal development (B1B) and monitoring environmental changes and technological opportunities (B1D) are the least important motives to source innovation externally in the fourth and fifth grade of importance.

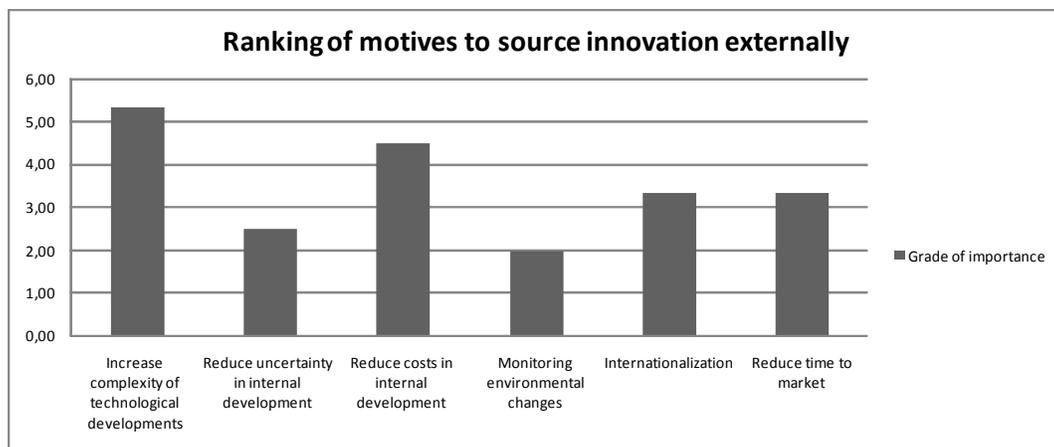


Figure 4.3 Ranking of motives to source innovation externally

The increasing complexity of technological developments which are the foundation of the value creation, converge on a mix of capabilities that are not part of only one company. In this sense, the necessity of these capabilities, not available inside of the firms, oblige them to look for external sources of technological complements and/or technological expertise in order to develop innovation reducing the technological uncertainty and increasing the chance of success.

In second place financial motives based on the reduction of the substantial development costs of innovations by sharing these costs with external partners involved in the innovation process is also one of the main reasons to look for external sources of innovation.

In third place, the involvement of external partners with the aim of assuring the access of innovation to new potential markets and/or as an internationalization strategy are together with the reduction of time to market, important motives to source innovation externally. These motives are focused on the reduction of market uncertainty of innovation by sharing these risks with external partners.

The reduction of uncertainty in internal development is a more important motive to source innovation externally than the monitoring of environmental changes and technological opportunities which is the less important motive of the list. However it is by itself less important than the financial motive and specific uncertainties such as technological, market that the participating firms choose in the first positions of importance. The monitoring of environmental changes and technological opportunities are in concordance with the strategic orientation and they are relatively the least important motives, considered by this group of companies when sourcing innovations externally.

4.2.3 RANKING OF MOTIVES TO CHOOSE INTERNAL VS. EXTERNAL SOURCE OF INNOVATIONS

For internal as well as external sources of innovation a mix of exogenous and endogenous uncertainties as well as strategic and financial factors are taken into consideration by decision makers when deciding for a specific source of innovation (Figure 4.4).

- Internal R&D:

Endogenous uncertainties such as technological distance (expertise related to the technology), and partner uncertainty (control over developed technology) and an exogenous uncertainty concerning the technological uncertainty (risk connected to the technology) are the three more important types of risk that decision makers considers when firms decide to make innovation in-house. Less important factors are those related to market uncertainty (time to market and uncertainty connected to the market) and financial aspects (cost reduction).

- Alliances:

Exogenous uncertainties represented by market uncertainty (time to market and uncertainty connected to the market) and financial aspects (cost reduction) are the most important criteria when firms decide to make alliances in order to develop innovation. Less important motives but not are technological uncertainty (uncertainty related to the technology), technological distance (expertise related to the technology) and partner uncertainty (the control over the developed technology).

- M&A:

M&A are mainly motivated based on criteria regarding exogenous and endogenous uncertainties such as technological risk (the uncertainty connected to the technology), technological distance (the expertise related to the technology) and partner uncertainty (the control over developed technology). Less important aspects are market uncertainty (time to market and uncertainty connected to the market) and financial aspects (cost reduction).

For all the sources of innovation (internal or external), the existing portfolio of external sources of technology (referred to the management of inter-firm relationships based on a dynamic portfolio perspective), and information asymmetry, based on the lack of experience (trust) with

partner, are the least important motives when firms decide for any of the possible sources of innovation, internally as well as externally.

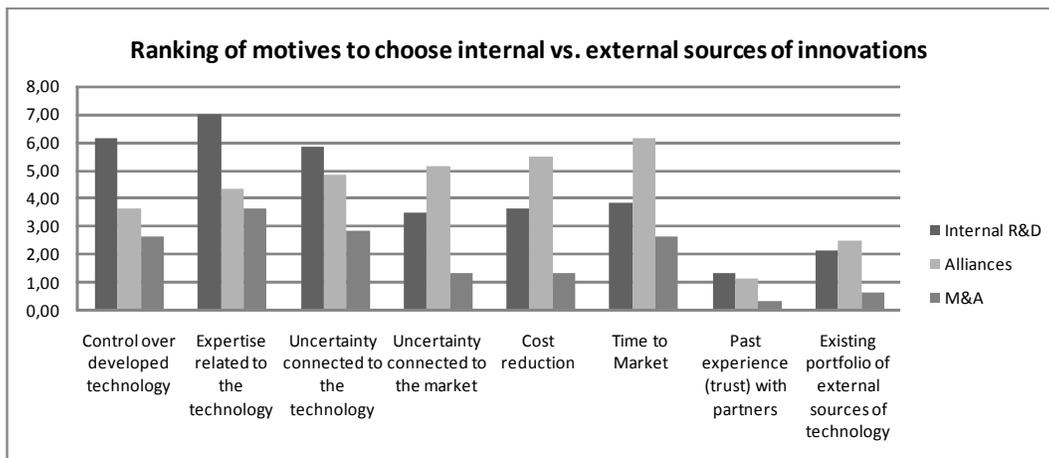


Figure 4.4 Ranking of motives to choose internal vs. external source of innovations

The results show that technological distance of the partner with respect to the core competences of the firms as well as the partner intentions regarding the control over the developed technology are the most important endogenous sources of uncertainty that decision makers consider when deciding to make innovations internally or by M&A. In the same context the level of technological uncertainty is also a high score motive when innovations are made in-house or by M&A. However, these motives are less important when firms decide to develop innovations externally by creating alliances.

Motives regarding market uncertainty and financial aspects are the most important criteria when firms decide to make alliances and less important criteria when firms develop innovation in-house or by M&A.

4.3 CASE STUDY DESCRIPTION

This section of the chapter includes the main findings regarding the reasoning of decision makers behind the choice of a specific kind of governance structure to manage their innovation. The situations are divided by types of innovation (product, process, and radical innovation), strategic (time to market and entry into a new market) and financial (high development costs) motivations. All situations include changes regarding to specific assumptions offered to decision makers, with the aim of isolating specific sources of uncertainties.

4.3.1 PRODUCT INNOVATION

For this question the respondent considered the assumptions that his/her firm has low level of technological and market uncertainty, because they manage the technological expertise and

market conditions in which the product innovation will be developed. At the same time the level of partner and task uncertainty are low as well as the differences with the partner due to information asymmetry, because they already know the business partner.

- **Choosing between in-house and external sources of innovation**

All participating firms agree that the improvement of an existing product will be developed in-house if the technology and market uncertainties are lower regarding the fact that they manage the technology expertise and the market acceptance for their product. An external partner could be considered if this partner could reduce time to market or the development costs of the modification, or could make better job considering their capabilities.

Technological distance of the partner and environmental uncertainty that surround the scenario of assumptions are not considered by the decision makers.

“...Only if the partner could give an extra value added to the improvement of an existing product, the partnership could be considered...”

“...If the market acceptance of the product is relatively certain and the technology expertise required for developing the innovation is sufficient there is no need for an external partner...”

- **Choosing an organizational structure (governance mode)**

The decision to choose a specific kind of organizational structure (alliance, JV or M&A) to manage the inter-firm relationship varies depending on the size of each firm. However, an external relationship could be completely avoided if the required technology or knowledge, which is the purpose of the partnership, could be acquired from the potential partner by buying a patent or by buying a specific technology. In this sense, this would be the first option for firms in order to avoid any kind of partnership. “...Usually, this firm does not establish any alliance, JV or M&A if the firm can buy the technology or patent required to make the innovation...”

If the previous option is not possible, most of the firms establish alliances as organizational structures with the aim of achieving innovation externally in order to reduce the financial commitment with respect to the uncertain future value of the technology. In this sense the type of technology, regarding its cognitive distance to the core business of the firm, its strategic importance for the firm and its potential added value are the main criteria when they choose alliances like organizational structures to manage the relationship with an external partner.

However, depending on the size of the firms, besides of considering the previous aspects of the technology, companies consider also financial aspects to choose more integrated forms of governance. In this context, in one hand, relatively big companies take also into consideration their financial position with respect to the global economy and the size of the partner when they decide to acquire the partner company. In this sense, if the partner's technology is strategically important for the firm, if the firm is in a strong financial position in that specific moment, and if the size of the target firm is relatively small, big companies would preferred more integrated

forms of governance such as JV or M&A” If the external partner adds value to the firm (because of something the firm does not have) and the firm is in a strong financial position regarding the external financial market conditions, the first option would be an acquisition”...

In the other hand, small companies, which don't have financial capacity to acquire other company, consider that alliances are the most suitable form of governance with the aim of achieving innovation externally.

- **Portfolio perspective (Influence of existing partnerships)**

In most of the firms, the decision to establish a new relationship with a potential business partner is influenced by the current alliances, JV and M&A that the firms are carrying out. However, it is very important to remark that this influence is basically over the decision to establish or not the relationship but not on the type of organizational structure that the firms would choose to manage a new partnership. ...“It is avoided to establish any alliances, JV or M&A with a new partner in order to develop the same product that it is being developed by other existing partnership”...“Current partners are the first option when firm decides to improve an existing product”.

- **High level of technological uncertainty**

If the technology or its application is highly uncertain, most of the firms are willing to establish an alliance with an external technology partner such as university or research institute or other kind of technology partner in order to co-develop the required technology, product-improvement or innovation. However, if the required technology is already developed by a potential partner, firms consider as the first option licensing or negotiate agreements regarding exclusiveness with respect to the use of a certain technology, for a certain period of time, with the potential partner. In this way firms avoid any kind of more formal relationship. Moreover these options are considered highly important for firms when the technology required is close related to the core competences of the firm but at the same time more formal and integrated forms of governance are less preferred. Alliances or more flexible forms of organizational structures are applied in this case. “Agreements of exclusiveness concerning a specific technology or product which is required to develop our innovation could be established for certain period of time with the potential partner. This agreement will give to the firm the right to be the first users of this technology in order to develop the innovation. Moreover this kind of agreement avoids the establishment of any kind of more formal relationship...” “... The acquisition of a whole company which possess a new technology, strategically important to our firm, could be considered if this firm has also a market share, a new technology that could be strategically important for our firm it is not a enough reason to buy a whole company...”

- **High level of market uncertainty**

Most of the firms consider that product-improvement or innovation in which the market is highly uncertain could negatively affect the development of this improvement and in some cases if the

market is highly uncertain, it could stop completely the development of this innovation, before of thinking to source a potential business partner with the aim of reducing this uncertainty.

However all firms consider that market is an extremely important factor when an alliance is established with a potential business partner who could guarantee the access to the market. "...High uncertainty regarding to the market acceptance of a product is crucial when improving an existing product, consequently, it is very important to find a partner who knows the target market and could guarantee the access of a desired market reducing the market uncertainty..."

- **Nature of the potential partner (technological distance, information asymmetry and partner uncertainty)**

The nature of the potential business partner is not influencing the decision to establish any partnership but it could influence the organizational structure chosen to manage the relationship. For all participating firms, alliances are by default the most suitable organizational structures chosen to manage partnerships with competitors, customers or suppliers. However this decision could change depending on the nature of the partner. "...With all the potential business partners the most important is to find a "win-win" situation..."

