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**THE PATTERNS OF COMPANY: FIRM AND ORGANIZATION**

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2017**

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Dissertação apresentada ao Programa de Pós-Graduação em Administração da Universidade Federal do Rio Grande do Sul, como requisito para a obtenção do título de Mestre em Administração.

Orientador: Paulo Antônio Zawislak

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*Humanity's deepest desire for knowledge is justification enough for our continuing quest. And our goal is nothing less than a complete description of the universe we live in.*

— Stephen Hawking, *A Brief History of Time*

## ABSTRACT

The industrial economy showed that economic agents, companies, are different from one another. Based on that, differences among companies under real constraints came into the spotlight: why do some companies succeed while others fail? Any existing company is both a firm, i.e., the economic agent developing and transacting goods and services, and an organization, i.e., the structure to efficiently coordinate the production of these goods. If firms are different, then there are different patterns of organizing the firm. In that sense, for each one of those different knowledge and organizational abilities and routines, there will be different capabilities. Thus, firms are organized according to their capabilities. The main objective of the present research is then to identify different patterns of company, considering firm-organization combinations. The objective is achieved through the analysis of secondary data from a survey conducted in 1331 manufacturing companies from 2010 to 2015. Data were analyzed through factor analysis, cluster analysis, Pearson correlation, multiple regression analysis and descriptive analysis. Results show four different patterns of company: *nearly balanced companies*, *firm-based companies*, *advanced organization-based companies* and *basic organization-based companies*. The four identified patterns suggest that companies may act towards efficacy, stability or fulfilling their innovative potential over time. In that sense, disorganization appears whenever firm and organization are unbalanced. However, that may be momentary, as a natural consequence of innovation, or permanent, as a consequence of internal inefficiency. Thus, there is no single best firm-organization combination, but there are different combinations for different positionings and, thus, different performances. In that sense, the disorganized firm is the firm that does not have the adequate organization that guarantees its best outcomes at a given moment. Based on its results, this study may help managers understand that being an organization-based company is risky if firm does not present an adequate and aligned level of development. The study elucidates directions to be followed by companies that aim at advancing their firm complexity towards a more balanced company, and future directions to those companies that already present satisfactory outcomes, according to each positioning. The study also sheds light on the importance of alignment between regulatory agencies and the direction of a nation's competitiveness. By doing so, the study can help make policy makers aware that innovation policies should focus on innovations primarily focused on the firm sphere, to, later, organization be structured – and not vice versa.

**Keywords:** company, firm, organization, innovation, capabilities.



## RESUMO EXPANDIDO

### OS PADRÕES DE EMPRESA: FIRMA E ORGANIZAÇÃO

Desde as primeiras discussões sobre o processo de criação de riqueza, avançando para o *mainstream* econômico, as empresas eram consideradas perfeitamente racionais, realizando suas atividades de acordo com a mesma combinação de fatores. No entanto, invalidando a hipótese geral da função de produção com lucro máximo e dissolvendo o pressuposto de equilíbrio, a economia industrial trouxe uma nova perspectiva sobre a realidade. A economia industrial mostrou que os agentes econômicos, as empresas, são diferentes uns dos outros. A abordagem foi então invertida: em vez de "por que as empresas deveriam ser iguais?", a questão passou a ser "por que as empresas diferem?". A partir de então, as diferenças entre empresas sob restrições reais entraram em destaque, especialmente no que diz respeito ao desempenho: por que algumas empresas prosperam, enquanto outras fracassam? É fundamental, portanto, compreender que qualquer empresa existente é, ao mesmo tempo, uma firma, i.e., o agente econômico que desenvolve e transaciona bens e serviços, e uma organização, i.e., a estrutura para coordenar eficientemente a produção desses bens e serviços. Se as empresas são diferentes, então há diferentes padrões de organização da firma. Nesse sentido, para cada diferente conhecimento, rotinas e habilidades organizacionais, as empresas apresentarão diferentes capacidades. Sendo assim, pode-se dizer que as firmas são organizadas de acordo com suas capacidades. No entanto, o que significa de fato organização da firma? O que é uma firma organizada? Em que tipo de esforço deve a estrutura de coordenação da firma depender? Qual é a organização adequada para diferentes tipos de firmas? Com o objetivo de responder a essas perguntas, o principal objetivo da presente pesquisa é identificar diferentes padrões de empresa, considerando a combinação firma-organização. O objetivo é alcançado a partir da análise de dados secundários do projeto "Caminhos de Inovação na Indústria Brasileira", coordenado pelo Núcleo de Estudos em Inovação (NITEC) e realizado no período de 2010 a 2015. O projeto foi baseado em um modelo de capacidades de inovação que abrange capacidades relacionadas tanto à firma quanto à organização. Foram analisados os dados quantitativos coletados na pesquisa realizada em 1331 empresas industriais. Análise fatorial, análise de agrupamentos, correlação de Pearson, regressão múltipla e análise descritiva foram os métodos utilizados. Os resultados demonstram quatro padrões diferentes de empresa: *empresas quase equilibradas*, *empresas*

*baseadas na firma, empresas baseadas em organização avançada e empresas baseadas em organização básica.* Ao detalhar os diferentes padrões de empresa, é possível compreender o que está por trás da inovação e da desorganização dentro das empresas analisadas. Os quatro padrões identificados sugerem que as empresas podem agir em prol da eficácia, da estabilidade ou do cumprimento do seu potencial inovador ao longo do tempo. Nesse sentido, a desorganização aparece sempre que firma e organização estão desequilibradas. No entanto, isso pode ser momentâneo, como uma consequência natural da inovação, ou permanente, como consequência de ineficiência interna. Como conclusão, é possível sugerir que não existe uma única melhor combinação entre firma e organização, mas existem combinações diferentes para posicionamentos diferentes e, assim, diferentes desempenhos. Nesse sentido, a empresa desorganizada é a empresa que não tem a organização adequada para garantir seus melhores resultados em um dado momento. A partir dos resultados identificados, este estudo pode ajudar empresários a entender que ser uma empresa baseada em organização é arriscado se a empresa não apresentar um nível adequado e alinhado de desenvolvimento. O estudo elucida as direções a serem seguidas pelas empresas que visam avançar a complexidade da firma rumo a uma empresa mais equilibrada e direções a serem seguidas por empresas que já apresentam resultados satisfatórios, dado o posicionamento de cada uma delas. Como contraponto, o estudo também esclarece a importância do alinhamento entre as agências reguladoras e a direção da competitividade de uma nação. Ao fazê-lo, o estudo pode ajudar a elucidar aos decisores políticos que as políticas de inovação devem centrar-se nas inovações relacionadas principalmente à esfera da firma, para, mais tarde, a organização ser estruturada – e não vice-versa.

**Palavras-chave:** empresa, firma, organização, inovação, capacidades.

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## 1 Introduction

Since the very first discussions on the process of wealth creation, advancing to the mainstream economics, companies were considered perfectly rational, performing their activities according to the same combination of factors. However, invalidating the general hypothesis of the production function with maximum profit and dissolving the assumption of equilibrium, the industrial economy brought a new perspective on the evolution of reality. The industrial economy showed that economic agents, companies, are different from one another. The approach was then reversed: instead of “*why should companies be equal?*”, the question turned to be “*why do companies differ?*” (Nelson, 1991).

Based on that, differences among companies under real constraints came into the spotlight, especially on their performances: why do some companies succeed while others fail? As a precondition to understand that, it turns relevant to understand the very essence of the company. More than the economic agent producing and transacting goods and services, which are supposedly made under an efficient way, the company is above everything a knowledge and capability based agent.

In fact, that is exactly on what the transaction cost economics relies, by considering that a company may reduce transaction costs and efficiently carry its production internally thanks to its unique knowledge. Companies grow as they add more of what was formerly transacted to their repertoire; however, this happens solely when the production cost to make internally is equal to or smaller than the cost in the market (Coase, 1937). From that point of view, knowledge stands as the ultimate factor that guides the decision whether any economic agent should make (because it holds knowledge enough to supply market needs more efficiently) or buy (because it does not hold enough knowledge to make).

Any existing company is then, at the same time, a pack of different knowledge applied on different levels. From development to transaction, any existing company should look for the operational efficiency in the allocation of scarce resources. To do so, it is needed an effort of coordination, translated into the organization of the company.

As a matter of fact, any existing company<sup>1</sup> is, at the same time, a firm, i.e., the economic agent developing and transacting goods and services, and an organization, i.e., the structure to

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<sup>1</sup> There are several different synonyms referring to company, such as organization, firm, enterprise, or business. Scholars suggest, however, that a company is composed by a firm and an organization, which ensures its ability to transform technology into business (Baecker, 2006; Zawislak, 2012).

efficiently coordinate the production of these goods. By being so, companies internalize, within their organizational limits, the different levels of knowledge they are able to deal with (Coase, 1937; Penrose, 1959). In other words, the organization becomes responsible for structuring the way the firm will effectively make what it has decided to make (instead of buying). Thus, if firms are different, then there are different patterns of organizing the firm.

In that sense, for each one of those different knowledge and organizational abilities and routines, there will be different capabilities. Since its first definitions (Richardson, 1972), the term ‘capabilities’ has been understood as knowledge, experience and skills that companies own in order to perform their activities and to fill market gaps with new offerings of value. Each company is then a bundle of commitments to technology, personnel, and methods, all contained and constrained by an insulating layer of information that is specific to the company (Demsetz, 1993). Through this perspective, every company, by being a firm and an organization at the same time, will perform different strategic functions involving development, operations, management and transaction. Therefore, for each function, there should be a specific capability (Zawislak et al., 2012). Considered that, capabilities are determinants of the boundaries of the firm, since they determine the relative costs of different firms in organizing particular activities (Alves & Zawislak, 2015; Langlois & Foss, 1999; Richardson, 1972).

While transaction cost theory proposes that there are some market costs because of the natural limitations of knowledge and information, capability approach suggests that those limitations of knowledge and information are the key to understand everything a company in fact does. It is through the capabilities arrangement that companies have their firm and organization combined to produce and transact. Moreover, in such an uncertain environment, in which bounded rationality and multiple limitations determine the opportunities, capabilities will thus determine the different organization of the firm and their success – or not.

However, what is indeed the organization of the firm? What is an organized firm? On what kind of effort should the coordination structure of the firm rely? What is the adequate organization for different types of firms?

Aiming to answer these questions, the main objective of the present research is **to identify different patterns of company, considering firm-organization combinations**. The following specific objectives are considered essential to achieve the referred main objective:

- to define different firm-organization combinations based on the capabilities approach;
- to determine the different organization levels for the different firm types;
- to characterize each pattern of firm-organization combination.



These objectives are achieved through the analysis of secondary data from the project entitled “Paths of Innovation in the Brazilian Industry”, coordinated by the NITEC Innovation Research Center and developed from 2010 to 2015. The project was based on an innovation capabilities model that encompasses capabilities related both to firm and to organization. Quantitative data collected in the survey conducted in 1331 manufacturing companies during the referred project are analyzed. The statistical analyses were performed using the software Statistical Package for Social Science – SPSS.

According to Nelson (1991), the diversity of companies is an essential aspect in the processes that promote economic progress. In that sense, the present study helps to broaden the understanding of why companies differ, through the barely explored relationship between firm and organization under the capabilities approach. By identifying the different types of firms and the adequate level of organization for each type, this study may help companies to surpass the dilemma on how to guarantee a pattern that allows the company to perform efficient, continuous and successfully. Moreover, this should help one to better understand the reasons why there is so much disorganization within existing firms.

Following introduction, this study presents other five chapters. A literature review discussing the concepts and the relationship between firm, organization and capabilities is presented in chapter 2. In chapter 3, the patterns of company are outlined. After that, in chapter 4, the research method is explained. The results are presented and discussed in chapter 5. Finally, chapter 6 presents the concluding remarks.

## 2 Firm, Organization and Capabilities

Coase (1937) argues that the use of the word “firm” in economics may be different from the use of the term by the “plain man.” Accordingly, Zawislak et al. (2012) say that in the concrete world, the firm is commonly viewed as a business enterprise, in other words, as a legal-institutional entity. Economic theories, however, go further than this solely contractual arrangement (Alchian & Demsetz, 1972).

In Zawislak’s et al. (2012) definition, the firm is the transaction-economic agent that carries out the production and sales of goods and services within the expectations of another agent, the customer. In accordance to the transactions costs economics, Zawislak et al. (2012) state that the *sine qua non* condition for the company to become a firm is to have a specific knowledge that can be efficiently applied to bring valuable solutions with selling potential. Through this perspective, firms should translate specific knowledge into an efficient, well-arranged set of organized and structured procedures, decision rules, specific skills, and products aiming to fulfill the knowledge gap in the market (Zawislak et al., 2012). In other words, the firm requires an organization to transform the specific knowledge into selling products (Zawislak et al., 2012). In that sense, if the firm is responsible for developing and selling the product, organization is in charge of its operation and management control over the processes.

The organization is then characterized as the structure responsible for the availability of resources (human, materials, energy and equipment) according to a given technology (knowledge, methods and practices) for the production and sale of goods and services with value (Zawislak et al., 2012). The organization is an indirect but necessary consequence of any firm. There is no firm without an organization. In Penrose’s words, “the business firm, as we have defined it, is both an administrative organization and a collection of productive resources” (Penrose, 1959, p. 28).

Remarkable here is that either between the so-called Coasean “plain man” and the literature, there are several different nomenclatures used to refer to a firm, such as organization in a general perspective, enterprise, company or business. Considering that every firm requires an organization to be able to transform technology into business, these concepts can be unified.

Putting all together, any company is a firm (i.e., the economic agent that develops, produces and transacts goods and services in the market) operating under an organizational structure and changing over time, both by internal and external forces:

$$\text{COMPANY} = \text{FIRM} + \text{ORGANIZATION}$$

In other words, the firm is the result of an organized technological pattern transformed into business and, thus, profit. So, the essence of every company is to be an organized firm.

## 2.1 Firm and Organization

According to Baecker (2006), any firm must find a way to organize itself, which simply means being able to communicate its own way of work with respect to the identity of the firm and the social and natural environment. Inside a firm there are observers who accommodate the work necessary with the social context within which that firm exists – they do so by giving the firm an organization.

In that sense, the firm consists of an authority relationship that can enforce an organizational structure (Kogut, 2000). Thus, the greater the involvement of the firm with operations it chooses to make rather than buy, the greater its need for organization.

While organizations are typically described in organizational scholarship as aggregations of individuals, as instantiations of the environment, as nodes in a social network, as members of a population, or as a bundle of organizing processes, King, Felin and Whetten (2010) understand organization in a broader social landscape by perceiving it as a social actor.

In the organizational literature, the concept of the organizational actor, distinct from cultural and market-like forces, was highlighted by Coleman (1990), who remarked the increased growth of purposefully established organizations and their rather radical influence on the social environment. Accordingly, Simon (1991) argued that much of market activity indeed was organizational activity.

Considering that, many macro-theoretical perspectives, focusing on the organization's behavior and ability to make decisions, reinforce that the organization is an actor (Argote & Greve, 2007; Cyert & March 1963; Gavetti, Levinthal & Ocasio, 2007). Expanding that perspective, the organization can be perceived as an actor that, given the ubiquitous uncertainty (Knight, 1921), must allow stability to the firm through a coherent structure of decisions and operations. According to Cyert and March (1963), firms face uncertainty concerning market

behavior, attitude of stakeholders, behavior of competitors and future actions of governments. Therefore, the organization seeks to avoid uncertainties through planning.

King, Felin and Whetten (2010) state that the very existence of organization depends on member-agents' collective ability to solve internal conflicts and reduce competing goals as they formulate strategy and make direction-setting decisions. In that sense, Penrose (1959) states that one important aspect of the definition of the firm involves its role as an autonomous administrative planning unit. All such units have some form of central managerial direction responsible for the general policies under which the firm's administrative hierarchy operates (Penrose, 1959).

In that sense, Coase (1937) presents the coordinator as responsible for managing new transactions within its technological state of knowledge, choosing the best way to organize production of a given product under the hierarchical structure of the firm. On the other hand, Schumpeter (1942) states that the role of the entrepreneur is to decide whether to turn new technological solutions into new operations or not. Thus, the function of Schumpeter's entrepreneur is to, based on a new technological possibility, reform or revolutionize the pattern of production (Schumpeter, 1942).

Considering that, Zawislak et al. (2012) promote the combination of Coase's and Schumpeter's view upon the entrepreneur-coordinator function to help to describe the nature of the firm: an economic agent that promotes technological change and innovation in order not only to reduce costs, but also to increase revenues by making it more efficient than the market. In that sense, Coase's (1937) coordinator is more an agent of efficiency rather than of change, while Schumpeter's (1942) entrepreneur is considered a breaker of constraints, changing the efficiency pattern (Zawislak et al., 2012). Through this point of view, one can say that the coordination function is to the organization, just as the entrepreneur is to the firm.

The entrepreneur-coordinator function is then responsible for establishing an organization that sustains the firm. In that sense, Nelson (1991, p. 68) states that

to be successful in a world that requires that firms innovate and change, a firm must have a coherent strategy that enables it to decide what new ventures to go into and what to stay out of. And it needs a structure, in the sense of mode of organization and governance, that guides and supports the building and sustaining of the core capabilities needed to carry out that strategy effectively.

Once the firm decides to make rather than buy, the organization will work on operationalizing how to make to later sell. In fact, through both the entrepreneurial and the coordination point of view, any company handles the same purpose: to transform technology

into business. Thus, *every company is both firm and organization*. The way the company will be internally structured is dependent on its resources and capabilities, being this the main role of organization, which is to ensure coherence to the firm acts in a specific market.

## 2.2 Organization as a Function of the Firm

Combining economics and the organizational approach, transaction cost theory describes firms and markets as alternative modes of governance. If firms and markets are alternative modes of organization, then the boundary of the firm needs to be derived rather than taken as given by technology (Williamson, 1996). In that sense, a firm will internalize as much transactions as its knowledge will be able to handle. However, the firm needs to give rise to such an organization that will enable it to do so, more efficiently than the market.

Considering that the firm (the economic agent that makes) needs to transform specific knowledge into selling products, there should be an organization adequate to the market in which the firm aims to act; and not the contrary. This happens because it is only after the firm has decided to make, that the organization will search for the best way to allocate the necessary resources to make so. In that sense, Knight (1921) states that the primary problem or function of the company is on deciding what to do (the firm) and, then, on how to do it (the organization).

This is why the organization will help on determining the structure of the firm only after the firm has already determined the specificity of knowledge to be transformed into products. In other words, at the end, *the organization is a function of the firm*. Nelson (1991) highlights then that organizational change must be perceived as a handmaiden to technological advance, and not a separate force behind economic progress.