- **Competitor**

Most of the firms agree that a partnership with a competitor is never attractive and always difficult. This relationship is usually managed through alliances, but it could change to more integrated forms of governance (JV) without reaching a total integrated form of organization depending on: 1) if the business opportunity that the firm could achieve from the relationship is enough attractive to the firm (close related to the strategic orientation of the firm) and 2) if the technological field which is part of the relationship are enough distant from the core competences (competition field) of the investing firm (long technological distance).

- **Customer**

Alliances with a customer are always preferred than those with suppliers and competitors based on the added value that this kind of relationship could offer to the development of an innovation or the improvement of an existing product.

- **Supplier**

Alliances with suppliers are considered only if there is a key supplier from who depends strategic components of the firm`s products or innovations.

In both cases more integrated forms of governance could be consider depending on the strategic importance regarding to the strategic orientation of the firm, that a customer or supplier could have.

- **Partner involved with a competitor (information asymmetry, partner and task uncertainty)**

For most of the firms this situation does not affect the decision to establish an alliance with a potential business partner but in some cases it is avoided considering the high probability to

lose confidential information concerning the core competences of the firm, because of the higher levels of partner and task uncertainty.

For firms which are able to hold the decision to establish the alliance it is very important to include a clear disclosure agreement regarding the flow of information between partners. In this case agreements of exclusiveness, (less formal than alliances) regarding the exclusive use of this technology for a certain period could be more used in order to avoid any close relation with a competitor

- **Lack of previous experience with a partner (information asymmetry)**

Information asymmetry between partners regarding the lack of previous experiences or prior cooperation is not a limit to establish an alliance with a potential business partner but this situation could delay the decision to set up the alliance until sufficient information regarding the reliability of the potential business partner based on its expertise, its strategic orientation, and the current business and market in which the partner is embedded.

4.3.2 *PROCESS INNOVATION* (LOWER LEVELS OF EXOGENOUS THAN ENDOGENOUS UNCERTAINTIES)

Considering that a process innovation could be too close related to the core capabilities of the firm, this kind of innovation must be develop in-house in order to protect these capabilities. But If the firm don't have the expertise enough or the machinery or equipment to develop it in-house, the acquisition of a required technology, or the establishment of an alliances (non-equity) with a potential technological partner, who possess the required technology, could be established. "...When it is possible, any innovation regarding a new process will be develop in-house, considering that the technology developed by our firm is unique in the world..."

4.3.3 *RADICAL INNOVATIONS* (HIGHER LEVELS OF EXOGENOUS THAN ENDOGENOUS UNCERTAINTIES)

The decision of the development of a radical new product in-house depends on if the firm posses the technology and market required to make and trade this radical new product. The lack of one of this aspects push firms to look for external partners with the aim of reducing the technological and market uncertainties. In this sense, big companies considering that depending on the size of the potential business partner, the type and importance of the technology for the development of a radical new product, it is possible to use more or less integrated organizational structures. High important technologies from big companies could be obtained by alliances while from small companies could be obtained by M&A. However if the technology is available by licensing or buying the patent, this will be the first option with the aim of avoiding any kind of partnership.

In the other hand small firms consider the non-equity alliances as the main organization structure used to manage a partnership with the aim of developing a radical new product.

4.3.4 STRATEGIC MOTIVES

- **When entering into a new market with an existing product (high market uncertainty)**

All firms agree that entering into a new market with an existing product is a high market uncertainty scenario and they also agree that the best strategy to reduce this uncertainty is by involving an external partner who could reduce the uncertainty, assuring the access to a desired market. However, the decision regarding the choice of a specific kind of organizational structure is based on the size of the firm. In one hand relatively bigger companies consider that the acquisition of a target company is the most suitable organizational structure to reduce the market uncertainty and increase the probability of success. "...The best strategy to entry into a new market with an existing product is by acquiring an existing company who could ensure the market acceptance of the product and at the same time increase market share..."

In the other hand relatively smaller companies consider that alliances and non-equity alliances are the most suitable structure to manage a partnership with the aim of reducing the market uncertainty. Their decision is based on the difficulties regarding the complexity of a JV or M&A and the amount of time, financial and human resources that a JV or M&A could demand in order to be setting up.

- **When needing to reduce time to market (low market uncertainty)**

If after a financial and strategic analysis regarding the extra benefits that the firms could obtain by reducing the time to market are sufficient to pay the extra cost that the firm could make by involving an external partner, most of the firms are willing to establish an alliance with the external partner with the aim of developing the innovation faster and introducing the innovation earlier to the market.

"...If the firm does not have the internal capacity or capabilities to reduce the time required to develop the innovation with the aim of entering it early in the market, our firm would carry out an alliance with a partner who have the required capacity or capabilities to do it..."

4.3.5. FINANCIAL MOTIVE

- **When the development costs are substantial**

All firms converge in the fact that always it is preferred to develop any innovation in-house in order to keep as much as possible the profitability of the innovation only for the company. However, depending on the financial aspects of the innovation such as: the financial resources required to carry out the innovation, the time-return on the investment and the profitability of the innovation obtained by a cost-benefit analysis or NPV, the project could or not be developed internally or externally. After this analysis, and consider a high profitability regarding the amount of financial resources required and a shorter time to obtain the return on the investment; all firms agree to establish an alliance with an external partner who can support financially this

innovation. "...Before make a decision to establish a partnership, the project needs sufficient guarantee that it will be profitable. If this parameter is fulfilled and the firm is not able to finance the project, it will be required to establish an alliance with an external financial partner..."

CHAPTER 5. CONCLUSIONS AND DISCUSSION

The aim of this thesis was to obtain in-depth insights of how uncertainty affects the innovation performance of a firm through the analysis of the influence of uncertainty factors in the selection of organizational structures chosen to manage external technological innovations. A theoretical and empirical research was carried out in order to accomplish this goal and the results of those researches are included in this chapter. Section 5.1 depicts the conclusions of the study based on the specific objectives included in chapter 1. The next section will consist of a discussion, based on the methodology (chapter 3) and results (chapter 4). The last section (5.3) is composed of suggestions of topics for further research.

5.1 CONCLUSIONS

The conclusions of this study, which are based on the objectives presented in Chapter I, have been outlined regarding: (1) the types of uncertainties and their effects on the choice of a source of innovation and its organizational structure; (2) the choice of a source of innovation (internal vs. external) and the organizational structure to manage external innovation; and (3) the perspective of the portfolio. These conclusions follow.

(1) Regarding the types of uncertainties and their effects on the choice of a source of innovation and its organizational structure, it has been proven that a mix of exogenous and endogenous uncertainties, together with firm`s strategies and financial aspects, are considered when decision makers choose the source (internal or external) of their innovation.

This mix of criteria is also important in the choice of the type of governance to establish partnerships when they choose an external source of innovation. There is not always possible to conclude which type of uncertainty or aspect is more important. This is, because their relevance and influence change depending on the specific contextual circumstances in which the decision is taken regarding the size of the firms, the industry in which firms are embedded and internal features of the firms, such as their strategic orientation. Most of the time decisions are based on a co-influence of a group of aspects instead of a single specific aspect.

- **Exogenous uncertainties**

Given the turbulent environments in which the firms are embedded based on the high level of competition of their industries, firms are confronted with high levels of exogenous uncertainties permanently. These levels are higher considering the high level of innovativeness and the increased importance of innovations for the competitive success of firms. In this sense, exogenous uncertainties, such as environmental, technological and market uncertainties have an important role when firms decide to make innovation. This has already been shown by Van de Vrande and co-authors (2006) who conclude that early stages of new business development

are characterized by higher levels of exogenous uncertainties because the lack of information regarding the market and technological aspects of the new technology.

These uncertainties affect continuously their decisions regarding the source of innovations and the type of governance mode (organizational structures) that firms choose when deciding for external sources of innovation. Higher levels of exogenous uncertainties are managed with less integrated forms of governance. Conclusion that goes along with results obtained from previous studies made by Van de Vrande and co-authors (2006) and Lambe and Spekman (1997), although it is not possible to conclude that when the level of these uncertainties decrease, more integrated forms of governance could be preferred.

High levels of environmental uncertainty that come from the high level of competition in the industry and the market orientation of firm's products are limiting the type of governance structures that firms use to manage their external sources of innovations. A preference for less integrated forms of governance, such as alliances is identified in the participating firms of this research, giving conditions of high level of environmental uncertainty. This conclusion also has been seen in previous studies made by Eisenhardt and Schoonhoven (1996); Lambe and Speakman (1997) and Garette and Dussage, (2000) and allow me to accept the first hypothesis (Hp1) concluding that higher levels of environmental uncertainty reduce the preference to use more integrated forms of governance.

The highest level of importance that the increase complexity of the technological developments has when firms decide to look for external sources of innovation is also the main source of technological uncertainty which affects the decision to choose a specific kind of organizational structure to manage this external source of innovation. Less integrated forms of governance, such as alliances, instead of more integrated forms of governance, such as M&A are preferred when the level of this uncertainty is high. This is base on the tendency of firms trying first to establish flexible agreements regarding the exclusive use of a technology for a certain period of time with the aim of avoiding as much as possible any close relationship when the uncertainty regarding the technology is high. This has already been shown in previous study made by Van de Vrande and co-authors (2006). Based on this, it is possible to accept the second hypothesis (Hp 2) regarding the fact that higher levels of technological uncertainty motivate the use of more flexible forms of governance.

The market acceptance of an innovation, market access and the successful introduction of a specific innovation into a specific market are highly important factors that decision makers consider when they decide to develop innovation in-house or externally. At the same time these factors are the main sources of market uncertainty which is highly important and a decisive factor when firms decide a governance structure to manage external sources of innovation. High levels of market uncertainty push companies to choose more flexible forms of governance, such as alliances instead of M&A. The reduction of this uncertainty, based market features of the potential partner, its market orientation and market share are decisive factors considered by decision makers when establishing alliances. This has been shown by previous study made by

Duysters and de Man (2003). At the same time the market features of the partner is the most important reason in which firms based their decision when firms decide to take over a partner. In this sense and based on the previous conclusion it is possible to accept the third hypothesis (Hp 3) which implies that higher levels of market uncertainty influence negatively the use of more integrated forms of governance.

- **Endogenous uncertainties**

Given the lack of information about partner`s intentions, the reliability of its capabilities and its unpredictable behavior regarding a potential threat to the core competences of the firms when partner`s cognitive distance is close to firm`s competences, endogenous uncertainties are from a theoretical perspectives, important when firms decide to source innovation externally. This is regarding the governance mode that firms would choose to establish partnerships with the aim of achieving innovation externally.

Based on the results of this study, partner uncertainty and technology distance are the most important sources of endogenous uncertainties that firms consider in order to decide to develop innovations internally. This implies indirectly that higher levels of these uncertainties might be strongly considered when firms decide to source innovation externally. In this context, the uncertainty regarding the control over the developed technology (high partner uncertainty) and the uncertainty regarding the potential damage to the firm`s core capabilities, because of closeness cognitive distance of the partner (short technological distance) are the highest important endogenous uncertainties that firms consider when deciding to take over the partner firm. Similar conclusion regarding both types of uncertainties are found in previous studies made by Folta (1998), Vassolo and co-authors (2004), Hagedoorn and Duysters (2002), Sutcliffe and Zaheer (1998) and Santoro and McGill (2005). In this sense, high level of partner uncertainty and short technological distance influence positively the choice of total integrated forms of governance such as M&A which could confirm the fourth "a" and sixth hypothesis (Hp 4a and Hp 6) and reject the fourth "b" hypothesis of this research.

Although, these uncertainties (partner and technology distance) have a strong influence in the choice of M&A, they are less important when firms decide to choose less integrated forms of governance (alliances). Their level of importance is close but below the grade of importance of the uncertainty connected to the market (market uncertainty), financial (cost reduction) and strategic (reduce time to market) aspects when firms decide to establish alliances. Moreover there is not a clear positive or negative influence of these uncertainties in the choice of less integrated forms of governance (alliances) when the nature of the partner is changed (competitor, customer or supplier). Most of the firms agree in the fact that the effect of the nature of partner and its portfolio of alliances influences the decision to establish the inter-firm relationships, but not the choice of the less integrated forms of governance (alliance) as an organizational structure to manage these relationships.

Information asymmetry, which is also considered an important source of endogenous uncertainty, does not have a clear effect on the decision to choose a specific kind of governance. This is based on the relatively low level of importance that the lack of prior cooperation or past experience with a partner, has, when firms decide to establish alliances or M&A with the aim of achieving innovation externally. This is based on the higher level of importance that: 1) strategic and financial aspects regarding alliances and 2) partner uncertainty and technological distance concerning M&A, have, when they are compared to the level of importance of information asymmetry. However the level of importance of previous experience with a partner is more significant when firms establish alliances than in the case of M&A.

At the same time, all firms agree that the lack of previous experience or prior cooperation does not influence the decision to choose alliances as the governance structure to manage external sources of innovation. However, firms confirm that this source of uncertainty could delay the decision to establish an alliance, until more information about partner's capabilities and values being obtained. Previous to establish alliances, informal agreements are setting up with the aim of reduce information asymmetries between partners. Based on this, it is possible to conclude that higher information asymmetries between partners motivate the use of less integrated forms of governance at least until partners get known each other concerning its values and capabilities. This has been already concluded by previous studies made by Van de Vrande and co-authors (2009) and, Barakrishna and Koza (2003). In this sense, it is possible to accept the fifth "a" hypothesis (Hp 5a) but it is no possible to accept or deny the fifth "b" hypothesis (Hp 5b) because of the lack of information.

Although the reliability of a potential partner's capabilities is considered when firms decide to establish a partnership, from the results of this study, it is not possible to establish a clear influence of task uncertainty in the choice of a specific kind of governance. Therefore, it is no possible to accept or deny the seventh hypothesis (Hp 7) because of the lack of information.

(2) Concerning the choice of the source of innovation (internal vs. external) and the organizational structure to manage external innovation, the study has shown that the development of innovation in-house is always preferred over external sources of innovation if firms posses the technological expertise and the market acceptance to develop innovation.

In addition to previous requirements, strategic aspects, such as the reduction of time to market and financial aspects, like the reduction of cost in internal development, are factors that, in this study, have been proven to strongly influence the decision to source innovation externally instead of in-house. In the same way, these are the most important motives that decision makers take into account when deciding to establish an alliance as governance form to achieve innovation externally.

The establishment of inter-firm relationships with a potential partner in order to source innovation externally is never the first choice of companies, if they could obtain the technological

expertise or the market access by other mechanisms which do not involve any inter-firm relationship. In this sense, exclusivity agreements regarding the exclusive use of a desire technology for a certain period of time or the acquisition of a patent or specific technology are always the first choice for all companies.

Less integrated forms of governance such as alliances are preferred than more integrated forms of governance like M&A when firms are requiring to establish inter-firm relationship and choose a specific type of governance with the aim of achieving innovation. However, a tendency to choose total integrated types of governance (M&A) was found when the innovation is close-related to the core competences of the firm (short technological distance with the partner) and there is a high uncertainty regarding the behavior of the partner with respect to the developed technology (partner uncertainty). This conclusion is supported by previous study made by Hagedoorn and Duysters (2002) who conclude that short technological distance of potential partner to core competences of investing firms could push firms to choose M&A in order to protect the core capabilities of the investing firm.

- **Strategies of the firms and industry context**

Strategic aspects of the firms like their internationalization strategy, growth strategy and the opportunity to increase market share are important factors that apart from uncertainty factors, firms take into account, when deciding to acquire a whole company. In this sense, ensuring market share and guaranteed market access are decisive conditions closely related to the reduction of market uncertainty that firms consider sufficient reasons to take over another firm. This is clearly aspect found in this study in big companies of agro-food and chemicals industry which consider that if the partner position in the industry and its market orientation fits with their strategic orientation and market objective, there is enough reason to choose total integrated forms of governance with the aim to improve their position in the industry and the market.

- **Financial position and size of the firm**

Financial aspects and the size of the firms are, apart from uncertainty factors, important aspects which influence the choices and decision regarding the type of governance that firms choose to achieve innovation externally. Big companies with a strong financial position tend to prefer more integrated forms of governance than more flexible organizational structures as their better option when they are sourcing innovation externally. Different from big companies, small firms don't consider an option more integrated forms of governance, and preferring the more flexible organizational structures when innovating externally.

(3) As to the dynamic portfolio perspective, it has been seen from the results of the study that firms do not take into consideration the positive or negative effects of their existing partnerships (portfolio of inter-firm relationships) when they choose a type of governance structure. However different from the other companies, one of the firms consider that positive or

negative past experiences with a certain kind of organization structure affects the decision to choose the same type of governance mode when establishing a new inter-firm relationship.

Positive effects like the increasing returns based on synergies and the reduction of technological and market uncertainty based on risk diversification are not identified and not considered by decision makers when deciding for a new type of organizational structure. The existing portfolio of external sources of technology is one of the least important criteria that firms consider when they decide to do alliances or M&A.

5.2 DISCUSSION

- Differences in size and industry of participating firms

Firms that participate in this research are different with respect to their size and the industry in which they are embedded. The study includes big multinational companies and also small start up firms as well as firms from biotechnology, chemicals and agro-food industry. Although these relative big differences, it is important to notice that all companies consider not only the same factors (technological, market, strategic and financial) but also within a similar level of importance when deciding between internal and external sources of innovation.

However, important qualitative conclusions were obtained in this research, it is not possible to make general conclusions for the whole population at the industry level because its reliability are limited by the number of participating firms for each industry and firm's specific conditions. In this sense it is important to limit the study into a specific industry (as much dynamic as possible i.e. high tech industries) and firm's size, in order to increase the reliability of the main findings avoiding the effects of different industries and sizes.

- Implementation of a pilot interviews

Conducting a pilot interview with the aim of adding or reducing information into the interview protocol is an important procedure that could be used to tune the tool and assess its effectiveness regarding the collection of the required information before the application of the instrument in the sample. In this perspective, the application of pilot interviews in this research would have contributed to find the flaws regarding the tough questions that were a bottleneck for the respondents. At the same time, pilot interviews would have contributed to the experience of the researcher regarding the conduction of the interview in a more objective way, avoiding subjective ideas from the respondent.

- Standardization of definitions and understanding

With regard to the definitions of the different types of governance modes and of the different types of uncertainties, when choosing for one of the later, it is quite striking that the scientific literature, the interviewees and the researcher, had different understandings of these definitions. These different understandings are an important source of bias which affects the conclusions

that are obtained in this research. Different understandings regarding the same definitions, implies a limit to achieve the goals of the questions and a barrier to obtain clear and objective answers from the interviewees. This affects the validity of the answers of the respondents and therefore the validity of the conclusions of the research.

5.3 FURTHER RESEARCH

Because of confidentiality, it was difficult to obtain quantitative information from firms regarding their innovation activities and performance. In this regard, I consider that further research could focus on linking the qualitative results of this research with quantitative information indirectly but closely related to the firm's innovation activities and performance. The aim of this link would be to further give an economical value to each source of uncertainty. This, in turn, would allow decision makers to analyze the economical and financial impact of each uncertainty when choosing a governance structure.

An additional point for further research would be to add more types of organizational structures in the study by for example dividing alliances in equity and non-equity alliances, or including new organizational forms such as corporate venture capital. This will enable the assessment of the effects of uncertainties in a bigger range of governance modes.

Although this research concludes indirectly that decision makers do not apply the dynamic portfolio theory when deciding to choose a governance mode with the aim of achieving innovation externally, it is important to analyze the application of the dynamic portfolio theory from different perspectives like risk/return profile. The aim would be to assess the application of the dynamic portfolio theory from an empirical point of view and to study its effects on improving the decision making process.

Finally, another point for further research could be the evaluation of the impact of total integrated forms of governance (i.e. M&A) on the innovation performance of the acquired firms and their contribution to the value creation from a social perspective. Most of the studies analyze only the financial impact of the decision, without considering the effects on the employees of the acquired firm.

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APPENDIX

Firm # 1

1. Contextual situation

Table 1 sketches the contextual situation in which Firm 1 is embedded.

Table 1 Context and features of Firm 1

Question	Answer	Explanation
Employees R&D vs. total number of employees	9%	In the whole company there are at the moment in total around 2000 employees but specifically working in resins there are 450 employees from which 50 are working in R&D
Strategic Orientation	Customer Intimacy	The firm puts a lot of effort in really provides solutions to the customers who are part of the development of these solutions, being these orientation, a key success factor. <i>Operational excellence or product leadership</i> is also used depending on the type of product and its market orientation.
Sales	Global	This firm is a multinational company with production sites and sales worldwide, being its products manufactured mainly in Europe and commercialized in Asia, North and South America, and Europe. It is important to remark that the largest customers are mainly in Europe with a 70% of the market.
Competitors	Global	Competitors as well as customers are global, considering that only 4 companies which operate at global level have 80% of market share in this industry.
External relationship non innovative motives	Joint Ventures (JV) Mergers and Acquisitions (M&A)	Joint Ventures: The firm has established JV with the aim of setting up manufacturing plants outside Europe. Mergers and Acquisitions: This firm use M&A mainly as growth strategy in order to enter into a new market or to increase market share. Even with an important or interesting technology this company does not consider M&A if the target company does not have a market share

2. Innovative profile

2.1 Ranking of motives to source innovations externally

In Figure 1, the ranking of the motives to source innovation externally as established by Firm 1 is presented.

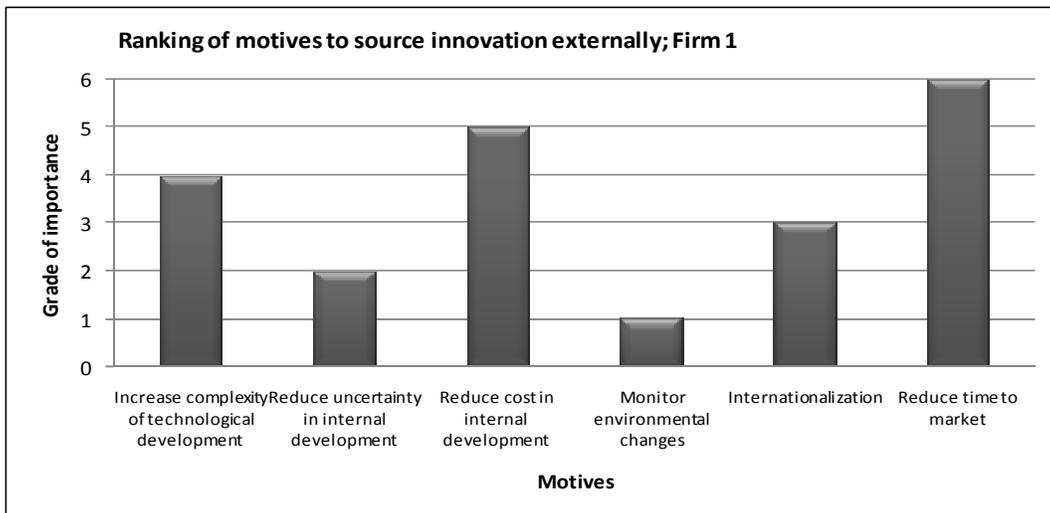


Figure 1 Ranking of the motives to source innovation externally in Firm 1

The most important motive to establish external relationships focused on innovations purposes are strategic reasons that goes in the same line of the strategic orientation of the firm. The enrollment of customers in the development of new products is important in order to reduce time to market and to ensure the market acceptance of the product. Financial reasons are located in the second place considering that the firm makes innovations based on projects subsidized by the government. These projects include the co-development of innovations with Universities and Research Institutes. To ensure access to technological capabilities is in the third place of importance and it is followed by less important motives such as internationalization or access to new product markets, the reduction of uncertainty in internal development and the access to new technological opportunities.

3. Governance structures

3.1 Ranking of motives to choose internal vs. external sources of innovations (Fig. 2)

Internal R&D:

Exogenous factors are the most important aspects considered for this company in order to develop innovation internally (market and technology uncertainty). After those, the protection of the core competences of the firm is also considered. In fourth and fifth place strategic and financial aspects (time to market and cost reduction) are also taken into account but with less level of importance.