Moreover, the larger the number of different transactions to be performed by the firm through the authority of an organization – and not by the price mechanism – the larger the firm will be. Coase (1937) asks then,

Why, if by organizing, one can eliminate certain costs and in fact reduce the cost of production, are there any market transactions at all? Why is not all production carried on by one big firm? (p. 394)

Following his own train of thought, he answers that a firm will tend to expand until the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange on the open market or the costs of organizing

in another firm (Coase, 1937). By forming an organization and allowing some authority to direct the resources, firms save certain marketing costs – depending on the entrepreneur to place the production factors in the uses their value is greatest (Coase, 1937).

So, before thinking of organization, one must prior think of the technological arrangement that will, eventually, define the firm in the market. What lies behind a firm establishment is its knowledge to offer solutions to an identified problem. However, to efficiently solve this problem, organization is needed. The success of the firm depends on its organization. It is needed then to be an organized firm.

*But what configures the different patterns of firm-organization combination?*

### **2.3 Capabilities: Different Possibilities to Combine Firm and Organization**

Kogut (2000) states that an important source of value for a firm lies in the capabilities supported by organizing principles of work. There is no perfect organizational form, as any actual management structure will exhibit advantages in some respects that have been acquired at the cost of disadvantages in others (Richardson, 2003). The quest is then related to the most suitable pattern between firm and organization.

To identify the different patterns of organizing firms, two different often-disconnected research approaches of the firm are considered, according to Zawislak et al. (2012). One approach, related to capabilities, considers the firm as a set of resources, knowledge, experience, skills and routines (Chandler, 1992; Nelson & Winter, 1982; Penrose, 1959; Richardson, 1972; Teece, Pisano & Shuen, 1997). The other, related to transaction costs, perceives firm as a nexus of treaties working under limits and according to a governance structure (Alchian & Demsetz, 1972; Coase, 1937; Williamson, 1985).

Richardson (1972) suggests that capabilities are determinants of the boundaries of the company, since they determine, accordingly to Coase, the relative costs of different firms in organizing particular activities (Alves & Zawislak, 2015; Langlois & Foss, 1999). Considered that, Langlois and Foss (1999) present the capabilities view not as an alternative to the transaction cost theory but as a complementary area of research. While transaction cost theory proposes that there are some costs because of the natural limitations of knowledge and information, capability approach insists that those limitations of knowledge and information are the key to understand everything an organization does (Langlois & Foss, 1999). Thus, the

firm should be viewed as an agent of transaction following a governance structure, as well as an agent of production that has specific knowledge and skills (Argyres, 1996).

Demsetz (1993, p. 108) states that “each firm is a bundle of commitments to technology, personnel, and methods, all contained and constrained by an insulating layer of information that is specific to the firm”. So, companies are not held together solely by the thin glue of transaction-cost minimization, but rather by the thicker glue of capabilities (Langlois & Foss, 1999).

“There is no reason to assume that as the large firms grow larger and larger they will become inefficient; it is much more likely that their organization will become so different that we must look on them differently” (Penrose, 1959, p. 17). In that sense, Penrose (1959) states that the knowledge a company possess may limit its growth, but its effective organization can broaden its boundaries.

If the firm decides whether to make or not, and the organization coordinates how to make it, it is then through the orchestration of different capabilities that companies reach the ideal internal combination to succeed. In other words, *firms are organized based on their capabilities*. The capabilities of a company represent its different possibilities of combining firm and organization.

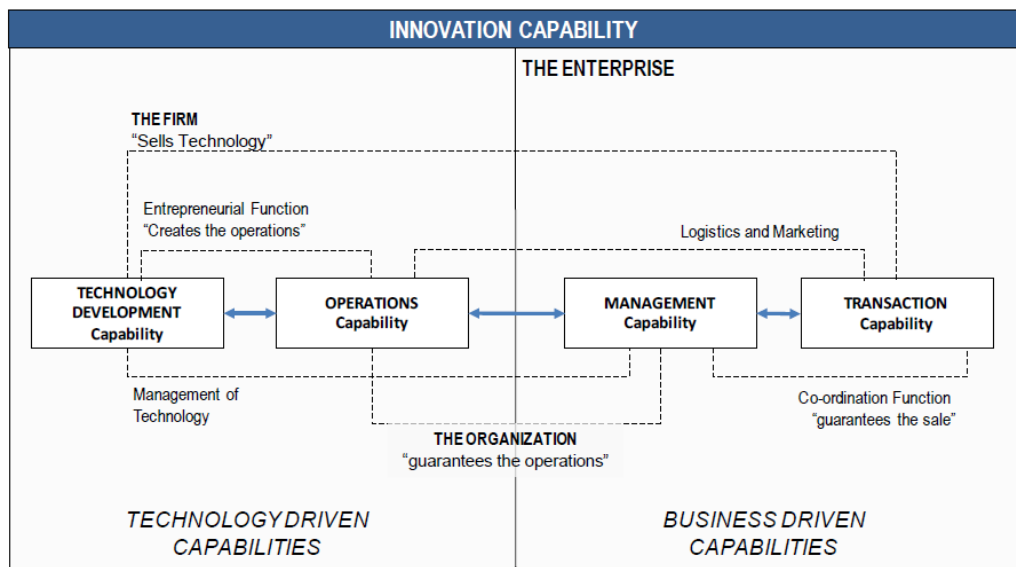
Within this context, Teece (1996) states that firm organization is an important determinant of innovation. Bessant, Rush & Hobday (2000) add that companies will be different accordingly to their capabilities, and, mainly, accordingly to how they are connected to the need to innovate. Related to that, Teece (1986) argues that the innovation boundaries of the company are best approached in terms of theory that combines capability and contractual theories. Through this combination, the Penrosian explanation of firm diversification through organization as a way to contour its limits, which, by doing so, allows the possibility to superior performance (Schumpeter, 1942), is reinforced.

Expanding on the idea that solely the technological capabilities, i.e., those related to product and process, will lead a company to achieve innovative performance, Zawislak et al. (2012) proposed an innovation model that encompasses technological and non-technological capabilities. For them, every company will perform four different strategic functions: technology development, operations, management and transaction. For each function, there should be a specific capability of innovation. The ensemble of these four capabilities composes the innovation capabilities.

Innovation capabilities refer then to the “ability to absorb, adapt and transform a given technology into specific operational, managerial and transactional routines that can lead a firm

to Schumpeterian profits, i.e., innovation” (Zawislak et al., 2012, p. 23). Thus, Zawislak’s et al. (2012) innovation model (Figure 1) presumes that every company has some level of four innovation capabilities affecting their performance and that innovation can emerge from each one of these capabilities.

Considering that the discussion on organizing the firm through capabilities relates both to firm and organization capabilities, i.e, technological and non-technological capabilities, the Innovation Capabilities Model proposed by Zawislak et al. (2012) seems to be the most appropriate alternative to evaluate the different patterns of companies through the capabilities approach. This model has been tested and validated through empirical data from different manufacturing sectors, which ensures its accuracy when depicting innovation capabilities of companies (Reichert, 2015; Reichert, Camboim & Zawislak, 2015; Zawislak et al., 2013; 2014).



**Figure 1 – Innovation Capabilities Model**

Source: Zawislak et al. (2012, p. 20).

According to Zawislak et al. (2012), *technology development capability* refers to the ability that any firm has to interpret the current state of the art, absorb and transform a given technology to create new products, processes, methods and techniques aiming at reaching higher levels of technical-economic efficiency. It involves monitoring, acquiring, adapting, designing, and developing a new set of knowledge and technical systems for internal use.

*Operations capability* is the ability to perform the given productive capacity through the collection of daily routines that are embedded in knowledge, skills and technical systems. It is a result of the selection of competitive priorities in order to take advantage of low cost, quality,



delivery time, responsiveness, flexibility, degree of product standardization, size of product mix carried within the firm, volumes required, and production lead-time.

*Management capability* refers to the ability to transform the technology development outcome into coherent operations and transaction arrangements. It is responsible for the matching and constantly fine-tuning between internal resources and goals with the external market environment and expectations. It involves corporate strategy, resource allocation, norms and procedures, coordination, and integration. Management capability maintains a smooth flow of information and outputs to reach higher rates of efficiency.

Finally, *transaction capability* is the ability to reduce marketing, outsourcing, bargaining, logistics, and delivering costs; in other words, transaction costs. Transaction capability refers then to the ability to effectively transact in the market what has been previously developed, operationalized and managed. It involves a set of specific skills and systems, which encompasses customer relationship, negotiation, contracting, and marketing.

Every company is then an agent of coordination. External coordination, through technology development and transaction capabilities, i.e., *firm*; and internal coordination, through operations and management capabilities, i.e., *organization*. These associations are further explored in the next subsection.

## 2.4 Firm and Organization Through the Lenses of Capabilities

The model proposed by Zawislak et al. (2012) presents the idea that every firm starts by having a special knowledge advantage that supposedly can be translated into a technology that has value on market. For the authors, if the firm exists to transact what it knows how to do, and this applied know-how corresponds to the firm's specific technology, *the firm sells technology*.

Selling technology is based on external coordination, which is based on specific capabilities. On the one hand, technology development capability relates to the external environment when interpreting, absorbing and transforming technology into new solutions within company's boundaries. On the other hand, transaction capability is concerned with reducing transaction costs, regarding company's external interaction with the market, to sell what has been developed.

Through this perspective, both technology development and transaction capabilities constitute the **firm**, by coordinating the search of a new knowledge that can be applied in

effective solutions to existing and identified market gaps and, then, by coordinating its transposition to effective markets and profitable sales.

However, solely external coordination does not ensure company's success. As stated by Nelson (1991), the firm needs an organizational structure that supports the building and sustaining of the core capabilities needed to carry out external coordination effectively. The potential technological solution must be translated into an operational arrangement and thus be efficiently managed to guarantee the delivery of the expected outcome in the market.

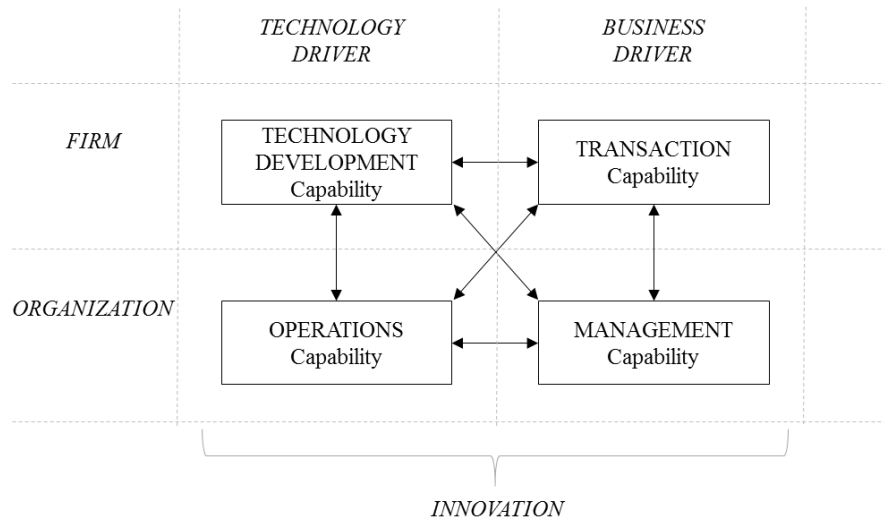
In that sense, the applied technological solution becomes concrete due to the operations capability, which uses already stabilized technology with established routines and procedures translated into productive capacity (Zawislak et al., 2012). Stability inside a company is guaranteed not only by its operations capability though, but by the combination of that with indirect procedures, resources allocation, decision rules, and coherent arrangements, which refer to the management capability.

Thus, internal coordination, aiming to achieve internal efficiency and stability, may be achieved by the combination of the management with the operations capabilities, which constitute the **organization**. The organization is then related to the control effort that *guarantees the operations*, from development to market. It may be perceived that the structuring of operations and management capability depends on what is developed and transacted, by technology development and transaction capabilities. In other words, the organization depends on the firm.

Remarkable is that the present discussion on organization is not solely related to administrative organization, but to knowledge, materials, human and technology resources that enable firm to act in the market. That certainly encompasses Chandler's (1962) and Williamson's (1975) administrative organization, and their U-form, M-form and structure governance debate – but it goes further.

Rather than simply classifying organization as the internal division of the administrative structure of a company, in terms of management, power and organogram configuration, organization is studied here through the lenses of capabilities arrangement. Therefore, organization involves function division within companies, but it is formed by several other activities in an extensive range carried out by management and operations capabilities to ensure company's performance.

Considered that, based on Zawislak's et al. (2012) model, Figure 2 shows the present study research framework translated into a Firm-Organization Capabilities Model, highlighting both the capabilities related to the firm and the capabilities related to the organization.



**Figure 2 – Firm-Organization Capabilities Model**

Source: Adapted from Zawislak et al. (2012).

Zawislak's et al. (2012) innovation capabilities model offers possible explanations not only for companies' existence but also for their differences regarding firm and organization. By presuming that every company has some level of four innovation capabilities and that innovation can emerge from each one of these capabilities, it is possible to suppose that there is a variety of capabilities combination within companies.

In that sense, Nelson (1991) suggests that diversity of firms is just what one would expect.

It is virtually inevitable that firms will choose somewhat different strategies. These, in turn, will lead to firms having different structures and different core capabilities. Inevitably firms will pursue somewhat different paths. Some will prove profitable, given what other firms are doing and the way markets evolve, others not. (Nelson, 1991, p. 69)

Consequently, firms that systematically fail to present positive outcomes will have to change their strategy and structure, i.e., internal and external coordination, and develop new core capabilities, or operate the ones they have more effectively, or drop out of the competition (Nelson, 1991). The author concludes then that change in organization, as well as advance in technology, has been an essential feature of the enormous economic progress that has been experienced over the last decades (Nelson, 1991).

## 2.5 The Firm-Organization Capabilities Indicators

Since different companies have different capabilities and different strategies in line with their capabilities, they will organize their activities differently (Madhok, 2002). Thus, capabilities can be viewed as the reasoning to why companies differ from each other and why there are performance differences across them (Madhok, 2002). Considering that, the innovation capabilities, which allow companies to perform and profit from innovation, should be arranged in ways to explore their strengths (Teece, 1986).

In that sense, Zawislak's et al. (2012) model with four innovation capabilities brings light to the understanding of how companies perpetuate even though being structurally different. That is, it helps to understand how different firms are organized. It is remarkable that, as previously discussed, firm is related to development and transaction capabilities, while organization relates to operations and management capabilities.

The discussion of the conceptual boundaries of each of the four capabilities and their complementarities is the basis for identifying different types of indicators for both firm and organization. Therefore, the indicators for each capability used in the "Paths of Innovation in the Brazilian Industry" project (further detailed in section 4, regarding Methods) could be divided into the firm and organization spheres.

**Table 1 – Indicators of Innovation Capabilities and Performance**

Company	Capability	Indicators	References
Firm	Technology Development	<ul style="list-style-type: none"> <li>✓ Acquisition</li> <li>✓ Imitation</li> <li>✓ Adaptation</li> <li>✓ Changes</li> <li>✓ Development of a new set of knowledge and technical systems for internal use</li> <li>✓ Project management</li> <li>✓ Development trigger</li> <li>✓ Development flow</li> </ul>	Afuah (2002); Bell & Pavitt (1995); Iammarino, Padilla-Pérez & Von Tunzelmann (2008); Lall (1992); Reichert, Camboim & Zawislak (2015); Zawislak et al. (2012, 2013, 2014)
	Transaction	<ul style="list-style-type: none"> <li>✓ Outsourcing</li> <li>✓ Distribution</li> <li>✓ Relationship with customer</li> <li>✓ Negotiation</li> <li>✓ Hiring</li> <li>✓ Marketing and branding</li> <li>✓ Logistics</li> <li>✓ Pricing</li> </ul>	Argyres (1996); Coase (1937); Tello-Gamara & Zawislak (2013); Langlois & Foss (1999); Mayer and Salomon (2006); Reichert, Camboim & Zawislak (2015); Williamson (1985, 1991, 2002); Zawislak et al. (2012, 2013, 2014)

<b>Organization</b>	Operations	<ul style="list-style-type: none"> <li>✓ Quality control</li> <li>✓ Flexibility</li> <li>✓ Formalization</li> <li>✓ Continuous improvement</li> <li>✓ Inventory management</li> <li>✓ Technological innovation</li> <li>✓ Production planning</li> </ul>	Chandler (1992); Hayes & Pisano (1994); Reichert, Camboim & Zawislak (2015); Skinner (1969); Ward et al. (1998); White (1996); Zawislak et al. (2012, 2013, 2014)
	Management	<ul style="list-style-type: none"> <li>✓ Integration</li> <li>✓ Objectives establishment</li> <li>✓ Norms and procedures</li> <li>✓ Decision making process</li> <li>✓ Management of human resources and learning</li> <li>✓ Financial management</li> <li>✓ Management model</li> </ul>	Barnard (1938); Chandler (1977); Langlois (2003); Mintzberg (1973); Penrose (1959); Pufal et al. (2014); Reichert, Camboim & Zawislak (2015); Whitley (1989); Zawislak et al. (2012, 2013, 2014)
<b>Innovation</b>		<ul style="list-style-type: none"> <li>✓ Profit growth</li> <li>✓ Market share growth</li> <li>✓ Revenue growth</li> </ul>	OECD (2005); Reichert, Camboim & Zawislak (2015); Schumpeter (1942); Zawislak et al. (2012, 2013, 2014)

Source: Adapted from the “Paths of Innovation in the Brazilian Industry” project.

These indicators also underlie the questions regarding each capability in the questionnaire used for the analyses to the development of the present study. With these indicators, it was possible to analyze the relationship between different firm complexities and organization structures, i.e., different patterns of company.

### 3 Patterns of Company

According to Penrose (1959), there will be great variations in the number, range, and nature of the tasks in different firms and so it is much more likely that their organization will become so different. As previously presented, Knight (1921, p. 268) argues that “with uncertainty present doing things, the actual execution of activity becomes in a real sense a secondary part of life; the primary problem or function is deciding what to do and how to do it”.

Through this perspective, the make-or-buy decision can be interpreted as a consequence of the firm and organization structures combined. Or, as Coase (1937, p. 388) suggests, “within a firm, (...) markets transactions are eliminated and, in place of the complicated market structure with exchange transactions, [are] substituted by the entrepreneur-coordinator, who directs production”.

Whenever the entrepreneur changes the efficiency pattern, coordination, through organization, must find new ways to reach efficiency and stability again, allowing firm to smoothly complete its cycle from concept to the market (Pufal et al., 2014). The entrepreneur-coordinator embodies, in some sort, the firm-organization combination. In this scenario emerges the so-called paradox of the organized firm: to cope change with stability (Pufal et al., 2014). If, on one hand, organization is responsible for fine-tuning efficiency and stability, on the other, whenever firm changes, organization must start looking for a new pattern of efficiency and stability; and so on (Pufal et al., 2014).

In Barnard’s (1938, p. 6) words, “confronted with a continuously fluctuating environment, the survival of an organization depends upon the maintenance of an equilibrium of complex character. (...) This calls for readjustment of processes internal to the organization”. Thus, the process of change in a firm’s way of doing things involves incremental adjustment in a complex, interdependent system (Williamson & Winter, 1993).

As consequence, the role of organization is to allow the firm to better identify the factors that may increase its understanding of the market. As technology is derived from time and organization from costs, the trade-off between technology and organization is inherent to the (at least, intentional) rationality of any firm (that is, to always work looking for the optimization of time and cost); and may be continuously adjusted into new patterns. In consonance, Nelson (1991) states that to be effective a firm needs a coherent strategy, that defines and legitimizes the way the firm is organized and governed, enables it to see organizational gaps or anomalies

given the strategy, and sets the ground for bargaining about the resource needs for the core capabilities the firm must present to take its next step forward.

Since the firm and its organization should be on continuous change, and, thus, new knowledge must be constantly internally incorporated to the firm's repertoire of actions, growth becomes inherent to any company (Penrose, 1959). In that sense, according to Coase's (1937) ideas, every company must adopt an ever-changing strategy to remain active and competitive:

It is clear that the dynamic factors are also of considerable importance, and an investigation of the effect changes have on the cost of organizing within the firm and on marketing costs generally will enable one to explain why firms get larger and smaller. We thus have a theory of moving equilibrium. (p. 405)

In that sense, Jones (1997) states that the activities performed by a firm are necessarily constrained by the bundle of capabilities or resources available to that firm at any particular time. Considering that differential capabilities are significant variables for explaining the boundaries of the firm and that the organization is a function of the firm, in a moving equilibrium scenario, the organizational possibilities are tempered by the nature of the reconfiguration required (Langlois & Foss, 1999). The quest for new organizational pattern will hang on the already-existing structure of capabilities and the nature of the economic change involved (Langlois & Foss, 1999).

Thus, growth involves a sequence of changes resulting from firm's own resources and activities. To ensure its flow, strategic management is then implemented. Therefore, strategic management emerges from organization's own disorganization in order to broaden firm's limits with a new organization pattern. In other words, it refers to the disorganization of the organization to organize accordingly to a new efficiency pattern. In this regard, Coase (1937, p. 393) states that "a firm becomes larger as additional transactions (...) are organized by the entrepreneur (...)".

It is remarkable that firm continues to be perceived as a production function; however, to consider that it is essential to take into account firm's capability to establish the most suitable pattern or to change its own structure into the most adequate one. That is, according to Coase (1937), perceiving coordination as a function of the entrepreneur. According to Richardson (2003), any firm can and will be obliged to develop its capabilities over time in response to perceived change in circumstance, considered the dynamic efficiency of the system. This continuous quest is directly related to the need for efficiency within its activities, i.e., within its organization (Pufal et al., 2014).

Thus, the production process may not be reduced to a simple array of sections petrified into specific equipment. More than just an agent that transforms raw materials into final products, the firm may be viewed through its capability to adjust to a changing situation, adapting its organization accordingly to the environment (Amendola, 1983).

The identity and the strategy of a particular firm constantly influence how its resources interact with the transaction and how it chooses to govern it (Madhok, 2002). According to Zawislak, Alves and Pacheco (2012), the combination of both transaction cost and capabilities approaches allows a better understanding of the trade-off between technology and organization and its consequent pursuit of firm-organization patterns that allow the company to perform efficient, continuous and successfully.

### **3.1 Towards Different Patterns of Company: The Contribution of Transaction Cost Economics**

Considering that efficiency is the product of adaptive capacities both of markets and hierarchies, transaction cost economics describes the firm not as a production function, which is a technological construction, but as a governance structure, which is an organizational construction, incurring into governance costs (Williamson, 2002). In that sense, Williamson (1996, p. 133) argues that “if firms and markets are governance structures for managing transactions, then organizational rather than technological features come to the fore”.

In fact, according to Williamson (1991, p. 79), this constitutes the essence of transaction cost economics: “to align transactions, which differ in their attributes, with governance structures, which differ in their costs and competencies, in a discriminating (mainly, transaction cost economizing) way”.

According to Alves (2015), as a moving puzzle, organization evolves based on the economic relation of technological complementarity. Therefore, economic activities influence the scope of a firm, and the consequent required standards and modularization affect its shape, as a result of adjustments in the organization sphere.

The governance approach maintains thus that structure arises mainly in the service of economizing on transaction costs (Williamson, 2002). It is related then to how trading partners choose the arrangement that offers protection for their relationship-specific investments at the lowest total cost (Shelanski & Klein, 1995). Williamson (1991, p. 81) states in that sense that



trading partners' decisions involve "(1) the technology to be employed, (2) the price under which a good or service will be transferred, and (3) the governance structure within which a transaction is located".

Accordingly, Zawislak, Alves and Pacheco (2012) argue that the more knowledge (and thus technology) becomes more firm-specific, the less is known by the market on what the firm does and how it does it. As aforementioned, Penrose (1959) states that to each knowledge unit that allows a new transaction to be internalized, it is needed one more unit of organization; and some sort of one more unit of competitiveness. Following with this line of thought, Williamson (1991) promotes the questioning on which governance structures are best suited to organize which transactions and why.

Not only alternative modes of governance differ in kind, but also generic modes of governance are defined by internally consistent ensemble of attributes, which represents distinctive strengths and weaknesses (Williamson, 2002). The challenge then is to articulate the relevant attributes for describing governance structures and thereafter to align different kinds of transactions with discrete modes of governance in an economizing way (Williamson, 2002).

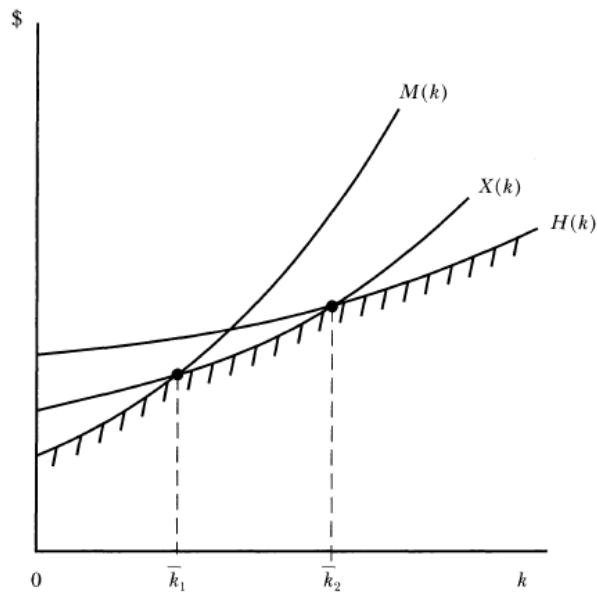
Through this perspective, Williamson (1991) affirms that the basic argument hinges on the condition of asset specificity. So, in a given point in time, governance structure is altered due to changes in assets specificity conditions (Williamson, 1991). Asset specificity refers then to "durable investments that are undertaken in support of particular transactions, the opportunity cost of which investments is much lower in best alternatives uses or by alternative users should the original transaction be prematurely terminated" (Williamson, 1985, p. 55).

Therefore, asset specificity could describe a variety of relationship-specific investments of the firm, involving specialized physical and human capital, as well as intangibles such as R&D and capabilities (Shelanski & Klein, 1995). Asset specificity is then related to knowledge: the more common the knowledge, the less specific the asset. Consequently, the less specific asset will be easier to be appropriated by any firm. The appropriability of more or less specific assets will determine the costs of dealing with them as well as of transacting them – the governance costs or, as one may consider, the organization costs. Thus, the more specific the asset, the higher the costs it incurs and the higher the returns it offers (Williamson, 1991).

Williamson (1985) mentions four types of asset specificity, namely human capital specificity, site specificity, physical specificity, and specificity in terms of dedicated assets. Williamson's typology does not explicitly refer to capabilities, however, according to Langlois and Foss (1999), capabilities may be added to the list. In their words, "capabilities would

certainly seem to qualify as specific assets – they are specialized to firms” (Langlois & Foss, 1999, p. 213).

Considering that governance structure cost (\$) is a function of asset specificity ( $k$ ), Williamson (1991) proposes three types of governance structure, as presented in Figure 3: (1) market – in which asset specificity is negligible, identified as  $M(k)$ ; (2) hierarchy – in which asset specificity becomes great, identified as  $H(k)$ ; and (3) hybrid forms – in which the degree of asset specificity is intermediate, identified as  $X(k)$ .



**Figure 3 – Comparative Governance Costs**

Source: Williamson (1991, p. 83).

In that sense, vertical integration is more likely when assets are specific (Williamson & Winter, 1993). Williamson (2002, p. 189) argues that “asset specificity is operational in that it serves to breathe content into the idea of transactional ‘complexity’” and, thus, it is intuitively obvious that complex governance structures should be reserved for complex transactions – or, if one may prefer, where complex knowledge is needed for the translation into selling products.

Whenever the asset specificity is enhanced, the governance costs are pushed to a new level. In other words, whenever the firm needs to deal with one more unit of knowledge, organization is pushed to a new level. In that sense, it is possible to suggest that *the more complex the firm is, the more complex the organization should be*.

In a study that explored the dynamics of industrial organization based on the analysis of evolutionary movements of the boundaries of firms and markets, Alves (2015) divided complexity into two dimensions: one related to the number of parts and pieces that interact in

multiple ways and the other related to the “complicatedness” of the type of problem to be solved.

Further exploring these two dimensions, the author detailed that complexity can be described in terms of number and types of parts that must be integrated; the technological domains of each part; the type of transformation required; the “complicatedness” to master the technological base and the ability to coordinate the necessary activities (Alves, 2015).

He suggests then that complexity influences the availability of certain capabilities across different economic agents. For example, “the higher the complicatedness of a technology, the harder it is to build the capabilities needed to deal with the technology and the lesser the availability of these capabilities in the market” (Alves, 2015, p. 51).

Wang and von Tunzelmann (2000) present, complementary to the idea of complexity related to technology stated by Alves (2015), the concept of complexity also related to markets and products, to production processes, and to administration and management.

To define complexity in technology, Wang and von Tunzelmann (2000, p. 808) first define technologies as “the principles underlying the nature of products and their methods of production”. In that sense, complexity in technology refers to the diversity of technologies encapsulated in product-related or process-related form and to the shift from one generation of technology to other more advanced (Wang & von Tunzelmann, 2000). It involves the number of knowledge fields, the scientific content and the novelty of the technology the company deals with. Scientific advances and know-how are the major influencers on this dimension of complexity.

Complexity in markets is concerned with customer diversity and market dynamics. Whereas customers’ diversity is related to their geographical, demographic and other social and psychological characteristics; market dynamics are related to factors such as the stages of market evolution and the competitive structure (Wang & von Tunzelmann, 2000). Complexity in products, in turn, can be perceived in terms of the number of components, the degree of technological novelty required for a product or system and the functionality of that (Wang & von Tunzelmann, 2000). Complexity in markets and products may be influenced by globalization, new technologies, market needs or competition.

According to the same authors, complexity in production processes refers to the ways the product materializes. They can usefully be separated into labour processes, capital processes and information processes. Thus, complexity in production can be perceived according to the number of parallel production lines and activities, as well as to the number of stages and

sequences in production (Wang & von Tunzelmann, 2000). It is influenced by new processes technology and the cognitive skills of the workforce.

Finally, according to Wang and von Tunzelmann (2000), complexity in administration and management is defined in terms of the number of functions and divisions, as well as the degree of tiered organizational structures. Technological changes may require reorganization through both specialization and integration in the control and the structure of the firms concerned. Therefore, new technologies and financial constraints may influence complexity in administration and management.

Thus, one may view complexity in technology, markets and products as denoting what has been called as “firm complexity”, whereas complexity in production processes and in administration and management is related to the “organization complexity”. In that sense, the complexity, in whichever dimension, increases the costs of building capabilities (Alves, 2015).

The problem is, however, to establish the adequate organization complexity to the existing firm complexity. Due to the inherent uncertainty and bounded rationality (i.e., ignorance) of economic agents, they may fail to find this balance and set an arrangement that configure the disorganization of the firm instead.

So, *on what kind of organization complexity should the firm rely to be successful?* To answer that question, we should, once again, turn the lights over the capabilities approach.

### **3.2 Different Patterns of Company: Different Capabilities**

It has been argued that the firm must know how to do something prior to buy anything, until the limit of its internal coordination efficiency costs. According to Coase (1937), this limit varies from industry to industry, from firm to firm. In that sense, Tigre (1998) remarks that even in the same period of time, there are different types of companies and market configurations coexisting in the same economic environment. Thus, taxonomies are attempts to classify and group them according to certain criteria of analysis.

In consonance, Penrose (1959) notes that it is the heterogeneity of the flows and stocks of knowledge within firms – not only their physical resources – that gives each firm its unique character. In that sense, Richardson (1972) presented the idea that capabilities are determinants of the boundaries of the firm, since they determine the relative costs of different firms in organizing particular activities (Alves & Zawislak, 2015; Langlois & Foss, 1999). It is then

through the arrangement of different capabilities that companies reach the ideal internal combination to succeed. Firms are organized according to their capabilities.

Agreeing with Bessant, Rush and Hobday (2000), Zawislak, Alves and Pacheco (2012) affirm that the more the technological trajectory becomes specific and based on complexity, the more updated and equally complex organizational structure should be in favor of the innovation capabilities of firms. Chandler (1992) also remarks that the firm exists because it is a hotbed for the cultivation of innovative capabilities. With that in mind, added to the principles of evolutionary theory (Nelson & Winter, 1982), the very essence of a successful company can be understood: to be an organized innovative firm.

Every company has all four innovation capabilities, i.e., technology development, operations, management and transaction (Zawislak et al., 2012). The different arrangements of these four capabilities generate different types of companies and, thus, different combination patterns of firm and organization.

In that context, technology development and transaction capabilities, by being respectively dependent to the state of art and to the market, are naturally related to the concept of firm. In the same way, management and operations capability, by characterizing the traditional internal routines of the company, refer to the organization. In that sense, considering Williamson's (1991) propositions, *asset specificity*, by involving technology and transaction, can be interpreted as corresponding to the *firm* sphere, while the *governance structure*, by being dependent upon the transactions that will be incorporated, is related to the *organization*. In that sense, to identify on what kind of effort should the coordination structure of the firm rely to be successful, it is fundamental to understand that companies' capabilities can be developed in a myriad of ways, creating different patterns of firm-organization combination.

A common approach to the study of organizational forms encompasses examining how a firm ought to organize as it grows in size and complexity (Armour & Teece, 1978). According to Armour and Teece (1978, p. 107), "a functionally organized firm is characterized by the decision-making authority, for both the development of long-run strategy and for daily operating activities, residing in a centralized management group"

The difficulties experienced by an expanding functionally organized firm can be expressed in terms of indivisibility, incommensurability, nonoperational goal specification, and the confounding of strategic and operating decisions (Armour & Teece, 1978). In that sense, Teece (1996) suggests that there is a variety of organizational modes that can support innovation, but that there are important differences amongst organizations in the types of innovation they can support. Teece (1996, p. 210) identified distinctive governance modes,

which led him to list the following archetypes: “(1) stolid, multiproduct, integrated hierarchies; (2) high flex “Silicon Valley”-type firms; (3) hollow corporations of various types; and (4) conglomerates of various types”.

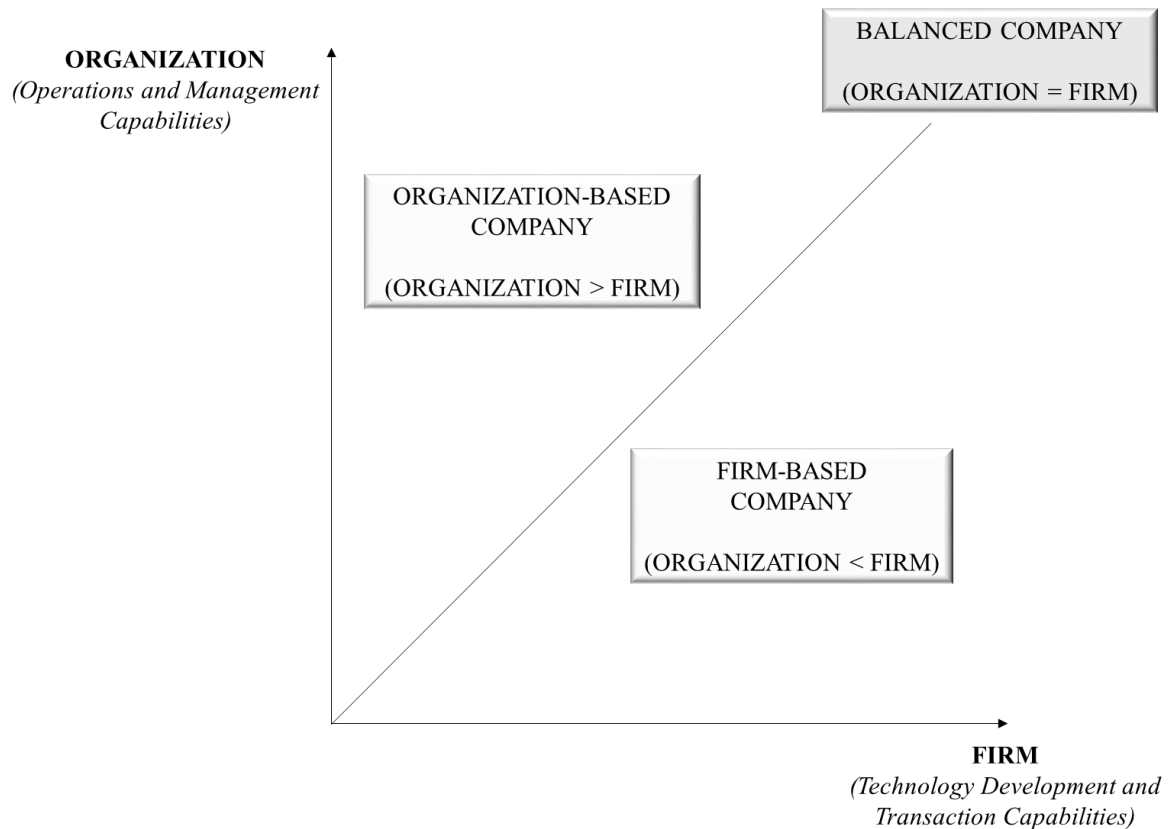
While Teece (1996) focused on the governance modes to identify different organizational modes that support innovation, in this study, the focus of analysis is on firm and organization capabilities, which are responsible for companies’ innovative performance. Combining that with the literature, it is possible to suggest distinctive patterns of firm-organization capabilities arrangement.