Alliances:

The reduction in time to market as well as aspects related to market and technology uncertainties are the three main issues considered when the innovation is developed externally by alliances. Internal aspects regarding to the trustiness about partner attitudes and intentions are considered in fourth and fifth place respectively. Financial aspects as cost reduction in the development of innovations is not so relevant for the firm when it establish alliances, neither prior experiences with partner nor its existing portfolio of external relationships.

M&A:

This firm does not make M&A based on innovation purposes. However based on a single event the main reasons to take over a task company was based in order of importance on 1) the strategic importance of its technology considering the trends of the market, 2) the risk connected to the lack of this technology and 3) the reduction on the time to market, considering the time that it could take to develop the technology internally.

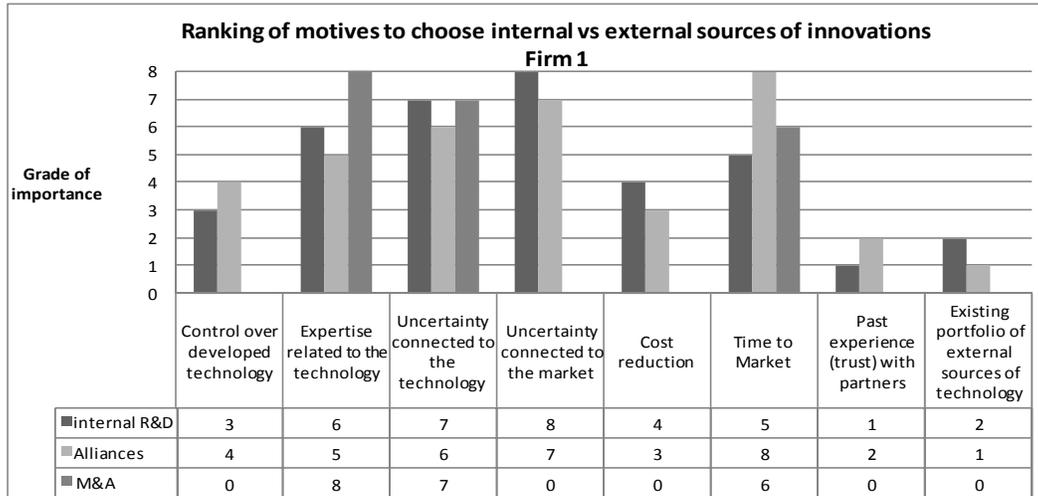


Figure 2 Ranking of motives to choose internal vs. external sources of innovation; Firm 1

4. Uncertainty factors to decide for an organizational structure to manage external sources of innovation

It is noteworthy to point out that the firm has clearly stated that almost all innovations of this firm are made in-house. In the case that the firm would establish an inter-firm relationship, it will be a non equity alliance.

Assumptions for D1: Suppose you want to modify and improve an existing product. You have already a level of expertise with respect to the technologies which have to be applied so you are confident about the technological success. The market acceptance of the product is relatively certain. An already known business partner could contribute.

D1. When improving an existing product

D 1.1 Exclusively in-house or external partner

When the company desires to make an improvement of an existing product, ensuring the market acceptance of the product and the expertise regarding the technology is of crucial importance. This firm considers that this kind of innovation is frequently made in-house.

D 1.2 Choosing an organization structure

Partnerships with customers are established only if the improvement of an existing product was required by a customer, in which case the involvement of the partner is in early stages of the

innovation process. Final stages of the innovation process also could include the establishment of partnership with the aim of assessing the application of the product which is not possible to do it in-house. This form of cooperation or joint-development is managed by formal or informal agreements in the form of alliance. JV or M&A are not usually used to manage these relationships.

D 1.3 Influence of existing alliances

The existing relationships of the firm are considered only when deciding for new alliance with the aim of avoiding any conflict with the existing partners regarding the specific kind of technology or product that the firm is co-developing.

D 1.4 and D 1.5 High technology and market uncertainty

In the case that the technology is not well known for the firm, and there is a partner (customer) willing to share the expertise regarding the technology and is able to cooperate in the development of the innovation, there is a high likelihood that the firm will establish an alliance with this partner in order to share the risk and cost.

High uncertainty regarding the market success or market acceptance of a product is crucial when improving an existing product. Consequently, it is very important to find a partner who knows the target market and could guarantee or at least reduce the uncertainty concerning the access to the desired market.

D 1.6 Nature of the potential partner

The nature of a potential partner is important but it is not a limit to establish a partnership. "Working with a competitor is never attractive and working with a customer is preferred than working with a supplier". With all potential business partners the most important is to find a "win-win" situation. This firm is able to work with a competitor, but not in the same competitive field.

D1.7 Partner involved with a competitor

The firm establishes that the fact that the partner is already involved with one of its competitors influences the decision on developing in house or accepting the external partner.

D1.8 Partner uncertainty related to the lack of previous experience

Previous experience with a potential business partner is not a limit when establishing a partnership but it hastens the process.

D2. When developing a radical new product

The firm establishes that the development of a radical new product is usually made in house, except for the case that the product requires to be tested in the applications or consists of specific new components not available in the market. In this case, the firm would try to establish cooperation with the customer or the supplier.

D3. When entering into a new market with an existing product

The firm establishes that it would generally look for an external cooperation with a strong partner in that market. The partner modality would be an alliance because JV and M&A are much more complex, require years of preparation, a lot of financial resources and human capital (with high management skills) and involve a high business risk.

D4. When developing a new process

The firm establishes that the development of a new process is usually made in-house. However, in the case that the firm is not aware of the expertise to develop the new process, it will definitely look for an external partner to establish a relationship which would be an alliance.

D5. When the development costs are substantial

Before making a decision to establish a partnership, the project needs sufficient guarantee that it will be profitable. If this parameter is fulfilled and the firm is not able to finance the project, it will require establishing a partnership. This is crucial in determining the establishment of inter-firm relationships.

D6. When needing to reduce time to market

The firm establishes that in this case it will look for a partner and will establish the partnership in the form of an alliance.

Firm # 2

1. Contextual situation

Table 2 sketches the contextual situation in which Firm 2 is embedded. This table follows.

Table 2 Context and features of Firm 2

Question	Answer	Explanation
Employees R&D vs. total number of employees	5.57%	The total number of employees is 52,000 from which 2,900 are part of R&D
Strategic Orientation	Customer Intimacy	Firm 2 follows two main strategic orientations: <i>customer intimacy</i> , considering that its main objective is to match the requirements and needs of the final consumers of its products and <i>operational excellence</i> with the aim of reducing costs in the manufacture of these products.
Sales	Global	Firm 2 sells its products at national, regional, continental and global level, being the latter the main sales.
Competitors	Global	Considering that Firm 2 sells its products at national, regional,

		continental and global level, its competitors are within all the mentioned levels.
External relationship non innovative motives	Mergers and Acquisitions (M&A)	M&A are considered to this company as a mechanism to entry into new markets, and obtain market share. Consumers are different all over the world and local companies have a valuable expertise in local markets. Taking over these local companies, it is possible to obtain this knowledge and growth at the same time.

2. Innovative profile

2.1 Ranking of motives to source innovations externally

In Figure 3, the ranking of the motives to source innovation externally as established by Firm 2 is presented.

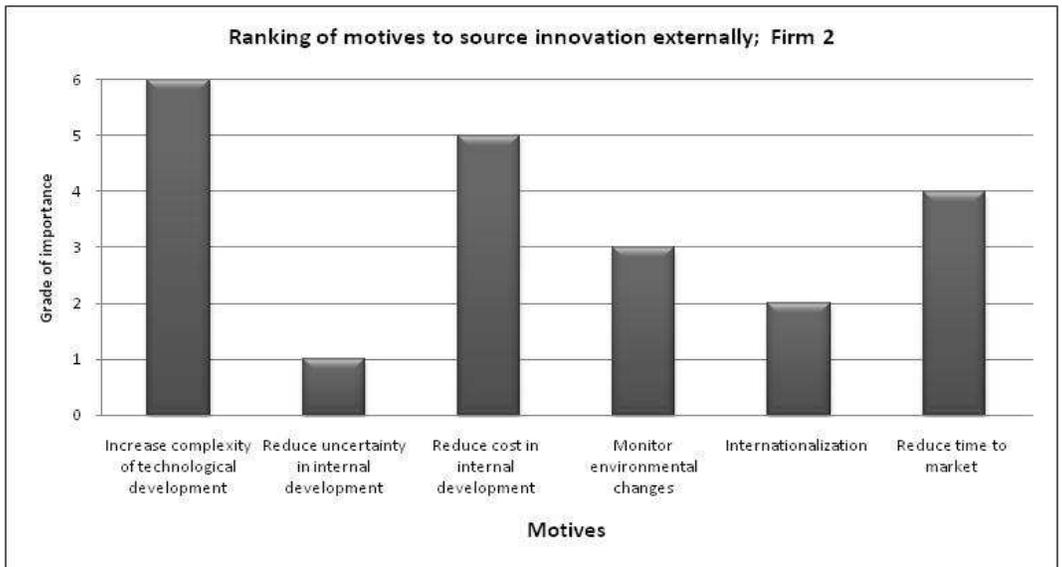


Figure 3 Ranking of the motives to source innovation externally in Firm 2

As seen in Figure 4.5, the most important motive to source innovation externally for Firm 2 is the increase in complexity of technological developments and the access to new knowledge. This is followed in decreasing order of importance by the reduction in cost of internal development and the reduction in time to market. At lower levels of importance are: monitoring environmental changes, internationalization and reducing uncertainty in internal development.

3. Governance structures

3.1 Ranking of motives to choose internal vs. external sources of innovations (Fig. 4)

Firm 2 believes that the motives sketched in Figure X vary with the situation. For instance, time to market could be more important than the technology that could be acquired when a product wants to be launched as soon as possible. Moreover, Firm 2 found it difficult to answer this question and the same answers were given to all the possible inter-firm organizational structures. This leads one to question the reliability of the answers to this question.

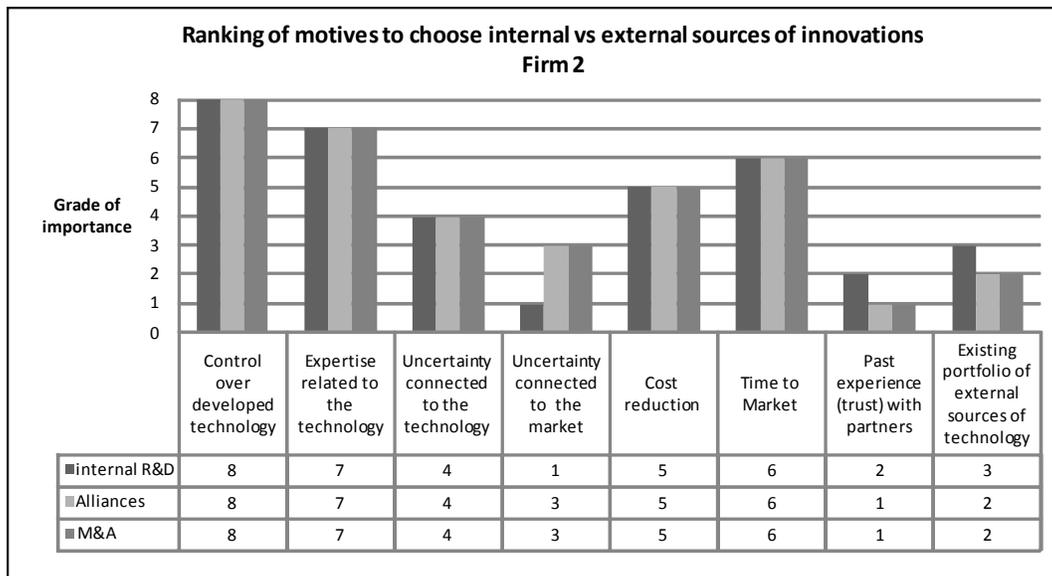


Figure 4 Ranking of motives to choose internal vs. external sources of innovation; Firm 2

4. Uncertainty factors to decide for an organizational structure to manage external sources of innovation

Assumptions for D1: Suppose you want to modify and improve an existing product. You have already a level of expertise with respect to the technologies which have to be applied so you are confident about the technological success. The market acceptance of the product is relatively certain. An already known business partner could contribute.