First, considering that there is a positive and direct relationship between firm and organization within a company (Penrose, 1959), the expected capabilities arrangement in a stable company is that in which *firm and organization are balanced*. That is consonant with the postulation that the organization complexity is adequate to the existing firm complexity.

Second, when firm is more expressive than organization, the company is perceived as *firm-based*. That may happen because of high technology specificity or high levels of transaction complexity, accompanied by not-adjusted structure, market position planning and defined business model within the organization sphere. Either technology development or transaction capability is expected to be more significant in this pattern.

Finally, whenever organization is more developed than firm within a company, due to higher organizing costs, low technology specificity or either low levels of transaction complexity, the company is considered to be *organization-based*. In this pattern, operations or management may be the most significant capabilities to the company.

Thus, by combining Williamson’s (1991) figure of the comparative governance costs, as previously presented in section 3.1, with Zawislak’s et al. (2012) innovation capabilities model shown in section 2.3, the present study suggests a new figure in which the “asset specificity” axis gives place to “technology development and transaction capabilities (firm)”, while the “governance costs” axis is transformed into “operations and management capabilities (organization)”, as proposed in Figure 4.



**Figure 4 – Comparative Firm-Organization Combinations**

By doing so, the statement that firm is the independent variable and that organization is the dependent variable can be validated (i.e., organization as a function of the firm). As stated by Penrose (1959), to each knowledge unit that allows a new transaction to be internalized, it is needed one more unit of organization. In that sense, there is a direct relationship in the enhancement of either firm or organization within company's structure. Consequently, there will be different patterns of company.

### **3.2.1 The Balanced Company**

This pattern is, certainly, a sort of conceptual assumption, based on the theoretical expectation of finding a balanced company. The right balance, in reality, illustrates the ideal type of organized firm acting in a stable way. In this type of company, no matter which level of firm and organization it has, its performance fulfills the strategic expectations. Low levels of firm and organization may perfectly fit to some low specific markets, where technology has

less specificity to generate the lowest organizational cost function possible. Conversely, in high end markets, where one should always expect to find rarity and specificity, higher prices are the reflection of a specific technology with higher costs.

According to Nelson (1991, p. 68),

(...) in a well tuned firm, its production, procurement, marketing and legal organizations must have built into them the capabilities to support and complement the new product and process technologies emanating from R&D. In Teece's terms, the firm's capabilities must include control over or access to the complementary assets and activities needed to enable it to profit from innovation. And in an environment of Schumpeterian competition, this means the capability to innovate, and to make that innovation profitable, again and again.

Thus, if recognizable balance between the four capabilities exists, then they are in close and continuous communication and engage in mutual adaptation if innovation in any one of them is to have a chance of succeeding. Within this scenario, innovation usually requires quick decision making and close coupling and coordination among research, development, manufacturing, sales and service (Teece, 1996). Put differently, organization must exist to enable these activities to be closely coordinated, and to occur with dispatch, from development to transaction (Teece, 1996).

Linkages of subunits such as R&D, manufacturing, management and commercial must be maintained in order to ensure that firm and organization are positively combined. Therefore, the balance of firm-organization capabilities hinges on organizational costs and firm specificity, which determine the level of capabilities arrangement – low or high.

Low levels of firm-organization capabilities arrangement are expected in companies acting in traditional sectors, in which technological intensity is low and so is the asset specificity. They are usually located in consolidated markets and present an established commercial position. Thus, the rhythm of product development is coherent to the rhythm of the market, in which the organizational cost function is reduced due to the low technology specificity. When firm and organization are balanced in a lower level, performance is expected to accompany this positioning, generating outcomes to sufficiently ensure company's survival and the maintenance of its non-variant operation over time.

High levels of firm-organization capabilities arrangement, in turn, are expected in companies acting in the frontier of knowledge, which deal with state-of-the-art products, technologies and methods. Thus, they are large innovative companies, mostly involved with sectors such as the creative industry, IT, electronics and health, for example. Within these



companies, rarity and specificity are expected, and so are higher costs and, consequently, higher prices. Higher performance is then a reflection of the higher level of firm-organization capabilities. As stated by Williamson (1991), the more specific the asset, the higher the costs it incurs and the higher the returns it offers.

### **3.2.2 The Firm-Based Company**

Companies created from the perception of an opportunity to be explored, due to the asymmetry of information derived from differentiated knowledge, are those in which firm is more developed than organization (Casson, 2005). The exploitation of this opportunity is the result of an entrepreneurial action (Gartner, 1990), based on differentiated skills that are, in fact, differentiated knowledge obtained by continuous efforts in research in the fields of science and technology, economics and new markets, which enables the development of potentially innovative products (Park, 2005).

While technology development and transaction capabilities are the most developed by this type of companies, operations and management capabilities need to be enhanced once the business starts to grow. If, on the one hand, there is an idea or an invention with potential for success, on the other, there is a long trajectory to improve this technology until its commercialization, passing through different stages of increasing technological complexity.

Thus, these companies may present high innovative potential, with high technology specificity and transaction complexity, but low organizational structure (Blank, 2013). As the technology is developed, different knowledge is needed demanding changes in the structure, authority, and complexity of tasks (Brinckmann & Hoegl, 2011; Tatikonda et al., 2013). Thus, firm can be more developed than organization in four distinctive cases.

#### **3.2.2.1 Technology Development Capability > Management Capability**

The characteristics of technological development have important implications in the way management will be conducted, for instance, to determine whether a vertical structure or an alternative governance mode will be established in the firm (Teece, 1996). According to Jones (1997), non-specific investment will result in market governance while specific or idiosyncratic investment and recurrent transacting will result in firm governance.

In that sense, economic historians have long suggested that there may be links between management structures and the rate and direction of innovation. Frankel (1955) has argued that the slow rate of diffusion of innovations in the British textile and iron and steel industries around the turn of the XX century was due to the absence of vertically integrated firms. For such reasons, Penrose (1959) states that management must deal with the ever-expanding boundaries of the firm.

Whenever any existing firm needs to internalize one extra unity of knowledge and technology, as a way to deal with change, management capability should make feasible a new pattern of efficiency and stability (Pufal et al., 2014). Thus, whenever technology development capability is explored faster than management capability can follow and readapt itself, the company faces an unavoidable unbalanced structure, which can be temporary or not.

That is the case of startups, for example, in which technology development runs faster than management can absorb. In the first stages of a startup, management is informal and less structured, having the founder as the main strategic decisions maker while leading development as well. In this type of company, an adaptation of management capability is expected over time, through professionalization, formalization and control of several procedures (Dullius, 2016).

### **3.2.2.2 Technology Development Capability > Operations Capability**

There are cases in which the firm masters enough knowledge to develop technology beyond its limits, although lacking operational skills to translate that into a final product. For instance, according to Teece (1996), when the inventor has solely a patent or similar, then the patent holder's options include:

- (i) licensing the technology to incumbent firms who already have the necessary complementary assets in place; (ii) using the patent as collateral to raise debt funds to help develop an organization to exploit the technology; (iii) exchanging the patent for equity in a start-up, equity-funded firm; (iv) exchanging the patent for equity in an established firm. (p. 210)

Once the firm decides rather to make than buy, the organization will work on operationalizing how to make to later sell (Zawislak et al., 2012). Therefore, it is not enough to have the necessary skills to create and develop a unique solution to the market – this potential technological solution must be translated into an operational arrangement and thus be efficiently managed, or coordinated, to guarantee the delivery of the expected outcome. If the company does not master the required operational skills, or it is costly to operationalize it somehow, it can look for operational alternatives outside its boundaries.

Thus, technology development surpasses operations capability when technology is highly specific, with low costs for organizing its final production. That is the case of large companies acting in technology development sectors, in which knowledge application into a technological device is the core business of the company, rather than its physical production, which is outsourced to lower costs manufacturers. This scenario illustrates the decision to make or buy based on transaction costs; in other words, the decision to go, or not, to the market (Coase, 1937; Williamson, 1991).

### **3.2.2.3 Transaction Capability > Management Capability**

When market demands and interfirm exchanges drive company's structuring, transaction capability takes the lead, instead of management. A collection of licensing, venturing, manufacturing and marketing agreements will typically characterize many interorganizational arrangements (Teece, 1996).

For example, one may cite R&D joint ventures, manufacturing joint ventures and co-marketing arrangements. Some of these arrangements constitute extremely complex open systems and some may be in fact unstable. Considering production and transaction costs in the longer term, companies get closer to other parties in order to coordinate interfaces and get more mutually aligned skills and knowledge that would otherwise be so onerous (Langlois, 1992).

Close relationships and intense interaction may not only lower transaction and production costs, but also generate productivity benefits (Madhok, 2002). For instance, working together from the outset on joint design and development can result in fewer errors, improved quality, faster dissemination and absorption of information and skills, reduced development time, and, consequently, lower production costs, more so than the individual firm would have the capacity to do on its own (Clark & Fujimoto, 1991).

The managerial functions in these interorganizational networks are to some extent different from the authority relationship which commonly exists in hierarchies. Managers must perform boundary-spanning roles, linking the organization's internal networks with external sources of information, and learn to manage in circumstances that involve mutual dependency and other entrepreneurs organizing transactions concomitantly (Madhok, 2002; Teece, 1996). Within these cases, decision making is usually simple and informal, and communication and coordination among functions is relatively quick and open. These firms are likely to be highly innovative, with management capability put on second plan (Teece, 1996).

#### **3.2.2.4 Transaction Capability > Operations Capability**

Strategic firm actions involve an attempt, within the limits of availabilities and indivisibilities, to establish a configuration of manpower, technology, and structural arrangements which is both internally consistent and consistent with the scale and nature of operations planned (Child, 1972). The right correspondence in the event achieved is seen to determine the level of efficiency secured which is expressed by output in relation to costs (Child, 1972). However, if such firms can develop and manage their external relationships without losing their culture and responsive structures, then many of the problems related to uncertainty, indivisibilities, asset specificity, and tacitness can be overcome, while organizational failure issues are held at a distance because much is outsourced and alliances are used frequently (Teece, 1996).

Within this scenario, the term “virtual corporation” has emerged in business parlance in the 1980s and 1990s to refer to business enterprises that subcontract anything and everything through a temporary network of independent linked companies (Mowshowitz, 2002; Rahman & Bhattachryya, 2002; Teece, 1996), as a way to minimize organization costs. With the advent of Internet in the end of 1990s and its advance in the 21<sup>st</sup> century, that definition turned to encompass also those companies distributed geographically and whose work is coordinated through electronic communications (Rahman & Bhattachryya, 2002). Thus, the term virtual, or hollow, corporations describes companies that have bolstered profits by abandoning manufacturing and outsourcing production to plants in low-cost locations (Rahman & Bhattachryya, 2002; Teece, 1996).

Virtual corporations are smaller than they might otherwise be and thus generally have shallow hierarchies (Teece, 1996). They might well have innovative cultures and external linkages to competent manufacturers. Defined this way, “virtuals” have the capacity to be very creative and to excel at early stage innovation activities. If they indeed establish a strong alliance with a competent manufacturer, they may also have the capacity to be first to market, despite the adequate development of the requisite internal capabilities (Teece, 1996).

#### **3.2.3 The Organization-Based Company**

Organization may be more representative in companies acting in a bureaucratic and efficacy-driven way. According to Teece (1996), decision making processes in hierarchical

organizations almost always involve bureaucratic features and is expected to have a committee structure, with top management basing significant decisions on reports and written justifications.

Within such companies, a formal expenditure process involving submissions and approvals outside the unit in which the expenditure is to take place is characteristic. If, on the one hand, this may ensure an efficient usage of expenditures to opportunities across a wider range of economic activity; on the other hand, it slows decision making and tends to reinforce the status quo (Teece, 1996). One consequence may be the so-called “anti-innovation bias” (Williamson, 1975). As stated by Downs (1967),

The increasing size of the bureau leads to a gradual ossification of operations – since each proposed action must receive multiple approvals, the probability of its being rejected is quite high – its cumbersome machinery cannot produce results fast enough, and its anti-novelty bias may block the necessary innovation. (p. 160)

Thus, companies in which organization is more significant are expected to present higher organizational costs, and relatively lower technology specificity and lower transaction complexity. On one hand, by investing more in organization, this type of company acts in a sluggish way towards development, which turns to be costly. Thus, they are frequently one step behind the market, acting reactively. On the other hand, even though putting development aside, investing more in organization may lead – given a stablished technological pattern and the consequent firm complexity – the company towards efficacy. That is, the company becomes capable of producing and achieving the desired result constantly. Within this scenario, the company has the ability to make more of the same that it has been doing, effectively.

The lack of alignment between firm and organization, with the latter being more expressive, may occur in four different combinations.

### **3.2.3.1 Management Capability > Technology Development Capability**

Management capability can integrate and support a set of capabilities related to development, logistics, marketing, cost control, financial and human resources (Desarbo et al., 2005). However, management does not necessarily master enough technical knowledge to sustain the company as a whole. But whenever innovations happen, management must orchestrate a new form of allocation of resources, which may mean organizational innovation (Pufal et al., 2014).

Hierarchical and fixed management structures though may present bureaucratic decisions and absence of a powerful change culture and high-powered incentives (Teece, 1996).

Such companies are likely to be internally focused and, consequently, external changes in the market and in the science and technology establishment are unlikely to get recognized in a timely fashion (Teece, 1996). Thus, decision making is slow and so it is the resulting development – when the latter should be presenting a more active structure instead (Teece, 1996).

Penrose (1959) states that enterprising is closely related to ambition, but even if a firm is not very ambitious it may nevertheless be competently managed.

This is particularly true of those smaller firms where there is a close relation between the ‘goals’ of owners and the ‘goals’ of firms. There are many businessmen, and very efficient ones too, who are not trying always to make more profits if to do so would involve them in increased effort, risk, or investment. In many industries and areas there are a considerable number of firms which have been operating successfully for several decades under competent and even imaginative management, but have refrained from taking full advantage of opportunities for expansion. (Penrose, 1959, p. 31)

In that sense, typical companies in which management speaks louder than technology development are family-owned companies (Penrose, 1959). Having development guided by tradition and by informal procedures, those companies present the owner as the main decision maker of its strategy, especially regarding what to produce and how (Pufal et al., 2014). Many of these owners of family firms show themselves content with a comfortable profit and unwilling to make more money or to raise capital through procedures that would reduce their control over their firms (Penrose, 1959). Within this scenario, development is conditioned to the owner’s decisions and guidelines, instead to technological possibilities.

In that sense, Teece (1996) states that, to assist development, a set of norms can be implemented, such as: the autonomy to try and fail; the right of employees to challenge the status quo; open communication to customers, to external sources of technology, and within the firm itself.

For instance, a declaration by top management that the firm is now going to be more open to external sources of technological ideas will not ensure that the strategy will be successful if there is a well-entrenched “not invented here” culture inside the organization (Teece, 1996, p. 206).

The right organization is not just an important asset to assist in technological development; it may be a requirement.

### **3.2.3.2 Management Capability > Transaction Capability**

While transaction capability is responsible for decoding the different market signals and for minimizing transaction costs, management capability gives rise to a specific architecture that allows the integration of all areas in order to look forward efficiency and stability, and thus to improve firm's performance (Pufal et al., 2014). The quest for efficiency on hierarchy, decision-making and coordination brings business inside the firm. Management capability enables firms to find their own path and a competitive attribute, combining continuity with innovation (Whitley, 1989).

However, whenever a steady management capability is in control, focused more internally than externally, mandatory decisions from top managers may speak louder than market trends, compromising company's responsiveness to customer demands.

Just as family-owned companies' technology development can be narrowed by its owner's decision, transaction opportunities might be lessened by top management lack of investments (Penrose, 1959). Accordingly, Teece (1996, p. 203) states that "individuals involved in the organization, including chief executive officers, can fall into the trap of adopting a citadel mentality".

Consonantly, the availability of a stable cash flow, guaranteed by the transaction capability, can help sustain that mentality and behavior for periods of time. Additionally, closed systems may be able to refine existing routines, honing even more the organization, but they will lose the capacity to engage in new routines and promote changes that may led to innovation. Thus, bureaucracy may lead the company to an inefficient accountability, with considerable hiatus to current market dynamics (Teece, 1996), if it does not act in service of promoting changes towards better organizational procedures.

### **3.2.3.3 Operations Capability > Technology Development Capability**

Operating plans are found to have impact in development, for example, in cost reduction: in such situations, operations will drive the process (Woodward, 1970). As stated by Tatikonda et al. (2013), the more advanced in the life-cycle phases the company is, the more it will advance towards stability.

Consequently, if aligned with the market positioning, the main focus of the company turns to be large production scale, seeking for reliable and economically sustainable operations and employee productivity to support greater unit output. By doing so, the company prioritizes operations efficacy over development expansion.

That is the case, for example, of manufacturing companies that act as suppliers to other manufacturing companies, within the business-to-business (B2B) model. Scale speaks louder than technology development, since they are simple manual followers, producing under customers' requests and according to pre-established norms. Within this type of company, machines and equipment may determine development guidelines, rather than market or research departments (Reichert, Camboim & Zawislak, 2015).

#### **3.2.3.4 Operations Capability > Transaction Capability**

Just as operation may lead the development of a company, it can also guide transactional activities. In order to try to secure a favorable demand that will be expressed by a high return based on company's products or services offered, operational limits can influence strategic transaction actions as to move into or out of given markets or areas of activity (Child, 1972).

For instance, the installed capacity of a company may configure a restriction to enter in a new market or to expand its portfolio, maintaining the company in the same position (Reichert, Camboim & Zawislak, 2015). In that sense, in the real world, transaction cost theory would appear here under the form of deciding neither to buy, nor to produce. That is, the company does not present enough capacity to produce what would be developed and, thus, does not advance into a new complexity level, which would ensure higher economic performance.

Within this scenario, whenever logistics and marketing are not aligned, companies face growth constraints (Zawislak et al., 2012). Companies that do not expand transactional abilities are those that have been producing the same product throughout the years and will continue to do so, because they have achieved secure and predictable organizational costs. That represents the inversion of the formula that understands organization as a function of the firm. That could work in previously mentioned supplier companies for a while; however, over time, companies that do not change are destined to fade (Penrose, 1959).

### **3.3 Organized Innovative Firms**

It has been argued that the diversity of companies is fundamental in the processes that promote economic progress (Nelson, 1991) and that the very essence of a successful company is to be an organized innovative firm. By understanding the different patterns of company, it is also possible to understand the reasons to the existence of disorganization within firms. Based



on the detailing of the above-mentioned patterns, i.e., the balanced company, the firm-based company and the organization-based company, one may suggest that disorganization can also be divided according to its *raison d'être*.

That is, there is a disorganization related to an incompetence that exists and continues due to the inability of the company to find the best use of the resources available (Penrose, 1959). In other words, the inability of the company to find the right organization to its firm. The other disorganization type is intrinsic to the process of innovation, considered the dynamic interacting process which encourages continuous growth (Penrose, 1959). Every time the firm changes, organization must be reorganized, establishing a new organizational pattern for the new firm pattern resulting from innovation.

In that second case, if one takes a snapshot of the moment when there is a mismatch between firm and organization, one may tend to think firm is disorganized – and it is. However, this is inherent in the process of change, both of firm and organization. In fact, technological and marketing innovations are results of changes in the firm sphere (technology development and transaction capabilities, respectively), while organizational innovations emerge either from management capability (managerial innovation) or operations capability (operational innovation) (Zawislak et al., 2012).

In that sense, Nelson (1991, p. 68) states that “while it may not be too difficult to destroy an old structure or its effectiveness, it is a major task to get a new structure in shape and operating smoothly”. Therefore, to the extent that a major change in strategy (firm) calls for a major change in structure (organization), achieving the needed changes may take a long time (Nelson, 1991). The author suggests then that the reason for changing structure is to change, possibly to enhance, the things a firm can do well – and that brings the discussion of capabilities.

Nelson (1991, p. 68) concludes then that “simply producing a given set of products with a given set of processes well will not enable a firm to survive for long”. To be successful for any length of time, a firm must innovate (Nelson, 1991; Schumpeter, 1942; Zawislak et al., 2012). Thus, the capabilities to be considered for the analysis are capabilities for innovation and to take economic advantage of innovation (Nelson, 1991). By being so, in this study, the focus of analysis is on firm and organization capabilities, which are responsible for companies’ innovative performance.

Considered that, if firm is responsible for the external coordination and organization is responsible for the internal coordination of the company, then innovation is the link between them. Whenever firm is enhanced, organization is pushed to a new level. In that sense, companies with higher levels of firm and organization capabilities arrangement present also

established commercial position and a rhythm of product development in consonant with the market in which they are inserted, just like lower level companies; however, their dynamic is different, because they act in quite different sectors. That highlights the dynamics of the (im)balance between firm and organization, when innovation occurs.

“In many technologies one innovation points more or less directly to a set of following ones, and the learning and complementary strengths developed in the former effort provide a base for the next round” (Nelson, 1991, p. 68). Accordingly, the author states that a firm needs a coherent strategy that defines the way the firm is organized and governed, enables it to see organizational gaps, and sets the ground for the core capabilities a firm must have to take its next step forward.

Also addressing the disequilibrium innovation may promote on the capabilities combination within a company, Penrose (1959, p. 4) states that

After a discussion of the characteristics of the business firm, its functions, and the factors influencing its behaviour, we shall turn to an examination of the forces inherent in the nature of firms which at the same time create the possibilities for, provide the inducements to, and limit the amount of the expansion they can undertake or even plan to undertake in any given period of time. It will then be shown that this limit is by its nature temporary, that in the very process of expansion the limit recedes, and that after the completion of an optimum plan for expansion a new ‘disequilibrium’ has been created in which a firm has new inducements to expand further even if all external conditions (including the conditions of demand and supply) have remained unchanged.

Penrose (1959) argues then that there is no reason to assume that as firms grow larger and larger they will become inefficient. She concludes that “it is much more likely that their organization will become so different that we must look on them differently” (Penrose, 1959, p. 17).

What appears here is an explanation for the different patterns of firm-organization combination within companies – and for firm disorganization as well. As firms change, they should also present following changes in their organization, determining the adequate structure for the firm act. In that sense, organizational innovation occurs (a) to find the best organizational arrangement to an existing firm and (b) to change the organization, given changes on the firm. Organization acting as a function of the firm, again.

Thus, disorganization appears whenever firm and organization are unbalanced. However, that may be momentary, as a natural consequence of firm change. When firm changes, the company is temporarily firm-based, until the organization responds and

restructures itself. In the next stage, as stated by Penrose (1959) and Nelson (1991), organization is well-tuned with the firm, as the focus turns to be stability and efficiency. When the company becomes organization-based, that means efficacy is the main asset, however, innovation endeavors are low.

Thus, while innovation leads to a temporarily disorganization, the lack of innovation can also lead to a long-lasting disorganization, since there are “decreasing returns to the entrepreneur function” (Coase, 1937, p. 394) and “diminishing returns to management” (Coase, 1937, p. 395). The company that does not innovate will succumb to the law of diminishing revenues of organization, with the natural attrition of the same pattern of organization.

As stated by Tatikonda et al. (2013), the more advanced in the life-cycle phases the company is, the more it will advance towards stability. That happens when company acts towards the organization-based pattern. However, one must bear in mind that these companies are those most oriented to remain performing just the same as in previous times, seeking for standardization instead of innovation. That does not mean, however, that it is negative. If it is aligned with company’s strategy, this pattern of company may be required. On the other hand, companies should constantly innovate to perpetuate. That means, these companies should constantly seek to change from organization-based to firm-based companies, in a constant evolving cycle (Nelson, 1991).

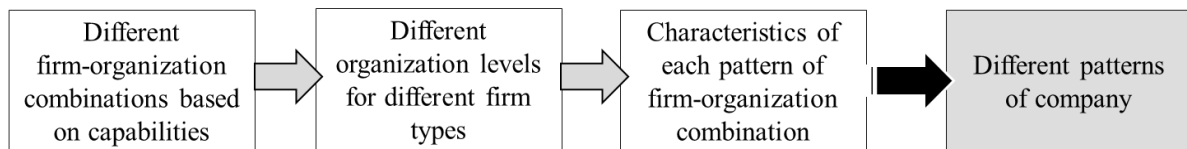
Nelson (1991, p. 71) reports that

At the present time there is little in the way of tested and proved theory (let me use the less pretentious word—knowledge) that enables confident prediction of the best way of organizing a particular activity, or what will be the consequences of adopting a different mode of organization. If the 'rationally choosing' view of technological advance is misguided, the 'rationally choosing' view of organizational change is even more so.

Therefore, the present study intends to shed light on the different patterns of company and broaden the understanding of why companies differ, through the barely explored relationship between firm and organization under the capabilities approach.

## 4 Methods

According to Myers (2013), quantitative methods are used for large sample size studies, generalizing the outcomes to a large population and discovering patterns that can be applied to distinct situations, i.e., to study a topic across many unities. Thus, in order to identify different patterns of company, taking into consideration firm-organization combinations and their capabilities arrangement, a quantitative study was conducted. Secondary data from an innovation survey was analyzed, aiming to achieve each research objective, as shown in Figure 5.



**Figure 5 – Research Objectives Design**

In the following subsections, methodological steps are described covering the definition of the sample, the structure of the questionnaire and the data analyses.

### 4.1 Research Data

For the development of the present study, secondary data from the project entitled “Paths of Innovation in the Brazilian Industry” were used. The project was carried out from 2010 to 2015 and involved four Universities: Universidade Federal do Rio Grande do Sul (UFRGS), Universidade do Vale do Rio dos Sinos (UNISINOS), Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS) and Universidade de Caxias do Sul (UCS). The project was coordinated by the NITEC Innovation Research Center and the principal investigator of the present study was part of the team since the first year of the project. The project focused on understanding the innovation dynamics in the Brazilian manufacturing industry.

A survey study was conducted with the application of the questionnaire to 6,142 companies, with five or more employees, from a universe of 10,930 manufacturing companies registered in the Rio Grande do Sul Industries Federation Database (FIERGS, 2010). A total of

1,470 companies answered the survey, and, from these, 1,331 questionnaires were considered valid.

Considering all valid respondents, it was verified that more than 85% of the companies are small, reflecting not only regional characteristics, but also Brazilian companies' characteristics as a whole (Reichert, Camboim & Zawislak, 2015), as shown in Table 2.

**Table 2 – Analyzed Companies Grouped by Size**

<b>Company Size</b>	<b>Amount of companies</b>	<b>% of the total surveyed</b>
Small	1156	86.8%
Medium	137	10.3%
Large	12	0.9%
<i>Missing</i>	26	2%
Total	1331	100.0%

Table 3 presents how many companies from the sample belong to which manufacturing sector and industry technological intensity. The division used here was proposed by Cavalcante (2014), who combined the Brazilian National Classification of Economic Activities (IBGE, 2017) to the industry technological intensity division created by the Organisation for Economic Cooperation and Development (OECD, 2011).

**Table 3 – Analyzed Companies Grouped by Sectors and Industry Technological Intensity**

<b>Industry Technological Intensity</b>	<b>Sectors</b>	<b>Amount of companies</b>	<b>% of the total surveyed</b>
Low-tech	Footwear and Leather	133	10%
	Food	120	9%
	Furniture	110	8.3%
	Textile Products	92	6.9%
	Wood	52	3.9%
	Other Manufacturing Products	36	2.7%
	Pulp and Paper	32	2.4%
	Printing	23	1.7%
	Textiles	15	1.1%
	Beverage	10	0.8%
Tobacco	7	0.5%	
Medium Low-tech	Metal Products	171	12.8%
	Plastic and Rubber	106	8.0%
	Nonmetallic Products	50	3.8%
	Metallurgy	29	2.2%
	Machinery Maintenance	12	0.9%
	Petroleum Refining	2	0.2%
Medium High-tech	Machinery & Equipment	159	11.9%
	Automotive	58	4.4%

	Chemicals	49	3.7%
	Electric	34	2.6%
	Transportation Equipment	6	0.4%
High-tech	Electronics	18	1.3%
	Pharmaceuticals	1	0.1%
	<i>Missing</i>	6	0.4%
	<b>Total</b>	<b>1331</b>	<b>100%</b>

## 4.2 Questionnaire

The questionnaire used in the survey (Appendix A) is divided into three different blocks. The first block contains multiple choice and Likert-type (with five levels of agreement) questions, and is divided into four parts: technology development capability, operations capability, management capability and transaction capability. The second block contains Likert-type (with five levels of agreement) questions related to performance. The third block contains general information questions using numerical and multiple-choice scales.

This questionnaire, by encompassing the technology development, operations, management and transactions capabilities, is adequate to achieve the present study objectives. As previously discussed in the theoretical review (section 2.3), the firm dimension can be understood by analyzing the technology development and transaction capabilities, whereas the operations and management capabilities refer to the organization dimension. The questionnaire involves all these capabilities and the indicators listed in section 3.4 to analyze each capability. Table 4 presents the questions created based on the indicators regarding each capability used for analysis, according to the research objectives.

**Table 4 – Questions Regarding the Innovation Capabilities**

Company	Capability	Indicators	Questions
<b>Firm</b>	Technology Development	<ul style="list-style-type: none"> <li>✓ Acquisition</li> <li>✓ Imitation</li> <li>✓ Adaptation</li> <li>✓ Changes</li> <li>✓ Development of a new set of knowledge and technical systems for internal use</li> <li>✓ Project management</li> <li>✓ Development trigger</li> <li>✓ Development flow</li> </ul>	<ul style="list-style-type: none"> <li>✓ Designs its own products (TDC1)</li> <li>✓ Monitors the latest technological trends in the sector (TDC2)</li> <li>✓ Adapts the technology in use to its own needs (TDC3)</li> <li>✓ Develops products in partnerships with Science and Technology Institutions (TDC4)</li> <li>✓ Prototypes its own products (TDC5)</li> <li>✓ Uses formal project management methods (Stage-Gate, PMBOK, innovational funnel, etc.) (TDC6)</li> <li>✓ Launches its own products (TDC7)</li> </ul>

	Transaction	<ul style="list-style-type: none"> <li>✓ Outsourcing</li> <li>✓ Distribution</li> <li>✓ Relationship with customer</li> <li>✓ Negotiation</li> <li>✓ Hiring</li> <li>✓ Marketing and branding</li> <li>✓ Logistics</li> <li>✓ Pricing</li> </ul>	<ul style="list-style-type: none"> <li>✓ Conducts research to measure its customers' satisfaction (TC1)</li> <li>✓ Conducts formal research to monitor the market (TC2)</li> <li>✓ Imposes its negotiating terms on its suppliers (TC3)</li> <li>✓ Imposes its prices on the market (TC4)</li> <li>✓ Imposes its negotiating terms on its customers (TC5)</li> <li>✓ Uses formal criteria to select its suppliers (TC6)</li> </ul>
<b>Organization</b>	Operations	<ul style="list-style-type: none"> <li>✓ Quality control</li> <li>✓ Flexibility</li> <li>✓ Formalization</li> <li>✓ Continuous improvement</li> <li>✓ Inventory management</li> <li>✓ Technological innovation</li> <li>✓ Production planning</li> </ul>	<ul style="list-style-type: none"> <li>✓ Formalizes the PPC procedures (OC1)</li> <li>✓ Keeps statistical control of the process (OC2)</li> <li>✓ Uses leading edge technology in the sector (OC3)</li> <li>✓ Maintains adequate stock levels of materials for the process (OC4)</li> <li>✓ Carries out the productive process as programmed (OC5)</li> <li>✓ Establishes a productive routine that does not generate rework (OC6)</li> <li>✓ Delivers the product promptly (OC7)</li> <li>✓ Manages to expand the installed capacity whenever necessary (OC8)</li> <li>✓ Manages to ensure the process does not lead to products being returned (OC9)</li> </ul>
	Management	<ul style="list-style-type: none"> <li>✓ Integration</li> <li>✓ Objectives establishment</li> <li>✓ Norms and procedures</li> <li>✓ Decision making process</li> <li>✓ Management of HR and learning</li> <li>✓ Financial management</li> <li>✓ Management model</li> </ul>	<ul style="list-style-type: none"> <li>✓ Formally defines its strategic objectives annually (MC1)</li> <li>✓ Includes social and environmental responsibilities on its strategic agenda (MC2)</li> <li>✓ Uses technology to integrate all its sectors (MC3)</li> <li>✓ Standardizes and documents the work procedures (MC4)</li> <li>✓ Updates its management tools and techniques (MC5)</li> <li>✓ Maintains the personnel adequately trained for the company functions (MC6)</li> <li>✓ Uses modern financial management practices (MC7)</li> </ul>
<b>Innovation</b>		<ul style="list-style-type: none"> <li>✓ Profit growth</li> <li>✓ Market share growth</li> <li>✓ Revenue growth</li> </ul>	<ul style="list-style-type: none"> <li>✓ The net profit has grown continuously over the last 3 years (IP1)</li> <li>✓ The company's market share has continuously grown over the last 3 years (IP2)</li> <li>✓ The company's revenue has continuously grown over the last 3 years (IP3)</li> </ul>

Source: Adapted from the "Paths of Innovation in the Brazilian Industry" project.

To identify the different patterns of company, these capabilities were analyzed and compared.

### 4.3 Data Analysis

In order to achieve the present study objectives, the main statistical techniques involved: description of frequency and percentage, mean, standard deviation, correlation, ANOVA, multiple regression, factor analysis and two-step cluster analysis. The software Statistical Package for Social Science – SPSS version 21 was used.

Factor analysis was first conducted, so that the factors that statistically explain the variation and covariation among capabilities measures could be identified (Green & Salkind, 2014). After that, the scale reliability was tested through the Cronbach's alpha analysis, which is a measure of internal consistency, i.e., how closely related a set of items are as a group (Hair et al., 2009).

Based on the four factors identified, it was possible to create the variable for the firm, unifying technology development and transaction capabilities variables factors, and the variable for the organization, unifying operations and management capabilities variables factors. Therefore, from that moment on, technology development and transaction capabilities variables factors combined were a proxy to analyze the firm and operations and management capabilities variables factors combined were a proxy to analyze the organization (Zawislak et al., 2012).

A two-step cluster analysis procedure was then conducted to reveal natural groupings within the dataset that would otherwise not be apparent (Hair et al., 2009). Four groups were identified.

Using regular mean of variables, Pearson Correlation analysis was conducted to investigate the relationship between firm and organization variables of groups. Considering the bivariate data, a scatterplot was then created to analyze the different combination of firm-organization capabilities, having firm as the independent variable and organization as the dependent variable.

Descriptive variables, such as mean, standard deviation and frequency distribution, regarding all four capabilities (technology development, operations, management and transaction) of each cluster were analyzed, as well as each cluster performance indicators. Regression analysis was conducted for estimating the relationships between the capabilities of each group and its performance (Green & Salkind, 2014). ANOVA and post hoc tests were performed to determine if there was statistically significant difference among the groups and to examine where the groups' differences laid (Hair et al., 2009).



Finally, descriptive analysis of complimentary multiple-choice questions of the research instruments was performed, to deepen the differences of all four groups of firm-organization capabilities combination, i.e., four patterns of company.

#### **4.3.1 Factor Analysis**

Factor analysis is a technique used to identify factors that statistically explain the variation and covariation among measures (Hair et al., 2009). Generally, the number of factors is considerably smaller than the number of measures and, consequently, the factors succinctly represent a set of measures. From this perspective, factor analysis can be viewed as a data-reduction technique since it reduces many overlapping measured variables to a much smaller set of factors (Hair et al., 2009). Factor analysis may be also used to determine which items or scales should be included in and excluded from a measure. Therefore, according to Green and Salkind (2014), there are three applications of factor analysis: defining indicators of constructs, defining dimensions for an existing measure and selecting items or scales to be included on a measure.

Considering that the questionnaire (Appendix A) used in the present study encompasses all four innovation capabilities with different items, the purpose of the factor analysis was to select the items to be included on each capability measurement, based on the 29 questions previously shown in Table 4.

Following Hair et al. (2009), the extraction method used was Principal Component Analysis (PCA), which reduces the original set of variables into a smaller group. The numbers of factors extracted from the PCA followed Kaiser's eigenvalue-greater-than-one criterion and were expected to finish in a total of four, considering the previous literature background on the four innovation capabilities. The rotation method was Varimax, which is an orthogonal rotation method superior to others and simplifies the interpretation of factors (Hair et al., 2009). Missing values were excluded listwise (Field, 2009). Factors with loading of 0.5 are considered as "practically significant" (Hair et al., 2009, p. 119). The higher the factor loading, the more important the loading is in the factor matrix interpretation (Hair et al., 2009).

After examining the factor loadings, it is required to analyze the communalities of each variable. Hair et al. (2009) indicate that researchers must decide and specify the minimum value for communalities to attend acceptable levels of explanation, according to the research context.

In that sense, Osborne and Costello (2009) state that the more common magnitudes in the social sciences are low to moderate communalities of 0.40 to 0.70 and that if an item has a communality of less than 0.40 it may not be related to other items.

Finally, with all factors identified – considered the specified values – and labeled, the variables of Technology Development and Transaction capabilities factors were grouped, forming thus, the Firm variable, and the variables of Operations and Management capabilities factors were also grouped, forming the Organization variable, under the notion of multiple scale, in which all variables with high loadings of a factor are combined and the resulting mean score is used as a new variable (Hair et al., 2009). The main advantage of multiples scale is its ability to represent multiple aspects of a concept with one single measure; and the starting point to create multiple scale is its conceptual definition, which is grounded on theoretical research (Hair et al., 2009). The internal consistency for the items was assessed with Cronbach's Alpha (equal or greater than 0.7) and reported.