D1. When improving an existing product

D 1.1 Exclusively in-house or external partner

Given certainty regarding the market acceptance of the product and technology required to make the improvement of an existing product, Firm 2 would develop it in-house, but if the potential partner could contribute with reducing cost of the improvement or reduce the time required to put the product in the market, the partnership could be considered.

D 1.2 Choosing an organization structure

The choice of a specific organizational structure to manage the partnership depends on each situation. Usually Firm 2 does not establish any alliance, JV or M&A if the firm can buy the technology or patent in order to make the innovation. A single technology is not considered reason enough to take over other company. However important criteria are the type and

features of the desired technology and how far or close this technology is to the core competences of the firm. A M&A or JV could be an option if 1) the technology is closely related to the core competences of the firm, 2) it is strategically important to the firm, and 3) the firm could obtain at least 50% of participation in the relationship.

D 1.3 Influence of existing alliances

Existing alliances, JV or M&A influence the decision to establish a new partnership with the aim of avoiding possible conflicts among partners due to the reduced number of possible partners. However, the type of organizational structure is not influenced by the existing governance structures.

D 1.4 and D 1.5 High technology and market uncertainty

If the technology or the application of the technology is not well known, the firm tries to establish an alliance with an external technology partner or a University in order to make the improvement of the existing product. However, if the partner is willing to sell the patent or the technology, the firm will consider buying the patent like its first option.

If there is a high market uncertainty regarding the improvement of existing product, the firm will stop the innovation project and it will not establish any kind of partnership.

D 1.6 Nature of the potential partner

This firm does not establish any kind of partnership with competitors and vice versa. Suppliers and customers could be part of the improvement of an existing product, however, the type of organization structure is a strategic decision that depends also on the technology and the market that the firm wants to achieve.

D1.7 Partner involved with a competitor

Firm 2 usually does not establish any kind of relationship with potential partners which are currently involved with a competitor because of the likelihood to lose confidential information. However, if there is no other option, the firm could establish the relationship but with a clear non-disclosure agreement. The partner portfolio is verified but it is not always required, considering that the consequences of hiding this information to this firm, could damage the partnership.

D1.8 Partner uncertainty related to the lack of previous experience

The lack of previous experiences with a new potential business partner is not a limit to establishing a partnership.

D2. When developing a radical new product

The first choice to this firm is to develop this project alone but if this project requires a technology that it is not well known for the firm, it will decide to buy or license the technology like the first option, otherwise, it could be considered to make an alliance.

D3. When entering into a new market with an existing product

The best strategy to entry a new market with this firm is by acquiring an existing company, in this sense a M&A of the company which could ensure the market acceptance of the existing product is the first choice.

D4. When developing a new process

Similarly to the case when the technology is not well known for the firm, the first option is to buy or licensing the required process in order to develop it in-house.

D5. When the development costs are substantial

Before making a decision of developing an innovation, this firm makes a detailed financial and economical analysis regarding the costs, profits, sales. If the development costs of the innovation are too high, the firm might decide to stop the project and it will not consider looking for external help.

D6. When needing to reduce time to market

This decision is based on an economical analysis to assess the advantages to reduce time to market involving a potential partner. If there is highly profitable to reduce time to market involving a partner to accomplish it, the decision could be establishing an alliance. However, the first option always is to buy or licensing before to establish an alliance.

Firm # 3

1. Contextual situation

Table 3 sketches the contextual situation in which Firm 3 is embedded. This table follows.

Table 3. Context and features of Firm 3

Question	Answer	Explanation
Employees R&D vs. total number of employees	67.9%	This company consist of 28 employees from which 19 are involved in R&D activities
Strategic Orientation	Customer Intimacy	Without the cooperation with collaborators, customers and potential customers this firm is not able to develop its products. This firm offers a technology platform with different applications that require specific customers and collaborators to apply and develop its products.
Sales	Continental and Global	This firm concentrates its sales at continental and at global level.
Competitors	Global	This firm does not have direct competitors regarding its technology but it has indirect competitors regarding the field of application of this technology. These competitors are at global level.

External relationship non innovative motives	Alliances	Alliances: This firm has established alliances with global distributor partners in order to trade its products at global level. This firm has establish alliances with partners in specific key activities in which the firm does not have the require expertise which are required to manufacture its products.
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2. Innovative profile

2.1 Ranking of motives to source innovations externally

In Figure 5, the ranking of the motives to source innovation externally as established by Firm 3 is presented.

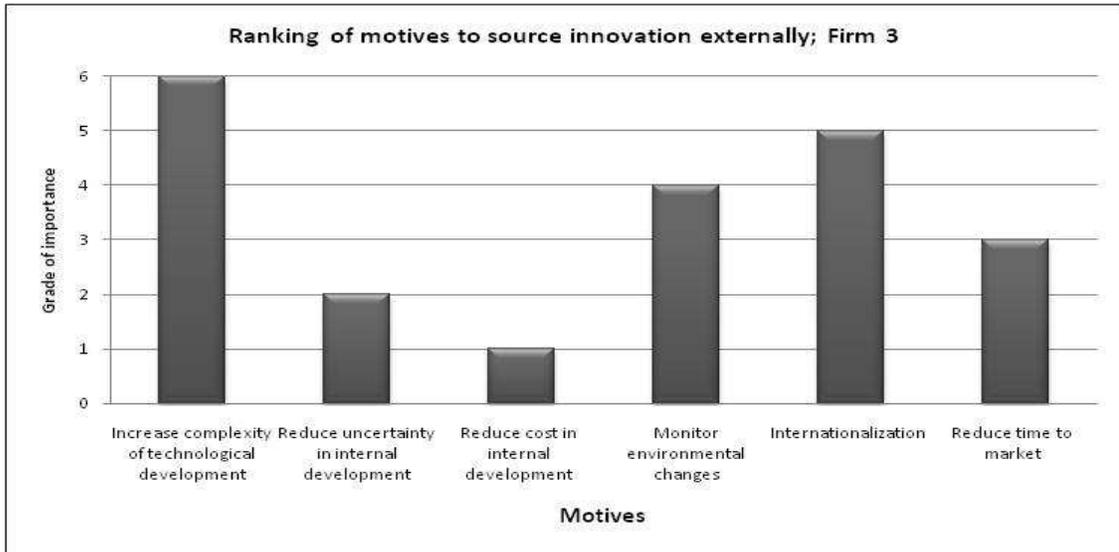


Figure 5 Ranking of the motives to source innovation externally in Firm 3

This firm argues that the main motive to source innovations externally is the access to increase number of samples which are needed for research. Therefore, the most important motive is based on the increased complexity of technological developments that the firm works with. This is followed by a market motivation in order to penetrate new product markets and a constant monitoring of environmental changes and technological opportunities. The reduction of: 1) time to market, 2) uncertainty in internal development and 3) costs in internal development are the less important motives to source innovation externally in that specific order of importance.

3. Governance structures

3.1 Ranking of motives to choose internal vs. external sources of innovations (Fig 6)

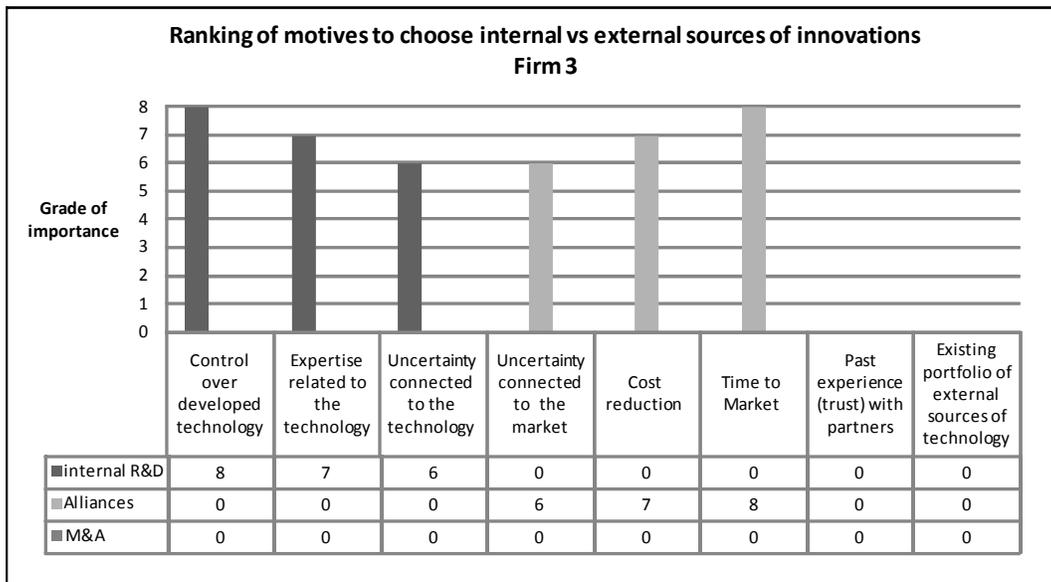


Figure 6 Ranking of motives to choose internal vs. external sources of innovation; Firm 3

The respondent implies that the motives exposure on this question could not be compare between each other because each motive could be more or less important regarding specific circumstances. Therefore, considering the firm`s experience, the respondent choose the three more important issues for internal development (R&D) and for alliances. It was remarked that for the respondent, based on the firm`s experience none of this issues are important when the innovation is made by M&A and it was mentioned that M&A are done only based on financial reasons regarding the cost reductions that could be obtained when two companies are merged. The most important issues consider when the innovation is made internally are: 1) the control over the developed technology, 2) the strategic importance of the innovation regarding to the core competences of the firm and 3) the technology uncertainty. The most important issues when the innovation is made by alliances are: 1) the reduction of time to market, 2) the reduction of costs in the development of innovations and 3) the uncertainty regarding the access to the relevant and desire market. Motives which are not included in this categorization are not relevant to this firm.

4. Uncertainty factors to decide for an organizational structure to manage external sources of innovation

Assumptions for D1: Suppose you want to modify and improve an existing product. You have already a level of expertise with respect to the technologies which have to be applied so you are confident about the technological success. The market acceptance of the product is relatively certain. An already known business partner could contribute.

D1. When improving an existing product

D 1.1 Exclusively in-house or external partner

If the firm has the expertise and the capacity to do the improvement of an existing product in-house, it will be developed in-house as the first option. In this sense, it is not needed to establish any kind of relationship with a partner with this purpose. If this is not the case, the establishment of a partnership is required.

D 1.2 Choosing an organization structure

An alliance, in the form of a non equity alliance will be chosen. JV and M&A are not considered as options for this firm.

D 1.3 Influence of existing alliances

The choice of this type of organizational structure is not influenced by any other existing alliance, JV or M&A that the firm could have.

D 1.4 and D 1.5 High technology and market uncertainty

If there is a lack of knowledge regarding the technology that will be used to make the innovation, the first option is to outsource and buy the required expertise. If there is not possible the firm might establish a partnership with an expert partner on this technology by an alliance.

If there is a high level of uncertainty regarding the market success of this improvement, the firm will not continue doing working in this project. This project will stop completely.

D 1.6 Nature of the potential partner

The nature of the potential partner does not influence the decision of establishing an alliance. Firm 3 considers that an alliance with a customer is always preferred take into account the high value added that this relationship could offer. An alliance with the competitors is always difficult because of the rivalry but it is not discarded. An alliance with the supplier is considered only if it is a key supplier of the specific components used in the development of its innovations.

D1.7 Partner involved with a competitor

Establishing an alliance with a partner who is currently involved with a competitor is always more difficult but it is not a reason enough to avoid the partnership. A detailed disclosure agreement regarding the flow of information must be included in the alliance.

D1.8 Partner uncertainty related to the lack of previous experience

The lack of prior experience with a potential business partner doesn't influence the decision of establishing an alliance, but it could delay the decision. Small collaborations with a potential business partner are required with the aim of knowing and learning about the partner before to establish an important partnership.