Initially, four variables with loadings under 0.5 were excluded: TDC4, OC3, MC4 and TC1. By that moment, five factors were formed. Aiming to define four factors, regarding the four innovation capabilities stated in the literature (Zawislak et al., 2012), the variable MC2 was removed, due to its high loading in the fifth factor. Then, data were rerun and variables OC1, OC2 and MC3 were removed because their loadings were under 0.5. Finally, after a new rerun, the variable OC4 presented communality under 0.4 and was therefore eliminated. With the elimination of those 9 variables, data met the statistical requirements<sup>2</sup>, resulting in four factors (Table 5), as in the Innovation Capabilities Model presented.

The Correlation Matrix does not present any value greater than 0.9 and its determinant is 0.001, greater than the necessary value of 0.0001 (Field, 2009). Therefore, multicollinearity is not a problem for the data and questions are considered to correlate well (Field, 2009). All the final variables present meritorious measure of sampling adequacy (MSA) (>0.84), which means data is suitable for factor analysis (Cerny & Kaiser, 1997). In addition, Kaiser-Meyer-Olkin (KMO) measure indicates a value of 0.905, which is considered superb and indicates that factor analysis yields distinct and reliable factors (Kaiser, 1974; Field, 2009). Bartlett's test of sphericity is significant ( $p = 0.000$ ), which shows adequacy to the conduction of factor analysis (Field, 2009). The total variance explained for the four factors representing the four innovation capabilities is 57.37%.

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<sup>2</sup> See Appendix B for the complete tables of Factor Analysis.

**Table 5 – Rotated Component Matrix**

	Component			
	1	2	3	4
(TDC5) Prototypes its own products	.769			
(TDC7) Launches its own products	.755			
(TDC1) Designs its own products	.750			
(TDC2) Monitors the latest technological trends in the sector	.678			
(TDC3) Adapts the technology in use to its own needs	.649			
(TDC6) Uses formal project management methods (Stage-Gate, PMBOK, innovational funnel, etc.)	.626			
(OC7) Delivers the products promptly		.748		
(OC6) Establishes a productive routine that does not generate rework		.739		
(OC9) Manages to ensure the process does not lead to products being returned		.735		
(OC5) Carries out the productive process as programmed		.668		
(OC8) Manages to expand the installed capacity whenever necessary		.607		
(TC4) Imposes its prices on the market			.772	
(TC5) Imposes its negotiating terms on its customers			.763	
(TC3) Imposes its negotiating terms on its suppliers			.742	
(TC6) Uses formal criteria to select its suppliers			.647	
(TC2) Conducts formal research to monitor the market			.512	
(MC7) Uses modern financial management practices				.745
(MC5) Updates its management tools and techniques				.739
(MC1) Formally defines its strategic objectives annually				.699
(MC6) Maintains the personnel adequately trained for the company functions				.661

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.<sup>a</sup>

a. Rotation converged in 5 iterations.

Analyzing the variables of each factor, it is possible to verify that they corroborate to the definition of the four innovation capabilities in the model of Zawislak et al. (2012). In that sense, factor 1 is related to Technology Development Capability, factor 2 refers to Operations Capability, factor 3 is related to Transaction Capability and factor 4 refers to Management Capability.

Finally, Cronbach's alpha was verified, to assess the reliability of the variables within the factors (Hair et al., 2009). As shown in Table 6, all factors present Cronbach's Alpha greater than 0.7, which is the acceptable value to confirm the internal consistency of items.

**Table 6 – Cronbach’s Alpha of each Factor**

Company	Factor / Capability	Cronbach’s Alpha	N of items
<b>Firm</b>	1. Technology Development	0.842	6
	3. Transaction	0.772	5
<b>Organization</b>	2. Operations	0.789	5
	4. Management	0.758	4

The factor scores for each variable in each factor (representing each capability) were saved as new variables, since they represent the relative importance of the variable within the factor (capability) definition (Hair et al., 2009). Thus, Table 7 presents the final variables.

**Table 7 – Final Factors and Variables**

Company	Factors / Capability	Variables / Questions
<b>Firm</b>	1. Technology Development	<ul style="list-style-type: none"> <li>✓ Designs its own products (TDC1)</li> <li>✓ Monitors the latest technological trends in the sector (TDC2)</li> <li>✓ Adapts the technology in use to its own needs (TDC3)</li> <li>✓ Prototypes its own products (TDC5)</li> <li>✓ Uses formal project management methods (Stage-Gate, PMBOK, innovational funnel, etc.) (TDC6)</li> <li>✓ Launches its own products (TDC7)</li> </ul>
	3. Transaction	<ul style="list-style-type: none"> <li>✓ Conducts formal research to monitor the market (TC2)</li> <li>✓ Imposes its negotiating terms on its suppliers (TC3)</li> <li>✓ Imposes its prices on the market (TC4)</li> <li>✓ Imposes its negotiating terms on its customers (TC5)</li> <li>✓ Uses formal criteria to select its suppliers (TC6)</li> </ul>
<b>Organization</b>	2. Operations	<ul style="list-style-type: none"> <li>✓ Carries out the productive process as programmed (OC5)</li> <li>✓ Establishes a productive routine that does not generate rework (OC6)</li> <li>✓ Delivers the products promptly (OC7)</li> <li>✓ Manages to expand the installed capacity whenever necessary (OC8)</li> <li>✓ Manages to ensure the process does not lead to products being returned (OC9)</li> </ul>
	4. Management	<ul style="list-style-type: none"> <li>✓ Formally defines its strategic objectives annually (MC1)</li> <li>✓ Updates its management tools and techniques (MC5)</li> <li>✓ Maintains the personnel adequately trained for the company functions (MC6)</li> <li>✓ Uses modern financial management practices (MC7)</li> </ul>

Having the factors identified and the scores saved, cluster analysis was then performed. Aldenderfer and Blashfield (1984) emphasize the importance of using transformed data for cluster analysis, just as scores from factor and principal component analysis. They state that “principal component analysis and factor analysis can be used to reduce the dimensionality of the data, thereby creating new, uncorrelated variables that can be used as raw data for the calculation of similarity between cases” (p. 21).

### 4.3.2 Cluster Analysis

Cluster analysis is a multivariate technique of grouping a set of objects in such a way that objects in the same group, called a cluster, are more similar to each other than to those in other groups – other clusters (Aldenderfer & Blashfield, 1984; Hair et al., 2009). In social sciences, cluster is used for typologies (Hair et al., 2009), and, thus, in the present work, the intention is to group companies within the sample, according to their firm and organization capabilities combination.

Considering that 1,331 questionnaires were valid and that there was no previous defined number of firm-organization capabilities combination (clusters) to be found within the sample, the two-step cluster analysis method was used. It is a method of the statistical software package SPSS used for large data bases, since hierarchical and k-means clustering do not scale efficiently when  $n$  is very large (Garson, 2012). According to Norusis (2008), if there is a large data file (1,000 cases are considered large for clustering) or a mixture of continuous and categorical variables, the SPSS two-step procedure is most suitable.

Two-step cluster analysis identifies the groupings by running preclustering first and then by hierarchical methods (Norusis, 2008). In the first step of preclustering, the goal is to reduce the size of the matrix that contains distances between all possible pairs of cases. Preclusters are clusters of the original cases that are used in place of the raw data in the hierarchical clustering. As a case is identified, the algorithm decides, based on a distance measure, whether the current case should be merged with a previously formed precluster or start a new precluster. When preclustering is complete, all cases in the same precluster are treated as a single entity. The size of the distance matrix is no longer dependent on the number of cases but on the number of preclusters.

In the second step, SPSS uses the standard hierarchical clustering algorithm on the preclusters. By forming clusters hierarchically, it is possible to explore a range of solutions with different numbers of clusters. Only cases with valid values for all variables are included in cluster formation. Thus, by comparing the values of a model-choice criterion across different clustering solutions, the procedure automatically determines the optimal number of clusters. The optimal number of clusters was automatically selected by an algorithm based on the Schwartz Bayesian Criterion (BIC).

The final solution grouped the companies into four groups, with significant difference. Analysis of variance (ANOVA) was used for validating the identified clusters, analyzing their

statistical significance (Hair et al., 2009). Tests confirmed that the four clusters were significantly different in terms of firm-organization capabilities. Cluster membership was then saved to be used in further analyses.

### **4.3.3 Correlation Analysis**

To investigate the relationship between firm-organization variables within the four groups identified, Pearson correlation analysis, involving regular means of variables, was conducted, given that Pearson correlation is a bivariate measure of association (strength) of the relationship between two variables (Laville & Dionne, 1999).

Correlation coefficients measure the strength of the relationship between variables (Pestana & Gageiro, 2005). Correlation coefficients vary from 0 (no relationship) to 1 (perfect linear relationship) or -1 (perfect negative linear relationship) (Hair et al., 2009). Positive coefficients indicate a direct relationship, indicating that as one variable increases, the other variable also increases. Negative correlation coefficients indicate an indirect relationship, indicating that as one variable increases, the other variable decreases. According to Hair et al. (2009), the strength of association is divided into five levels: mild, almost imperceptible (0.01 to 0.20); small (0.21 to 0.40); moderate (0.41 to 0.70); high (0.71 to 0.90) and very strong (0.91 to 1). These levels were considered to identify the intensity of relationship between firm and organization variables.

It is considered beneficial to create a scatter plot to visualize the relationship between the tested variables. While a correlation coefficient tries to summarize the relationship between two variables, a scatterplot gives a rich descriptive picture of this relationship (Green & Salkind, 2014). The purpose of the scatter plot is thus to clearly verify that the variables have a linear relationship. Having verified the positive relationship, the next steps were to analyze each group descriptive characteristics and how firm and organization capabilities impact on each group performance, by multiple regression analysis.

#### **4.3.4 Multiple Regression Analysis**

The goal of regression analysis is to examine the relationship between dependent and independent variables (Hair et al., 2009). When the problem involves one single independent variable, the statistical technique to be used is simple regression analysis. When the problem involves two or more independent variables, the process is called multiple regression analysis, which is the case in the present study.

As previously stated, Zawislak's et al. (2012) innovation model presumes that every firm has some level of four innovation capabilities affecting their performance. In consonance, multiple regression analysis was carried out to analyze how the capabilities of each group affect its performance, using their regular means. Therefore, the four innovation capabilities are the independent variables predicting performance, the dependent variable.

The innovation capabilities variables identified in former steps were included in this analysis; whereas performance was measured using three outcomes identified by OECD (2005), Schumpeter (1942), Reichert, Camboim & Zawislak (2015) and Zawislak et al. (2012, 2013, 2014): profit growth, market share growth and revenue growth. The result of multiple regression analysis for each of the four groups highlighted the importance of each innovation capability to their performances.

#### **4.3.5 Descriptive Analysis**

Descriptive analysis was conducted to further explore singular characteristics of each group, once the four groups of companies were identified and their innovation capabilities and performance were analyzed. According to Hair et al. (2003), descriptive studies can provide a description of elements at a given point in time by cross-sectional data, which are statistically summarized.

For that, analyses involving the description of qualitative variables of the questionnaire, such as frequency and percentage, were carried out. Considering that some of the companies did not answer the entire questionnaire, the valid responses vary from question to question.

## 5 Results

Following each of the analyses above-mentioned, it was possible to identify different patterns of companies within the sample. Differences and similarities within their innovation capabilities highlighted why they were so grouped. Performance indicators also showed variations according to the innovation capabilities arrangement of each group. General characteristics analysis complemented the definition of each pattern as well. Therefore, the results are presented and discussed in this section.

### 5.1 Definition of Firm-Organization Combinations

Cluster analysis highlighted that there are four statistically significant ( $p < .001$ ) different groups regarding firm-organization capabilities within the sample, as intended in the first specific objective “to define different firm-organization combinations based on the capabilities approach”. Cluster analysis presented a total of 1,156 valid cases, which is the total sample to be consider from now on in this study. Table 8 presents the number of cases in each cluster.

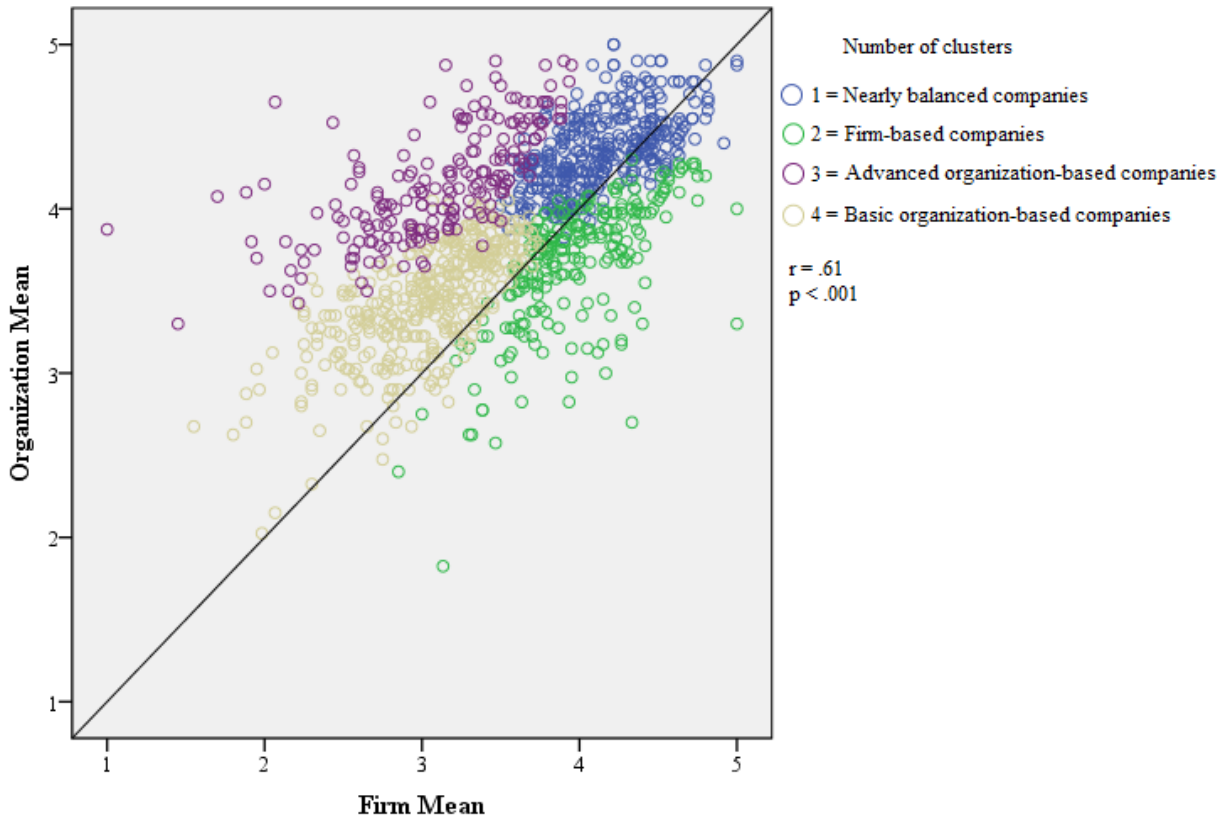
**Table 8 – Clusters**

<b>Cluster</b>	<b>Number of cases</b>
1	358
2	233
3	200
4	365
<b>Total</b>	<b>1,156</b>
<b>Missing</b>	175

Once the clusters were identified, Pearson correlation analysis was conducted to verify the relationship between firm and organization variables of groups. Correlation coefficient was computed between the regular mean (from 1 to 5) of firm and organization variables presented in the previous section. The correlation between firm and organization variables is statistically significant ( $p < .001$ ), with a coefficient of .61, which is considered moderate (see Appendix C).



To clearly verify that these variables have a linear and positive relationship, a scatter plot was created from the correlation analysis (Green & Salkind, 2014), having firm as the independent variable and organization as the dependent variable (see section 3.2). The four clusters are shown within the scatter plot in Figure 6.



**Figure 6 – Bivariate Scatter Plot with Firm-Organization Means, Highlighting Four Different Clusters**

Through the scatter plot, it is possible to verify the diversity of companies within the sample, based on their firm and organization capabilities. That underlines the idea that companies' capabilities can be developed in many ways, creating different patterns of firm-organization combination and is an initial step towards the identification of on what kind of effort should the coordination structure of the firm rely to be successful.

The 45-degree line within the scatter plot refers to the perfect correlation between firm and organization, representing organization as a function of the firm (see section 2.2). As expected, companies do present a positive correlation, showing that when firm (technology development and transaction capabilities) varies, organization (operations and management capabilities) accompanies.

It is clear to verify that neither firm or organization present zero values, in consonance with the assumption that all four innovation capabilities, studied here through the lenses of firm and organization capabilities combined, are never zero within a company (Zawislak et al., 2012). Therefore, all analyzed companies have a sort of combination of all four innovation capabilities, in different levels. Similar levels were statistically grouped into four clusters.

Mean description of firm-organization variables underlined the difference among the four clusters. Table 9 shows the means of firm-organization variables in each cluster. ANOVA confirmed ( $p= 0.000$ ) that the four clusters are significantly different in terms of firm-organization capabilities.

**Table 9 – Mean Analysis of Firm and Organization Comparing Clusters**

Cluster	Firm		Organization	
	Mean	Std. Deviation	Mean	Std. Deviation
<b>1</b> (n=358)	<b>4.13</b>	.32	<b>4.35</b>	.24
<b>2</b> (n=233)	<b>3.98</b>	.37	<b>3.68</b>	.39
<b>3</b> (n=200)	<b>3.10</b>	.51	<b>4.15</b>	.34
<b>4</b> (n=365)	<b>3.03</b>	.40	<b>3.44</b>	.34
<b>All clusters</b> (n=1156)	<b>3.58</b>	.64	<b>3.89</b>	.50

Note: The highest figures are highlighted.  
 $p < .001$  for all cases.

Cluster analysis and mean description show that organization mean is greater than firm mean in all clusters, except for cluster 2. In that sense, the four different clusters represent, in fact, different patterns in which organization is greater than firm (organization-based companies) and one pattern where firm is the main driver (firm-based companies). That result satisfies the second objective of this study, which is “to determine the different organization levels for the different firm types”.

The perfect balance between firm and organization is a theoretical assumption, considering that organization is a function of the firm. In the real world, companies are expected to behave as close to that relation as possible, but it is equally expected that only few will perform it in an exact way. Companies in cluster 1, therefore, are the most representative of this kind of pattern within the analyzed sample. It is clear that they may be mostly considered as organization based-companies, due to the predominance of organization within their structure;

however, firm indicators are not that far behind. Thus, companies in cluster 1 may be called as *nearly balanced companies*.