D2. When developing a radical new product

The development of radical new products implies most of the time the necessity to involve scientific technological partners in the project. Therefore, this firm might consider involving

customers and potential customers that could cooperate defining and developing the product. In this sense non-equity alliance is chosen to manage this relationship.

D3. When entering into a new market with an existing product

In this case the firm will involve a potential customer by the establishment of a non-equity alliance with the aim of reducing the uncertainty regarding the market success of its product.

D4. When developing a new process

If the development of new process implies to use an expertise that the firm does not possess, this could imply the necessity to involve an external partner who has the expertise. In this case a non-equity alliance will be used.

D5. When the development costs are substantial

This firm does not consider the development costs as criteria to decide doing the innovation internal or externally, because in its business activities, most of the time the innovation process involves high development costs. For this firm it is more important to have the expertise to develop the innovation. Therefore this kind of costs is covered by the shareholders of the firm.

D6. When needing to reduce time to market

This firm argues that to establish an alliance in order to reduce time to market it is always time demanding. Therefore, it considers more important to develop the innovation in-house if you have the resources available, considering that, for this firm, it is the fastest way to reach the target market. Outsourcing a specific activity that it could be required to reduce time to market, it is its best solution.

Firm # 4

1. Contextual situation

Table 4 sketches the contextual situation in which Firm 4 is embedded. This table follows.

Table 4. Context and features of Firm 4

Question	Answer	Explanation
Employees R&D vs. total number of employees	50%	This company consists of 2 employees from which 1 are involved in R&D activities.
Strategic Orientation	Customer Intimacy	The development of firm`s products are in a intimate relation with potential customers and it is based on the development of a project in which the priorities of the potential customer are highly considered.
Sales	National,	This firm sells its products at national, continental and global

	Continental and Global	level. More than 60% of their sales are at national and continental level.
Competitors	Global	There is no direct competitors in firm`s field of technology expertise, mainly due to the highly specificity of the technology. However there are indirect competitors trading similar products which are produced from other sources. Those companies compete at global level.
External relationship non innovative motives	Informal alliances	This firm has established informal alliances with companies in order to trade its products at global level. Firm 4 holds informal alliances with companies who make specific activities required to the development of its products.

2. Innovative profile

2.1 Ranking of motives to source innovations externally

In Figure 7, the ranking of the motives to source innovation externally as established by Firm 4 is presented.

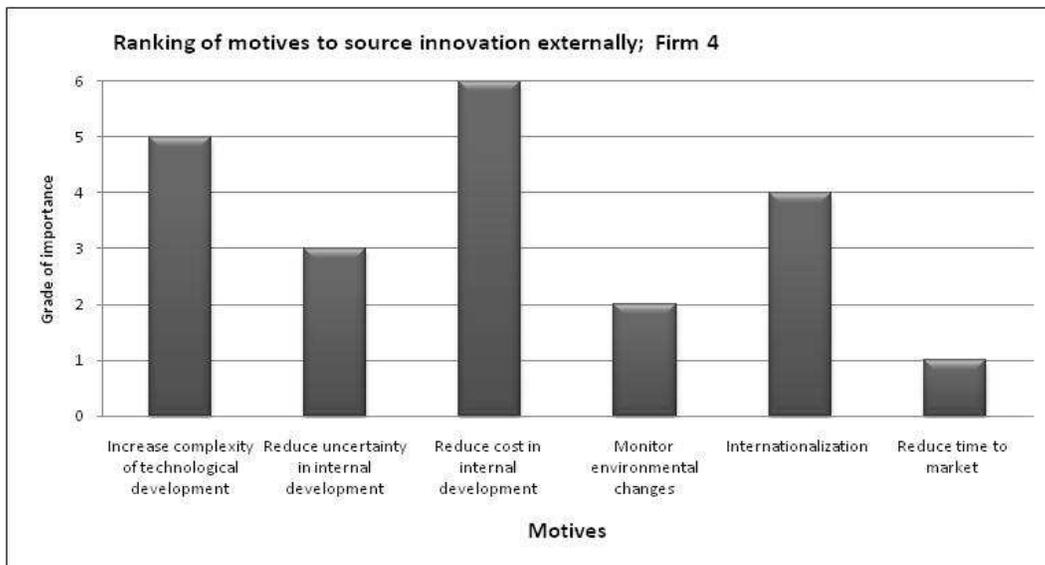


Figure 7. Ranking of the motives to source innovation externally in Firm 4

Given the grade of specificity of this firm`s products, the most important reasons to source innovation externally are: 1) the reduction of cost in the development of innovation, 2) the access to new knowledge that offer new applications to firm`s technology, 3) the access to new product markets, 4) the reduction of uncertainty in internal development, 5) the monitoring of environmental changes and technological opportunities and 6) the reduction in the time required to reach the target market; in this order of preference.

The last option is the least important motive to source innovations externally, given the fact that most of the innovation is co-developed with potential customers who will buy the product.

3. Governance structures

3.1 Ranking of motives to choose internal vs. external sources of innovations (Fig 8)

This firm has not established any M&A with the aim of developing product or process innovation. Therefore, the respondent avoids ranking the motives regarding this organizational structure.

Internal R&D:

The most important issues when the innovation is develop by internal R&D are: 1) the expertise related to firm`s core technology, 2) the uncertainty connected to the technology, 3) the control over the technology developed, 4) the reduction of cost in R&D, and 5) the uncertainty related to the market; in this order of preference.

Alliances:

The most important issues when the innovation is developed by alliances are: 1) the uncertainty connected to the technology, 2) the reduction of cost in the development of innovation, 3) the control over the developed technology, 4) the uncertainty connected to the market, 5) time to market aspects, 6) the expertise related to the technology, 7) the prior cooperation with a partner and 8) the existing portfolio of external sources of technology.

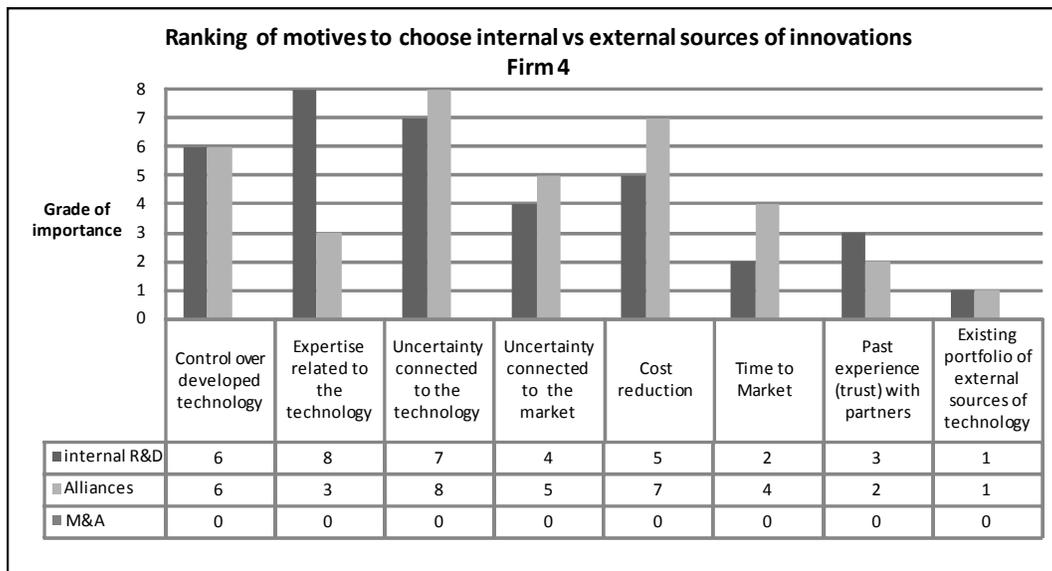


Figure 8 Ranking of motives to choose internal vs. external sources of innovations; Firm 4

This firm has not established any M&A with the aim of developing product or process innovation. Therefore, the respondent avoids ranking the motives regarding this organizational structure.

Internal R&D:

The most important issues when the innovation is developed by internal R&D are: 1) the expertise related to firm's core technology, 2) the uncertainty connected to the technology, 3) the control over the technology developed, 4) the reduction of cost in R&D, and 5) the uncertainty related to the market; in this order of preference.

Alliances:

The most important issues when the innovation is developed by alliances are: 1) the uncertainty connected to the technology, 2) the reduction of cost in the development of innovation, 3) the control over the developed technology, 4) the uncertainty connected to the market, 5) time to market aspects, 6) the expertise related to the technology, 7) the prior cooperation with a partner and 8) the existing portfolio of external sources of technology.

4. Uncertainty factors to decide for an organizational structure to manage external sources of innovation

Assumptions for D1: Suppose you want to modify and improve an existing product. You have already a level of expertise with respect to the technologies which have to be applied so you are confident about the technological success. The market acceptance of the product is relatively certain. An already known business partner could contribute.

D1. When improving an existing product

D 1.1 Exclusively in-house or external partner

Given certainty regarding to the technology used to develop the improvement of an existing product and the market acceptance to this improvement, this firm usually will develop this modification in-house. Only depending specific situations where a partner could give an extra value added to this firm's product, this firm could consider establishing a partnership in the improvement of an existing product.

D 1.2 Choosing an organization structure

In the case that an external partner could give an extra value to the modification of an existing product, an alliance is the type of organization structure chosen to manage this relationship. A JV or M&A is not considered appropriate to this firm.

D 1.3 Influence of existing alliances

The decision to establish an alliance with a partner with the aim of improving an existing product could be influenced by the existing alliance, JV or M&A that the firm is involved, considering positive or negative experiences regarding the use of these organization structures.

D 1.4 and D 1.5 High technology and market uncertainty

If the firm doesn't have the expertise regarding to the technology that will be used to make the improvement of an existing product, this firm is able to establish an alliance with a partner who has the proven expertise regarding to this technology.

If there is a high uncertainty regarding to the market in which this product will be traded. This firm is able to establish an alliance with a partner who could guarantee the market access of this product. However if the development cost of the improvement is too high, this firm could consider to stop this modification, if the market acceptance of the product is also highly uncertain.

D 1.6 Nature of the potential partner

Considering that the modification or improvement of the existing product is the final objective of the firm, the establishment of an alliance, without taking into consideration the nature of the partner, will be done. Specific clauses regarding confidentiality disclosure must be included in the agreement, when the potential partner is a competitor.

D1.7 Partner involved with a competitor

If the potential partner is already involved with a competitor, this firm keeps its decision to establish the alliances with the potential partner including in the alliance a confidential disclosure agreement which protect the firm`s specific information.

D1.8 Partner uncertainty related to the lack of previous experience

The lack of previous experience with the potential business partner does not change the decision to establish an alliance in order to improve the existing product.

D2. When developing a radical new product

The decision to establish an alliance with a partner will not change regarding the development of a radical new product.

D3. When entering into a new market with an existing product

The decision to establish an alliance with a partner will not change regarding the entrance to a new market with an existing product.

D4. When developing a new process

The production process is a very important core competence of this company. Therefore, when it is possible, any innovation regarding to a new process will be developed in-house. This is considering that the technology develop by this company is unique in the world.

D5. When the development costs are substantial

If the development cost of an innovation is high, this firm is able to establish an alliance with potential partners which could financially support this innovation. However when it is possible, it is better to make this innovation in-house.

D6. When needing to reduce time to market

For this company the reduction of time to market is not a really issue because in most of the cases the potential customers of the innovative products is already involved in early stages of

the development. However, if it is required to reduce the time to market, an alliance with a potential business partner could be done.

Firm # 5

1. Contextual situation

Table 5 sketches the contextual situation in which Firm 5 is embedded. This table follows.

Table 5. Context and features of Firm 5

Question	Answer	Explanation
Employees R&D vs. total number of employees	4%	This company consists of 1250-3000 employees of which 50 are in R&D unit.
Strategic Orientation	Operational Excellence	Operational excellence ensures giving the right answers to the demands of the customers. Cutting costs and becoming a cost leader is an important thing for success in the future which can be complemented by customer intimacy.
Sales	Continental and Global	This firm concentrates its sales at continental (50% including Netherlands which is 10-15%) and at global level (30% Asia, 15% North America and 5% South America).
Competitors	Global	It is a competition for the raw material and it is global
External relationship non innovative motives	Alliances	The alliance is with competitors and this gives the competitor rights over the distribution outside Europe. The alliance is a result of marketing motivation.