Companies in cluster 2, in turn, are the only example of companies figuring under the reference line in the scatter plot, i.e., in the firm sphere. By being so, they present higher means in firm and are, therefore, perceived as *firm-based companies*.

Companies in cluster 3 are highly more organization-based than firm-based. They figure in the organization side of the scatter plot, above the 45-degree line, and present higher mean in organization than in firm. They are, thus, *advanced organization-based companies*.

Companies in cluster 4 have the lowest firm and organization means. These companies represent the organization-based companies pattern as well, in which organization is more expressive than firm. However, by presenting the lowest means within the sample, they may be considered as *basic organization-based companies*.

It is possible to verify then that from cluster 1 (nearly balanced companies) to cluster 4 (basic organization-based companies), there are descendant firm means. That highlights the fact that transaction complexity and technology specificity decreases as companies focus mainly on organization, especially in basic and advanced organization-based companies.

In cluster 1, in which companies are seen as nearly balanced, is where firm complexity figures at its highest within the sample. In such cases, innovation is associated to quick decision making and close coupling and coordination among research, development, manufacturing, sales and service (Teece, 1996). By being so, organization exists to enable these activities to be closely coordinated, and to occur with dispatch, from development to transaction (Teece, 1996). As stated by Nelson (1991), in a well-tuned firm, its production, procurement, marketing and legal organizations must have built into them the capabilities to support and complement the new product and process technologies emanating from the technology development capability. Thus, the nearly balance of firm-organization capabilities hinges on organizational costs and firm specificity, determining the level of capabilities arrangement, which is high in this cluster.

On the other hand, companies in cluster 2 are firm-based companies by presenting higher firm means. That may be interpreted as a cluster in which companies deal with more complexity and specificity than companies that are basic or advanced organization-based (clusters 3 and 4), but still has firm less developed than the cluster of nearly balanced companies. Therefore, to further explore these differences and similarities, the characteristics of each pattern are analyzed, regarding innovation capabilities, performance indicators, size, industry technological intensity, investments in R&D, registered patents and management model.

## 5.2 Characteristics of Each Pattern of Firm-Organization Combination

With this section, the third specific objective of the study, which is “to characterize each pattern of firm-organization combination”, is accomplished. Detailing the characteristics of each pattern of companies is fundamental to determine what lies behind an organized innovative firm.

### 5.2.1 Innovation Capabilities of the Four Types of Firm-Organization Combination

As suggested by Richardson (1972), capabilities are determinants of the boundaries of the company, since they determine the relative costs of different firms in organizing particular activities. In that sense, companies will be different accordingly to their capabilities, and, mainly, accordingly to how they are related to the need to innovate (Bessant, Rush & Hobday, 2000). Therefore, this section details the innovation capabilities of each pattern previously identified.

To do so, firm and organization variables were divided into their composing capabilities. Thus, it was possible to verify which capability is most representative for either firm or organization. Table 10 shows the mean analysis.

**Table 10 – Mean Analysis of Innovation Capabilities Comparing Clusters**

Cluster	Firm				Organization			
	TDC		TC		OC		MC	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Nearly Balanced</b> (n=358)	<b>4.27</b>	.43	<b>3.99</b>	.46	<b>4.40</b>	.35	<b>4.29</b>	.40
<b>Firm-based</b> (n=233)	<b>4.14</b>	.49	<b>3.82</b>	.52	<b>3.83</b>	.47	<b>3.53</b>	.58
<b>Advanced Organization-based</b> (n=200)	<b>3.21</b>	.84	<b>2.98</b>	.65	<b>4.25</b>	.46	<b>4.05</b>	.49
<b>Basic Organization-based</b> (n=365)	<b>3.08</b>	.71	<b>2.99</b>	.57	<b>3.57</b>	.49	<b>3.32</b>	.57
<b>All clusters</b> (n=1156)	<b>3.69</b>	.83	<b>3.47</b>	.72	<b>4.00</b>	.57	<b>3.79</b>	.66

Note: The highest figures are highlighted.

SD = Standard Deviation, TDC = Technology Development Capability, TC = Transaction Capability, OC = Operations Capability, MC = Management Capability.

p<.001 for all cases.

Nearly balanced, advanced organization-based and basic organization-based companies, which have the highest mean in organization, present highest means in operations and management capabilities as well. Firm-based companies, however, have the highest mean in firm, due to its development technology capability.

The prevalence of operations and management capabilities in nearly balanced, advanced organization-based and basic organization-based companies shows that within these companies, organizational costs are higher than in firm-based companies. Remarkable is that organization-based companies are expected to have lower specificity and lower complexity. That is true when considering advanced and basic organization-based companies. However, nearly balanced companies show higher firm complexity as well. Again, that is related to their characteristic of being *almost* balanced, i.e., *almost* well-tuned, in Nelson's (1991) term.

Focusing more on operations and management capabilities, organization-based companies prime for efficacy rather than development (Reichert, Camboim & Zawislak, 2015). By doing so, such companies become capable of producing and achieving the desired result constantly. Within this scenario, companies make more of the same that they have been doing, effectively. However, organizing firms in such pattern, may lead the company to a considerable hiatus to current market dynamics (Teece, 1996), if it does not act in service of promoting changes towards better organizational procedures. To be organization-based means having a firm acting in a constant way and an organization that works to ensure efficacy to what has been developed. Thus, organizational innovations should be the focus of these companies, since firm has already changed – or presents no planning for changes in the short term.

The pattern of firm-based encountered within the sample, in turn, is based on technology development capability. That suggest that the company presents specific or idiosyncratic investments and recurrent transacting (Jones, 1997). In these companies, technology development surpasses operations capability, which comes in second place, and management capability, the least one to be focused within their structures. This suggests that they deal with specific products, with low costs for organizing its final production, but lack the adequate management to support that production. In this pattern, an adaptation of management capability is expected over time, through professionalization, formalization and control of several procedures (Dullius, 2016), aiming at stability, which may set the ground for future innovations (Nelson, 1991).

Considering that these conclusions are based on the results shown so far, by the analysis of the arrangement of the four innovation capabilities as a whole with the support of the literature, mean analysis related to the description of each capability was conducted to explore

differences within groups and to build the understanding of what represents to be in each cluster. Therefore, each variable of each capability is analyzed. By doing so, differences between clusters and explanations on why some companies were grouped together are elucidated.

**Table 11 – Mean Analysis of Technology Development Capability Comparing Clusters**

Technology Development Capability	Cluster 1: Nearly Balanced (n=358)		Cluster 2: Firm-based (n=233)		Cluster 3: Advanced Organization- based (n=200)		Cluster 4: Basic Organization- based (n=365)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Designs its own products	<b>4.30</b>	.68	<b>4.25</b>	.67	<b>3.09</b>	1.25	<b>3.16</b>	1.05
Monitors the latest technological trends in the sector	<b>4.42</b>	.64	<b>4.23</b>	.74	<b>3.57</b>	.96	<b>3.25</b>	.84
Adapts the technology in use to its own needs	<b>4.28</b>	.62	<b>4.02</b>	.73	<b>3.64</b>	.89	<b>3.28</b>	.80
Prototypes its own products	<b>4.25</b>	.78	<b>4.12</b>	.87	<b>3.10</b>	1.42	<b>3.00</b>	1.40
Uses formal project management methods (Stage-Gate, PMBOK, innovational funnel, etc.)	<b>4.08</b>	.78	<b>3.80</b>	.84	<b>2.85</b>	1.07	<b>2.52</b>	.91
Launches its own products	<b>4.32</b>	1.07	<b>4.45</b>	.89	<b>3.03</b>	1.48	<b>3.24</b>	1.25

Note: The highest figures are highlighted.

SD = Standard Deviation.

$p < .001$  for all cases.

Regarding *technology development capability*, shown in Table 11, it is clear that nearly balanced and firm-based companies present the highest means, which are very similar in content (Scheffé test will show that they perform similarly). They have a high level of own product development and prototyping, build on technological trends monitoring and the ability to adapt technologies to their own needs. That shows the agile responsiveness these companies present to market changes whenever necessary, which is essential to maintain their high level of own product launching. The indication of formal project management methods corroborates to the high structured product development activities, ensuring that these companies achieve positive outcomes as planned.

Advanced and basic organization-based companies also present similar levels of technology development capability (further elucidated by Scheffé test as well). That means,

companies within both groups have lower levels of own product prototyping, as well as its development and launching in the market. Market does not play a crucial role in these companies' product development, since technological trends monitoring is low. In consonance, project management formalization is also low. Therefore, these companies do not develop based on technological trends, nor following formal project management procedures. Within these types of companies, machines and equipment are expected to be development guidelines, rather than market or research departments (Reichert, Camboim & Zawislak, 2015).

**Table 12 – Mean Analysis of Operations Capability Comparing Clusters**

Operations Capability	Cluster 1: Nearly Balanced (n=358)		Cluster 2: Firm-based (n=233)		Cluster 3: Advanced Organization- based (n=200)		Cluster 4: Basic Organization- based (n=365)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Carries out the productive process as programmed	<b>4.41</b>	.55	<b>3.79</b>	.72	<b>4.34</b>	.59	<b>3.61</b>	.70
Establishes a productive routine that does not generate rework	<b>4.38</b>	.56	<b>3.75</b>	.75	<b>4.29</b>	.60	<b>3.61</b>	.68
Delivers the products promptly	<b>4.35</b>	.68	<b>3.78</b>	.75	<b>4.29</b>	.75	<b>3.57</b>	.78
Manages to expand the installed capacity whenever necessary	<b>4.39</b>	.63	<b>3.86</b>	.77	<b>3.98</b>	.79	<b>3.26</b>	.88
Manages to ensure the process does not lead to products being returned	<b>4.48</b>	.53	<b>3.95</b>	.61	<b>4.37</b>	.56	<b>3.79</b>	.61

Note: The highest figures are highlighted.

SD = Standard Deviation.

p<.001 for all cases.

Just like in technology development capability, nearly balanced companies present the highest means in *operations capability*, as shown in Table 12. The formalization in project management seems to echo in operations, since these companies carry the productive process as programmed, with routines that do not generate rework, and delivering the products promptly. These companies also present high flexibility to expand the installed capacity if necessary and high index of product conformity.

Although presenting low means in technology development capability, advanced organization-based companies do present a high level of operations capability, which is, in fact, their most representative capability. That means they are very good in producing, rather than developing. By doing so, they can be perceived as highly efficient in ensuring that production will be conducted as programmed, delivering products promptly to their clients, assessing high levels of product conformity. These characteristics highlight that organization-based companies in which operations capability is more expressive than technology development capability prioritize operations efficacy over development expansion. Thus, operating plans impact in development, since operations will drive the process (Woodward, 1970).

Firm-based companies, however, present lower levels of operations capability. Considering that their focus is on development and that operation capability comes in second place within their structure, it is reasonable that they invest solely what is needed to ensure that operations capability supports what is developed. As stated by Zawislak et al. (2012), the potential technological solution must be translated into an operational arrangement and thus be efficiently managed, or coordinated, to guarantee the delivery of the expected outcome.

The cluster of basic organization-based companies involves those firms with the lowest overall capabilities means, in which operations is the most expressive. Although operations capability takes the lead, it still presents lower levels than the other three groups. That elucidates these companies' pattern: focus on operation, ensuring that production flows as programmed, with product conformity and without rework. These companies, however, are less flexible than others in terms of capacity expansion, which demonstrates that they can only produce what has been previously decided. That means the installed capacity may configure a restriction to enter in a new market or to expand its portfolio, maintaining these companies in the same position (Reichert, Camboim & Zawislak, 2015), without much endeavor to change.



**Table 13 – Mean Analysis of Management Capability Comparing Clusters**

Management Capability	Cluster 1: Nearly Balanced (n=358)		Cluster 2: Firm-based (n=233)		Cluster 3: Advanced Organization- based (n=200)		Cluster 4: Basic Organization- based (n=365)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Formally defines its strategic objectives annually	<b>4.20</b>	.70	<b>3.53</b>	.92	<b>4.01</b>	.85	<b>3.32</b>	.89
Updates its management tools and techniques	<b>4.24</b>	.68	<b>3.35</b>	.82	<b>3.99</b>	.70	<b>3.12</b>	.73
Maintains the personnel adequately trained for the company functions	<b>4.42</b>	.63	<b>3.67</b>	.84	<b>4.26</b>	.67	<b>3.61</b>	.78
Uses modern financial management practices	<b>4.32</b>	.67	<b>3.55</b>	.89	<b>3.95</b>	.75	<b>3.23</b>	.74

Note: The highest figures are highlighted.  
SD = Standard Deviation.  
 $p < .001$  for all cases.

Nearly balanced companies have the highest mean in organization not only because of operations capability, but also due to *management capability*, as shown in Table 13. Formalization is also present here, regarding the strategic definition of objectives. These companies are update not only to market trends or new technologies, but also to management tool and techniques, as well as to financial management practices. Being open to novelties regarding these management practices, they maintain the personnel trained and informed. Thus, the proposition that management capability can integrate and support a set of capabilities related to development, logistics, marketing, cost control, financial and human resources is seen in companies that are nearly balanced (Desarbo et al., 2005). In that sense, nearly balanced companies present a management capability that integrates all areas in order to achieve efficiency and stability, and thus to improve firm's performance through time (Pufal et al., 2014).

Advanced and basic organization-based companies are also organization-based, with management capability following operations capability. That means they present the ideal management structure to make operations feasible and ensure its coherent course. Remarkable is that management is not highly developed in basic organization-based companies; it is just sufficient to stablish the necessary set of tools, techniques, training and financial management to the company act.

Firm-based companies, in turn, have management capability as the less expressive one. Focusing on development, they put management aside, with lower levels than the other groups. As stated by Penrose (1959) through the idea of organization learning and capabilities development, the more established routines a company presents, the less management resources should be used. Thus, by having formalized procedures in technology development and operations capability, these companies present lower level of management capability. However, to expand their limits over time, these company should have an organization that supports them to do so, i.e., a different organization (Penrose, 1959).

**Table 14 – Mean Analysis of Transaction Capability Comparing Clusters**

Transaction Capability	Cluster 1: Nearly Balanced (n=358)		Cluster 2: Firm-based (n=233)		Cluster 3: Advanced Organization- based (n=200)		Cluster 4: Basic Organization- based (n=365)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Conducts formal research to monitor the market	<b>4.05</b>	.92	<b>3.49</b>	1.06	<b>2.78</b>	1.08	<b>2.47</b>	.98
Imposes its negotiating terms on its suppliers	<b>4.02</b>	.69	<b>3.92</b>	.71	<b>3.17</b>	.90	<b>3.31</b>	.82
Imposes its prices on the market	<b>3.79</b>	.87	<b>3.89</b>	.79	<b>2.74</b>	1.07	<b>2.94</b>	.88
Imposes its negotiating terms on its customers	<b>3.91</b>	.76	<b>3.86</b>	.78	<b>2.94</b>	.96	<b>2.93</b>	.83
Uses formal criteria to select its suppliers	<b>4.17</b>	.79	<b>3.96</b>	.82	<b>3.29</b>	1.01	<b>3.29</b>	.80

Note: The highest figures are highlighted.

SD = Standard Deviation.

p<.001 for all cases.

*Transaction capability* in nearly balanced companies presents the highest means, even though being the less expressive within these companies' structure (Table 14). Just like technology development capability shows monitoring of technological trends, transaction capability within these companies is also closely related to the market, through formal researches to monitor the latest trends. They have great negotiation power with both suppliers and customers. Formalization is also present regarding criteria for selection of suppliers. Presenting higher means in operations and management capability, Penrose's (1959) argument that transaction opportunities might be lessened by top management lack of investments may

be the case here. So, it is fundamental to ensure that these companies do not fall into the trap of adopting a citadel mentality (Teece, 1996), responding to market in an agile timing.

Firm-based companies, which have transaction capability closely following operations capability in third place, also present high levels of the former capability variables. Companies in this cluster have the highest potential to establish prices in the market, relating to their high level on technology development capability, and the pattern of being firm-based. Being able to define their prices enhances their potential to negotiate with customers and profit from that. They are also in constant contact with the market, which is related to their high development performance.

Advanced and basic organization-based companies present similar transaction capability (elucidated by Scheffé test soon). That is, they have lower levels of this capability. Considering that they are majorly focused on operations, without much technology development also, they present a transaction capability that allows them to simply deal with customers and deliver what has been previously defined. Thus, they have less power to negotiate and do not see advantage on conducting formal research to monitor trends. They are, so, producers with low transaction capability. It is remarkable that these companies elucidate the proposition made by Child (1972) that, in order to try to secure a favorable demand that will be expressed by a high return based on company's products or services offered, operational limits influence strategic transaction actions as to move into or out of given markets or areas of activity.

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Differences in mean may not necessarily be significant; therefore, ANOVA was conducted to determine if there is statistically significant difference among groups (Hair et al., 2009). ANOVA confirmed ( $p= 0.000$ ) that the four clusters are significantly different in terms of firm-organization capabilities. As ANOVA solely identifies the existence or not in mean differences, post hoc tests must be carried out to identify where these differences are (Hair et al., 2009). Among all existing post hoc tests, Scheffé method is considered to be "the most conservative" (Hair et al., 2010, p. 375) and, thus, was the one used in this study. Scheffé test confirms there are differences between capabilities and clusters overall, with some exceptions (see Appendix D).

Even though all capabilities are statistically different among all clusters, Scheffé analysis shows that there are some differences within clusters that are not significant. They are

(i) technology development capability presents no difference between clusters 1 (nearly balanced companies) and 2 (firm-based companies); (ii) technology development capability presents no difference between clusters 3 (advanced organization-based companies) and 4 (basic organization-based companies); (iii) transaction capability presents no difference between clusters 3 (advanced organization-based companies) and 4 (basic organization-based companies). Thus, it is possible to verify that firm (technology development + transaction capabilities) presents no difference between clusters 3 (advanced organization-based companies) and 4 (basic organization-based companies).

### 5.2.2 Performance of the Four Types of Firm-Organization Combination

Considering Zawislak's et al. (2012) assumption that every company has some level of four innovation capabilities affecting their performance, mean and multiple regression analyses were conducted to verify differences among clusters' performance indicators. First, mean analysis was performed to identify which cluster presents the highest mean (Table 15). ANOVA certifies ( $p=0.000$ ) that the four clusters are significantly different in terms of performance. Scheffé test confirms there are differences between performances and clusters in all cases (see Appendix D).