2. Innovative profile

2.2 Ranking of motives to source innovations externally

In Figure 9, the ranking of the motives to source innovation externally as established by Firm 5 is presented.

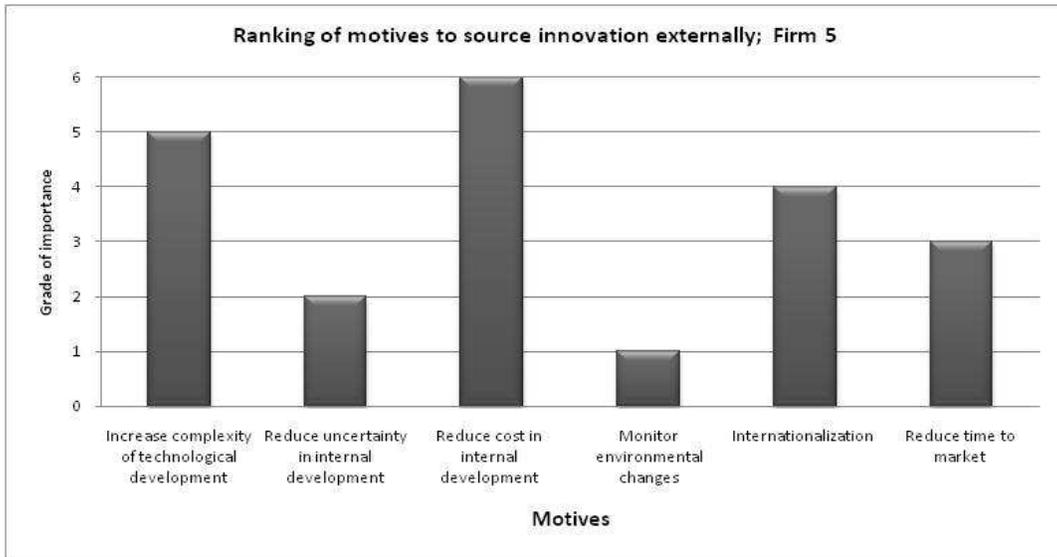


Figure 9 Ranking of the motives to source innovation externally in Firm 5

As seen in Figure 9, the most important motive to source innovation externally for Firm5 is to reduce cost in internal development and to increase complexity of technological developments and access to new knowledge. These are followed in decreasing order of importance by internationalization or entry into a new product market and the reduction in time to market. At lower levels of importance are: to reduce uncertainty in internal development and monitoring environmental changes.

3. Governance structures

3.1 Ranking of motives to choose internal vs. external sources of innovations (Fig 10)

Usually this firm doesn't make M&A in order to achieve innovations, therefore the respondent did not rank the motives regarding to this option.

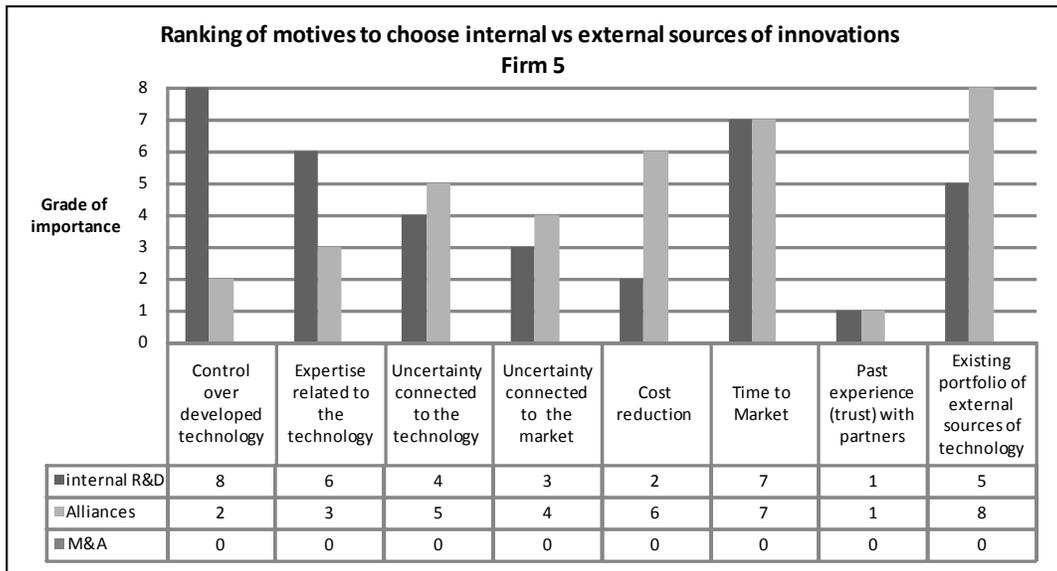


Figure 10 Ranking of motives to choose internal vs. external sources of innovations; Firm 5

4. Uncertainty factors to decide for an organizational structure to manage external sources of innovation

Assumptions for D1: Suppose you want to modify and improve an existing product. You have already a level of expertise with respect to the technologies which have to be applied so you are confident about the technological success. The market acceptance of the product is relatively certain. An already known business partner could contribute.

D1. When improving an existing product

D 1.1 Exclusively in-house or external partner

In the case that the market acceptance for the product is relatively certain and the level of expertise needed to develop the innovation (technology) is sufficient, there is no need for an external partner. A study of the NPV would be done to see the contribution of the external partner in order to include it in the project.

D 1.2 Choosing an organization structure

When having to choose an external partner, the decision on which type of inter-firm relationship Firm 5 would go into would depend on the financial position of the firm at that time. In cases in which the economy is in recession the first choice would be a non equity alliance, followed by a JV and finally an acquisition. On the other hand, if the external partner adds value to the firm (because of something the firm does not have) and there is no financial recession, the first option would be an acquisition.

D 1.3 Influence of existing alliances

The choice of the type of organizational structure to manage the relationship is not influenced by other existing alliances, JV or acquisitions the firm already has. Current partners are the first option when the firm decides to improve an existing product

D 1.4 and D 1.5 High technology and market uncertainty

Firm 5 considers that if they do not have the expertise sufficient regarding technology required to make the improvement of the existing product, the firm could establish an alliance if the external partner and the firm have a sufficient technological distance regarding the core competences of the firm.

If the market success is highly uncertain, the risk of the project is considered high and in this regard, the project will still go on.

D 1.6 Nature of the potential partner

The type of partner who is willing to establish an inter-firm relationship (customer, supplier or competitor) does not influence the decision of Firm 5 when having to choose between an alliance, a JV or an acquisition.

D1.7 Partner involved with a competitor

If the external partner is currently involved with one of the firm's competitor, this situation does not influence the decision to establish a relationship with this partner.

D1.8 Partner uncertainty related to the lack of previous experience

Even if there is no previous experience with the potential business partner, the main point of importance is the strategic direction of that business, a right understanding and communication with the people involved.

D2. When developing a radical new product

The firm believes that when developing a radical new product, the moment in which it will choose to establish an inter-firm relationship would be when the market and technological fields are unknown. If not, it will develop in-house.

In case the firm would establish an inter-firm relationship, it will first choose for an M&A, followed by a JV and followed by a strategic alliance in this order of preference.

D3. When entering into a new market with an existing product

Firm 5 would choose to establish an alliance when entering a new market with an existing product.

D4. When developing a new process

When developing a new process Firm 5 would establish an inter-firm relationship with an external partner choosing an alliance.

D5. When the development costs are substantial

Firm 5 believes that if the firm has enough money to develop on their own, they would not choose for an external partner. However, if the process and conditions in the industry of Firm 5 need an external party, a partner would be chosen. The modality depends on the business case.

D6. When needing to reduce time to market

When needing to reduce the time to market, Firm 5 believes that if the market is known, the innovation would be in-house. On the other hand, if the market is new to the firm, an external partner would be looked for. The type of inter-firm relationship would be an alliance.

Firm # 6

1. Contextual situation

Table 6 sketches the contextual situation in which Firm 6 is embedded. This table follows.

Table 6. Context and features of Firm 6

Question	Answer	Explanation
Employees R&D vs. total	Less than 1%	Firm 6 has 35000 employees from which 30 are working in the R&D division

number of employees		
Strategic Orientation	Operational excellence and product leadership	<i>Operation excellence</i> and <i>product leadership</i> are two of the corporate strategic orientation that this firm follows.
Sales	National, regional, continental and global	This firm sells its products from national to global level. However more than 70% of the sales are traded at continental level.
Competitors	National, regional continental and global	Depending on the product and the market, this firm has competitors from national to global level. Considering its home markets there are more national and regional competitors. Products more close related to commodity markets have a strong component of global competitors.
External relationship non innovative motives	M&A	M&A are used as a main growth strategy. In this sense, M&A are made with the aim of increasing market share or getting access to a new market. M&A are also established with the aim of ensuring the availability of raw materials for the firm.

2. Innovative profile

2.1 Ranking of motives to source innovations externally

In Figure 11, the ranking of the motives to source innovation externally as established by Firm 6 is presented

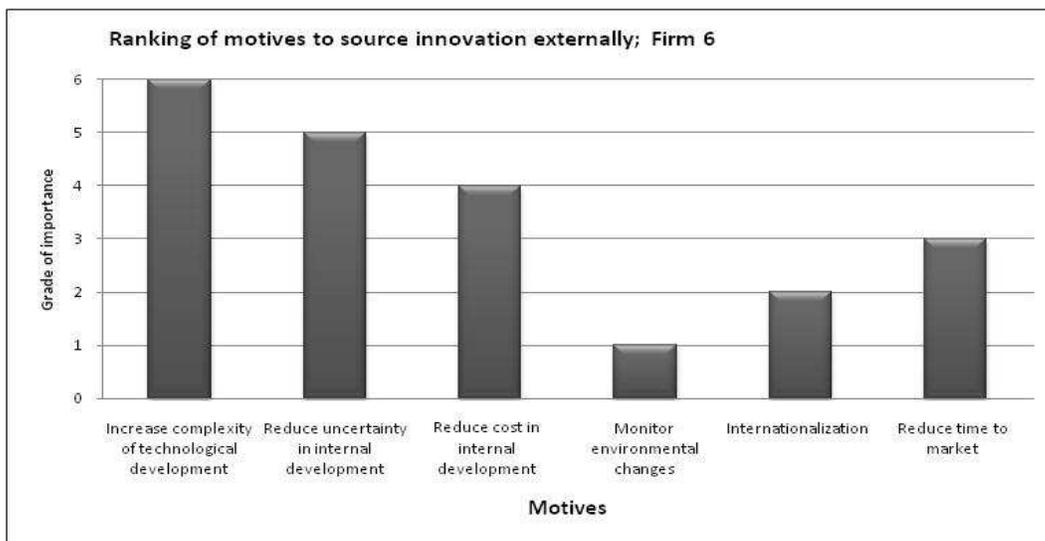


Figure 11 Ranking of the motives to source innovation externally in Firm 6

For firm 6, the main motives to source innovations externally considers are: 1) The increased complexity of technological developments, 2) the reduction of uncertainty in internal development, 3) the reduction of costs in internal development, 4) the reduction in time to market, 5) the entrance to new product market or internationalization and 6) the monitoring of environmental changes and technological opportunities; in this order of preference.

3. Governance structures

3.1 Ranking of motives to choose internal vs. external sources of innovations (Fig 12)

For firm 6 the control over the technological developments or new knowledge generated externally is the more important motive when the firm decide to make a M&A, and it is less important when the firm decide to develop the innovation internally and even much less important when the firm decide to develop the innovation by an alliance. The expertise related to the technology (core competence of the firm) is the most important issue when the firm decide to make the innovation internally or by an alliance. Uncertainty related to technology and market as well as the the reduction of cost are also important when the innovation is developed internally, or externally (alliances or M&A); in this order of importance. Less important issues for all the possible options are the reduction in time to market, the existing portfolio of external sources of technology and in the las position the prior or past experience with respect ot the potential partner.

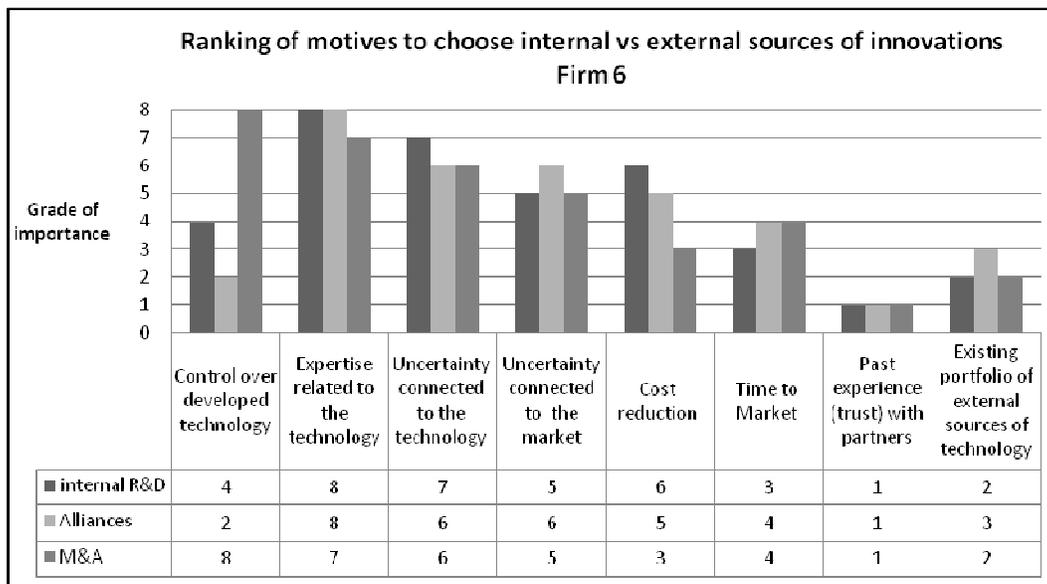


Fig 12 Ranking of motives to choose internal vs external sources of innovations; Firm 6

4. Uncertainty factors to decide for an organizational structure to manage external sources of innovation

Assumptions for D1: Suppose you want to modify and improve an existing product. You have already a level of expertise with respect to the technologies which have to be applied so you are

confident about the technological success. The market acceptance of the product is relatively certain. An already known business partner could contribute.

D1. When improving an existing product

D 1.1 Exclusively in-house or external partner

Given a scenario of certainty regarding to market and technology firm 6 consider that this modification is made in-house without external partner. However if the potential partner could reduce time to market, reduce costs and/or give an extra added value to this project, this firm would do it with an external partner.

D 1.2 Choosing an organization structure

Depending on the size of the company and the type of technology the decision varies from alliance to M&A. Alliances would be established with big companies in order to develop a certain product oriented to a specific market. JV could be used with medium companies like research institutes, while M&A could be made if there is a small star up company which possesses specific technology with a high strategic importance for this firm.

D 1.3 Influence of existing alliances

Existing alliances don't influence the decision to choose of a specific kind of organizational structure to manage a new relationship. However it is avoided to establish new relationships with the aim of developing the same product or process innovation which is being the target of an existing relationship. However if a new potential partner could offer better conditions in order to make an improvement of an existing product or to develop an innovation than an existing alliance, the firm could consider modify the existing composition of its business relationships.

D 1.4 and D 1.5 High technology and market uncertainty

Alliances or more flexible forms of organizational structures are applied in this case. Agreements of exclusiveness concerning a specific technology or product, required to develop the innovation could be established for certain period of time with the potential partner. This agreement will give to the firm the right to be the first users of this technology in order to develop the innovation. Moreover this kind of agreement avoids the establishment of any kind of more formal relationship.

D 1.6 Nature of the potential partner

The type of partner is not a bound when the firm decides to establish a relationship with the aim of developing an innovation. Agreements or alliances with competitors are always more difficult to be set up. These decisions also depend on the business opportunity that the firm could achieve from these relationships.

D1.7 Partner involved with a competitor

Firm 6 avoids a relationship with a competitor as far as possible. However, as long as the technology is strategically important for the firm and the alliance or agreement could offer

security regarding confidentiality giving the firm exclusivity rights concerning the use of this technology for a certain period of time; the firm would keep the decision to establish the alliance, although the partner could be already involved with a competitor.

D1.8 Partner uncertainty related to the lack of previous experience

The lack of prior cooperation with a potential business partner is not a bound to establish a relationship. However, this firm always tries to obtain as much information as possible related to the reliability of the potential partner in order to make a decision. This information is concerning its expertise, its strategic orientation (academic or commercial), age of the partner in its business, the current business and market in which it is embedded.

D2. When developing a radical new product

Depending on the size of the partner company and the type and importance of the technology, for the development of a radical new product, this firm would decide for more or less integrated forms of organizational structures. Relevant technologies in big companies could be obtained by an alliance or JV. Relevant technologies in small companies could be acquired. However if the target company is able to sell the patent or the technology this option could be the first option before to consider a partnership.

D3. When entering into a new market with an existing product

If this firm does not have access to a new market for an existing product, it would decide to establish a partnership to develop a new market or to buy the target company with the aim of obtaining access to this market and increase its market share

D4. When developing a new process

If the process innovation includes engineering expertise in order to develop new equipment or machinery, this firm would establish a partnership in the form of an alliance with a company which could offer this knowledge, but if the process innovation could be developed internally this firm would prefer to do it in-house.

D5. When the development costs are substantial

In this case firm 6 would do a financial analysis regarding the required time to recuperate the investment (return of investment). Projects in which the return of the investment exceeds 2 years would not be considered by this firm internally or externally.

D6. When needing to reduce time to market

If the firm does not have the capacity or capabilities to reduce the time required to develop the innovation. Firm 6 is open to look for a partner who could have the required capabilities or capacity to do it. Initially this partnership would be carry out by an alliance.

Interview Protocol

Date: _____
Hour: _____
Company Name: _____
Respondent: _____
Position in the company: _____
Years of experience: _____
Interviewer: Victor Hugo Lascano

Introduction:

This interview is part of an MSc. Thesis developed in the Management Studies Group with the collaboration of the Business Economics Group of Wageningen University.

The purpose of the interview is to collect information on the current managerial practices on which companies base their decision to choose for a specific type of partnership (alliances, acquisitions). This information will be used to make a comparison between theoretical insights and what is applied in strategic business practice by decision makers. The model that we are developing is aiming at supporting dynamic (time-dependent) decision making. The conversation will help to determine synergies between theory and practice and it will allow to both tune the model and to propose decisional guidelines for enhancing current decision-making process.

The information given will be kept confidential and the company has the right to choose in which way it wants the information to be handled. Moreover, the results of this research will be handed in to the company once the analysis is finished.

The interview is divided in four parts:

- A. Question about general Information of the company concerning innovation
- B. Questions about specific information about the motives to establish external relationships
- C. Question about specific criteria to choose different forms of governance structures
- D. Question about the decision making process assuming specific circumstances

Please follow the instructions stated in each question. If you need additional information please do not hesitate to contact me at: 0634731158 or victorhugo.lascanoalcoser@wur.nl

Thank you very much for your time and your valuable contribution in the development of this research.

Definitions:

Innovations are defined as products and/or processes that are new to the firm and/or new to the market and that are introduced in the market

Portfolio refers to all the business to business relationships in which the firm is

QUESTIONS A:

1. How many **employees** does your company have (in full time equivalent)?
2. How many **R&D-E personnel** does your company have (in full time equivalent)?
3. On a scale from 1 to 7, with 7= very important, 4= neutral and 1= not important, how would you define **the importance of innovation** for your **competitive success**?
Not important 1 2 3 4 5 6 7 very important
4. On a scale from 1 to 7, with 7= ahead of competition, 4= neutral and 1= follower, how would you define the **strategic orientation** of your firm?
Follower 1 2 3 4 5 6 7 Ahead of competition
5. What is for your company the importance of the following **strategic orientations**: (you can choose more than one. Please explain your answers)
 - a. operational excellence
 - b. customer intimacy
 - c. product leadership
6. Are your **sales**: (if you choose more than one please give the percentage on base to 100% as the total)
 - a. National%
 - b. Regional%
 - c. Continental%
 - d. Global $\frac{\text{.....}}{100}\%$
7. Are your **competitors**:
 - a. National
 - b. Regional
 - c. Continental
 - d. Global
8. On a scale from 1 to 7, with 7= very high, 4= neutral and 1= very low, how would you categorize the **competition levels** in the industry in which your company operates?
Very low 1 2 3 4 5 6 7 very high
9. Considering 100% as the total sum. How much of your innovation in percentage comes nowadays from:
 - a. In-house R&D%
 - b. Non equity alliances%
 - c. Joint Ventures%
 - d. M&As $\frac{\text{.....}}{100}\%$

QUESTIONS B:

1. Please rank the following motives (A to F) for **sourcing innovation externally**, from 1=the most important to 6=the least important.

	MOTIVES	RANKING
A	Increased complexity of technology developments and access to new knowledge	
B	Reducing uncertainty in internal development	
C	Reducing costs in internal development	
D	Monitoring environmental changes/technological opportunities	
E	Entry in new product markets/internationalization	
F	Reducing the time to market	

2. Does your company have alliances, joint ventures and M&As **for reasons other than innovation**? Please, mention.

QUESTIONS C:

1. Please rank the following **motives** from 1=the most important to 8=the least important, when innovating: by **internal development** (R&D), by **alliances** and by **Mergers and Acquisitions** (M&A) (i.e. When innovation is made by internal development: A=1, C=2, H=3...)

	MOTIVES / ISSUES	INTERNAL DEVELOPMENT (R&D)	ALLIANCES	M&A
A	Control over the developed technology/new knowledge			
B	Strategic importance/expertise related to the technology (core to the company)			
C	Uncertainty/risk connected to the technology (product/process)			
D	Uncertainty/risk connected to the market (product differentiation/business model)			
E	Cost reduction			
F	Time to market			
G	Past experiences and/or trust with respect to the partner			
H	Existing portfolio of external sources of technology modalities			

2. On a scale from 1 to 7, with 7= continuously, 4= sometimes and 1= on demand, **how often** do you monitor/rebalance the **composition of business relationships**? Please explain your answer

On demand 1 2 3 4 5 6 7 continuously

QUESTIONS D:

1. Suppose you want to modify and **improve an existing product**. You have already a level of **expertise** with respect to the **technologies** which have to be applied so you are confident about the technological success. The market acceptance of the product is relatively **certain**. An **already known** business partner could contribute.
 - 1.1 Under which conditions would you **develop exclusively in-house (and reject the external partner)**?
 - 1.2 Suppose that you accept the external partner would enter into an **alliance, joint venture or acquisition**? Please give your argumentation about the elements supporting your decision.
 - 1.3 Is your choice influenced by **other existing alliances/joint ventures/acquisitions** you already have? How?
 - 1.4 What would change in your decision if the **technology is not well-known to you** (higher technology risk)? In which way?
 - 1.5 What would change in your decision if the **market success is highly uncertain**?
 - 1.6 Would the nature of the potential partner -(1) **supplier** or a (2)**customer** or a (3) **competitor** -change your decision? How?
 - 1.7 What would change in your decision if your partner is **already involved with one of your competitors**? Do you verify the portfolio of your partner before taking a decision?
 - 1.8 What would change in your decision if you **do not have previous experience with the potential business partner**?
2. What changes in your answers **if you are developing a radical new product**
 - 2.1. with respect to in-house vs. external decision?
 - 2.2. with respect to the partnering modalities?
3. What changes in your decision **if you are entering in a new market** with an existing product
 - 3.1. with respect to in-house vs. external decision?
 - 3.2. With respect to the partnering modalities?
4. What changes in your answers **if you are developing a new process**
 - 4.1. with respect to in-house vs. external decision?
 - 4.2. With respect to the partnering modalities?
5. What changes in your answers **if the development costs are substantial**
 - 5.1 With respect to in-house vs. external decision?
 - 5.2. With respect to the partnering modalities?
6. What changes in your answers **if you need to reduce time to market**
 - 6.1. with respect to in-house vs. external decision?
 - 6.2. With respect to the partnering modalities?