**Table 15 – Mean Analysis of Performance Comparing Clusters**

Cluster	Performance	
	Mean	Std. Deviation
<b>1: Nearly Balanced</b> (n=358)	<b>3.92</b>	.58
<b>2: Firm-based</b> (n=233)	<b>3.63</b>	.73
<b>3: Advanced Organization-based</b> (n=200)	<b>3.36</b>	.85
<b>4: Basic Organization-based</b> (n=365)	<b>3.13</b>	.74
<b>All clusters</b> (n=1156)	<b>3.52</b>	.78

Note: Figures are highlighted in a descendant order of values.  
 $p < .001$  for all cases.

It is clear that nearly balanced companies present the highest performance, as well as the highest means in firm and organization variables. That corroborates with the idea proposed by Williamson (1991) that the more specific the asset, the higher the costs it incurs and the higher the returns it offers. These companies, by presenting higher levels of firm and

organization, present also higher performance. As stated by Schumpeter (1942), innovations are solely perceived as such if they bring positive returns to the company in terms of extraordinary profits. Due to the highest mean in performance identified in these companies, it is remarkable that they have a firm organization that ensure positive outcomes and, thus, allows the company to take its next step forward. They highlight, thus, what Nelson (1991) perceives as a firm that present a coherent strategy, that defines and legitimatizes the way the firm is organized and governed, and enables the company to set its capabilities towards further expansion.

Firm-based companies come in second place regarding performance. As Blank (2013) suggests, such companies present high innovative potential, with high technology specificity and transaction complexity, but low organizational structure. The performance mean illustrates that, in combination with the previous identification that technology development is the prime capability within these companies. That means, they present firm complexity, especially in relation of product launching, and profit from that. However, it is important to consider that as the technology develops, different knowledge is needed demanding changes in the structure, authority, and complexity of tasks (Brinckmann & Hoegl, 2011; Tatikonda et al., 2013). Thus, it is expected that these companies look for an organization that sustains their firm strategy, reaching some stability in production and coordination, given that operations is the second more developed capability within this group, and enables them to achieve new innovative outcomes again.

Advanced organization-based companies take the third place, with higher mean in organization than basic organization-based companies. Remarkable is that in both clusters, firm sphere can be interpreted similarly. Thus, what differs them is mainly their organization sphere. Advanced organization-based companies present also higher performance than basic organization-based companies. That is, companies that have more advanced and developed organization are able to achieve higher outcomes than those acting with low-level organizational capabilities. As stated by Penrose (1959), owners of organization-based companies can show themselves content with a comfortable profit and unwilling to make more money. Therefore, companies that have more advanced organizational skills can be seen as more intended to organizational changes in favor of efficacy, i.e., to keep on doing the same, but achieving better results.

Complementary to the mean analysis of performances, regression analysis was conducted in order to verify how each capability predicts performance in each cluster (Green & Salkind, 2014). By doing so, it was possible to identify how each cluster can be developed

towards the idea of innovative organized firm. Appendix E presents all detailed tables regarding multiple regression analysis.

In **nearly balanced companies**, the linear combination of capabilities measures was significantly related to performance,  $F(4, 353) = 4.35$ ,  $p < .01$ . The multiple correlation coefficient was .28, indicating that approximately 5% of the variance of performance index in this cluster can be accounted for by the combination of capabilities. On the basis of the relative strength of each predictor (capability) generated in the multiple regression analysis, it is tempting to conclude that the only meaningful predictor is the strength measure for **Management Capability**, which is the only statistical significant variable at the .01 level, presenting a Beta of .241. Even though, the following equation<sup>3</sup> represents the configuration of performance within nearly balanced companies:

$$Performance = 1.820 + 0.110*tech + 0.128*op + 0.241*man + 0.009*tran$$

(Equation – Nearly balanced companies)

Based on the equation, it is possible to verify that the organizational capabilities present higher Betas. That is, variations in their indicators would impact performance more than variations in firm capabilities. Given that they focus more on operations and management capabilities, it is remarkable that they concentrate efforts in exactly those capabilities that ensure more positive returns. These capabilities, in turn, are developed in a way to ensure stability to the company (Tatikonda et al., 2013). Considering that their firm capabilities present lower Betas, suggesting a lower impact on performance, these companies are seen to have achieved stable procedures and are expected to move forward a disequilibrium in the next step, caused by some technological or marketing innovation (Penrose, 1959; Zawislak et al., 2012), enhancing thus their firm capabilities' influence on performance.

In **firm-based companies**, the linear combination of capabilities measures was significantly related to performance,  $F(4, 228) = 10.11$ ,  $p < .01$ . The multiple correlation coefficient was .39, indicating that approximately 15% of the variance of performance index in this cluster can be accounted for by the combination of capabilities. Based on the relative strength of each capability, it is possible to verify that the only meaningful predictor is the

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<sup>3</sup> In order to shorten the terminology of capabilities in the equation, Technology Development Capability is reported as *tech*; Operations Capability as *op*; Management Capability as *man* and Transaction Capability as *tran*.

strength measure for **Technology Development Capability**, which is the only statistical significant variable at the .01 level, presenting a Beta of .445.

$$Performance = 0.702 + 0.445*tech + 0.115*op + 0.109*man + 0.068*tran$$

(Equation – Firm-based companies)

Companies in this cluster are considered to be firm-based because they present the technology development capability as the most representative one. The regression model highlights, in consonance, that these companies focus on that capability that ensures more returns as well. That is, they are able to develop and launch products that generate positive outcomes back. Just like in the order of capabilities' means, operations capability comes in second place in terms of impact in performance. That illustrates the movement that happens once the firm decides rather to make than buy: the organization works on operationalizing how to make to later sell (Zawislak et al., 2012).

In **advanced organization-based companies**, the linear combination of capabilities measures was significantly related to performance,  $F(4, 195) = 8.80$ ,  $p < .01$ . The multiple correlation coefficient was .39, indicating that approximately 15% of the variance of performance index in this cluster can be accounted for by the combination of capabilities. It is remarkable that the only meaningful predictor is the strength measure for **Management Capability**, which is the only statistical significant variable at the .01 level, presenting a Beta of .629.

$$Performance = 0.510 + 0.042*tech + 0.006*op + 0.629*man + 0.047*tran$$

(Equation – Advanced organization-based companies)

The performance of these companies is mostly influenced by management capability, which, together with operations capability, ensures a higher mean in organization rather firm within their structures. Even though focusing more on operations capability, they focus in management at second place – and profit from that. These companies present formalization in objectives definition and maintain personnel adequately trained, which is essential to ensure responsiveness to conjunctural changes. Thus, changes in management capability indicators reverberate more in performance than any other capability. Following management capability,

firm's capabilities would impact more in performance, rather than operations capability. That means, they have already achieved an efficient operational configuration, ensuring the productive processes to be carried out just as programmed and without rework. Management capability acts then to ensure the adequate coordination for that to happen. Since this type of company, organization-based, focuses more on producing than developing, these companies should attempt to the fact that to invest in firm capabilities would guarantee enhancements in performance also.

Regarding **basic organization-based companies**, the linear combination of capabilities measures was also significantly related to performance,  $F(4, 359) = 14.82$ ,  $p < .01$ . The multiple correlation coefficient was .38, indicating that approximately 14% of the variance of performance index in this cluster can be explained by the combination of capabilities. The relative strength of each capability analysis suggests that the strength measures for **Technology Development and Transaction Capabilities** are the only two meaningful predictors, with statistical significance at the .01 level, presenting Betas of .193 and .410, respectively.

$$Performance = 1.186 + 0.193*tech - 0.080*op + 0.125*man + 0.410*tran$$

(Equation – Basic organization-based companies)

Companies in this cluster are not only those that represent the lowest firm and organization means, but also the lowest performance mean within the sample. Although operations capability is the most developed capability within these companies, it still presents lower levels than the other three groups. It presents basic characteristics regarding following pre-established procedures, ensuring product conformity and avoiding rework. By being less flexible than others in terms of capacity expansion, they can only produce what has been previously decided. Thus, by being merely producers with low technology development and transaction capabilities, these companies present the lowest performance. Remarkable is, however, that exactly those two capabilities influence performance at most, which means, these companies are organization-based, when what actually brings positive economic performance are the firm capabilities – and not operations capability, their main focus.

As previously discussed, whenever logistics and marketing are not aligned, companies face growth constraints (Zawislak et al., 2012). Therefore, these companies should expand technology development and transaction capabilities in order not to fade over time.



### 5.2.3 General Characteristics of the Four Types of Firm-Organization Combination

It is important to verify general characteristics to further understand the differences among all four clusters formed. Therefore, descriptive analysis was used to access differences in terms of general characteristics of the companies identified in the literature as relating to the organization of the firm: size (Penrose, 1959), industry technological intensity (Williamson, 1991), R&D (Nelson, 1991), patent registration (Teece, 1996), and management model (Penrose, 1959). Chi-square test evaluated that the frequency distributions of these categorical variables differ from one another (Hair et al., 2009).

Regarding *company size*, all clusters present mostly small companies (Table 16). That is an expected result and is strictly related to the predominance of small companies within the analyzed sample, which reflects the predominance of small companies in the universe of companies from the state of Rio Grande do Sul and from Brazil (Reichert, Camboim & Zawislak, 2015). The difference in company size among clusters, however, is significant ( $p < .001$ ).

**Table 16 – Percentage of Companies regarding Size by Clusters**

<b>Company Size</b>	<b>Cluster 1: Nearly Balanced</b>	<b>Cluster 2: Firm-based</b>	<b>Cluster 3: Advanced Organization- based</b>	<b>Cluster 4: Basic Organization- based</b>
Small	82.8%	82.5%	94.4%	94.8%
Medium	15.4%	16.6%	5.6%	5.3%
Large	1.7%	0.9%	0.0%	0.0%
	100.0%	100.0%	100.0%	100.0%

Chi-square (12df) = 46.706

Likelihood Ratio (12df) = 53.054\*

Note: \* $p < .001$ .

It is remarkable that solely nearly balanced and firm-based companies contain large companies. That illustrates Penrose's (1959) argument that as companies grow, there is no reason to assume that they will become inefficient; they just present a different organization of the firm. Based on that, it is possible to verify that companies that present higher levels of firm-organization capabilities are more prone to be large companies. In addition, the companies in both clusters are the ones that present higher performance indicators, corroborating to the statement that the higher the firm complexity, the higher the costs it incurs, and, thus, the higher returns it offers (Williamson, 1991).

On the other hand, companies that are advanced or basic organization-based are mostly small firms. Given their focus on organization with low firm complexity, their size is limited by their knowledge, verified under their low specificity in terms of technology and the reactivity by which transaction capability is carried out (Penrose, 1959).

In terms of *industry technological intensity*, most companies act in low-tech industries, as expected due to the sample configuration as well (Table 17). Differences are statistically significant with  $p < .05$ .

**Table 17 – Percentage of Companies regarding Industry Technological Intensity by Clusters**

<b>Industry Technological Intensity</b>	<b>Cluster 1: Nearly Balanced</b>	<b>Cluster 2: Firm-based</b>	<b>Cluster 3: Advanced Organization- based</b>	<b>Cluster 4: Basic Organization- based</b>
Low-tech	46.1%	49.4%	42.0%	49.9%
Medium Low-Tech	24.9%	24.0%	34.0%	27.1%
Medium High-Tech	26.8%	21.9%	19.0%	21.6%
High-Tech	1.7%	2.1%	2.5%	0.8%
<i>Missing</i>	0.6%	2.5%	2.5%	0.5%
	100.0%	100.0%	100.0%	100.0%

Chi-square (15df) = 24.832

Likelihood Ratio (15df) = 25.357\*

Note: \* $p < .05$ .

Reichert (2015, p. 28) states that “low-tech firms may innovate in relation to their operational process and equipment, in relation to business models or commercial models and, similarly to what happens in high-tech industries, through new product development”. Thus, innovation in low-tech companies may be design-oriented or business-oriented (Reichert, 2015). On the other hand, the nature of innovation in high-tech companies is strongly dependent on R&D activities, i.e., technology-oriented.

The presence of more nearly balanced and firm-based companies in medium high-tech and high-tech industries reinforces that higher means in technology development capability, and consequent higher technology specificity, set the ground and are required for a company to act in such industries. Surprisingly is the incidence of advanced organization-based companies in high-tech industries as well. Given that companies in this group present lower technology development capability, one may suggest that they act in high-tech industries due to the already effective procedures they have developed. Such efficacy is mandatory in high-tech industries, in which requirements are higher and so must be the internal coordination.

As previously discussed, high levels of firm-organization capabilities arrangement were expected in companies acting in the frontier of knowledge, which deal with state-of-the-art products, technologies and methods – such as the creative industry, IT, electronics and health. Within these companies, rarity and specificity are expected, and so are higher costs and, consequently, higher prices. Remarkable is, however, that even though having a significant number of companies acting in medium high-tech and high-tech industries, nearly balanced and firm-based companies still present most companies acting in low-tech industries (just like clusters advanced and basic organization-based companies), as an intrinsic characteristic of the analyzed sample.

Regarding *investments in R&D*, most companies present an investment of more than 0% to 5% from the revenues, as shown in Table 18. However, remarkable is that more than 5% of nearly balanced and firm-based companies invest more than 10%, which reflects their high means in technology development capability.

**Table 18 – Percentage of Companies regarding Investment in R&D by Clusters**

<b>Investment in R&amp;D</b>	<b>Cluster 1: Nearly Balanced</b>	<b>Cluster 2: Firm-based</b>	<b>Cluster 3: Advanced Organization- based</b>	<b>Cluster 4: Basic Organization- based</b>
0%	24.3%	22.8%	31.3%	32.1%
More than 0% to 5%	43%	48.9%	58.2%	57.9%
More than 5% to 10%	27%	22.8%	10%	7.9%
More than 10%	5.7%	5.5%	0.5%	2.1%
	100.0%	100.0%	100.0%	100.0%

Chi-square (81df) = 176.167

Likelihood Ratio (81df) = 185.789\*

Note: \*p < .001.

Teece (1996) states that linkages of subunits such as R&D, manufacturing, management and commercial must be maintained to ensure that firm and organization are positively combined. In that sense, more expenditures by companies that are nearly balanced or firm-based in R&D are related to their presence in medium high-tech and high-tech industries, as well as to their higher means in technology development capability. Thus, considering their expressive performances, it is possible to verify that they present capabilities that support and complement the new product and process technologies emanating from R&D (Nelson, 1991).

In terms of *registered patents*, companies in most clusters indicate no registrations (Table 19), just like the tendency of Brazilian companies (Reichert, 2015).

**Table 19 – Percentage of Companies regarding Registered Patents by Clusters**

<b>Registered Patents</b>	<b>Cluster 1: Nearly Balanced</b>	<b>Cluster 2: Firm-based</b>	<b>Cluster 3: Advanced Organization- based</b>	<b>Cluster 4: Basic Organization- based</b>
No	54.2%	52,8%	64,5%	65,8%
Yes	41.8%	43.3%	33%	32.9%
Missing	4%	3.9%	2.5%	1.3%
	100.0%	100.0%	100.0%	100.0%

Chi-square (81df) = 109.628

Likelihood Ratio (81df) = 112.688\*

Note: \*p < .05

Although having less companies with no patents than with some registered, nearly balanced and firm-based companies present more companies with a greater number of registered patents. That is related to the previously mentioned investments in R&D, which, eventually, turn to generate new patents (Reichert, 2015).

Finally, regarding *management model*, nearly balanced companies are the only one to present more professionalized family organization, rather than centralization on the owner (Table 20).

**Table 20 – Percentage of Companies regarding Management Model by Clusters**

<b>Management Model</b>	<b>Cluster 1: Nearly Balanced</b>	<b>Cluster 2: Firm-based</b>	<b>Cluster 3: Advanced Organization- based</b>	<b>Cluster 4: Basic Organization- based</b>
Centralized in the owner(s)	23.7%	37.3%	36.5%	47.4%
Family executive positions	30.4%	29.2%	24.0%	30.3%
Professionalized family organization	31.6%	18.9%	23.5%	14.9%
Professional organization	11.7%	13.7%	15.5%	7.4%
Corporate Governance	2.5%	0.9%	0.5%	0.0%
	100.0%	100.0%	100.0%	100.0%

Chi-square (12df) = 75.208\*

Note: \*p < 0.001

Lopez (1999) states that a family company is characterized by the desire of its founders and successors that the property and the management remain in the family's hands. The company undergoes the professionalization process when employed and salaried managers are integrated to the governance structure (Lodi, 1993). The professionalization of a company is the process in which a family organization assumes more rational, modern and less customized administrative practices; it is the replacement of intuitive methods by rational methods (Lodi,

1993). In that sense, more professionalization in companies that are nearly balanced reflects the more formalized procedures, planned objectives and structured routines verified in the innovation capabilities structuring of these companies, as well the highest mean in their management capability.

On the other hand, Penrose (1959) states that enterprising is closely related to ambition, but even if a firm is not very ambitious it may nevertheless be competently managed. In that sense, typical companies in which management speaks louder are family-owned companies (Penrose, 1959), in which the owner is the main decision maker of company' strategy, especially regarding what to produce and how (Pufal et al., 2014). That is the case of advanced and basic organization-based companies, which present prevalence of family-owned companies. Through this perspective, there is a need for these companies to avoid restricting development because of that characteristics. As stated by Teece (1996), within such companies, it is fundamental to promote changes arousing the autonomy to try and fail; the right of employees to challenge the status quo; and open communication to customers, to external sources of technology, and within the firm itself.

In firm-based companies, in turn, management capability is the least developed, with low impact in performance. Thus, as their performance is considered expressive, with high means in technology development capability ensuring that, these companies are expected to professionalize their structure over time, by formalization of managerial processes and more structured routines (Lodi, 1993). By doing so, they can develop an organization that sustains their firm strategy and sets the ground for the core capabilities a firm must have to take its next step forward (Nelson, 1991).

## 6 Conclusion

The pattern of company, considering the firm-organization combination, represents the extent to which a company seeks to employ the most advantageous arrangement of its capabilities. As every company produces and sales solutions in the market, organizational costs are thus inherent. Therefore, neither firm nor organization can be null within a company structure. However, different levels of company's capabilities arrangement are possible – and expected. Different patterns of company may exist in the same period of time, evincing the myriad of strategies in the business environment in which companies are inserted (Tigre, 1998).

It has been argued that organization is a function of the firm, and, therefore, operations and management capabilities hinge on what will be developed and later sold, based on technology development and transaction capabilities. That is, the more complex the firm is, the more costs the organization incurs. In that sense, a balance between firm and organization is envisioned. In the real world, however, this balance is not widely found. Considering that, results show four different patterns of company: *nearly balanced companies*, *firm-based companies*, *advanced organization-based companies* and *basic organization-based companies*.

Companies characterized as *nearly balanced companies* are those with higher performance indicators. Although being organization-based, they present higher levels of firm as well. They present, thus, organization costs that are justifiable given their firm characteristics, but could be reduced aiming at a more balanced company. By doing so, they would reach more internal stability that would enable them to keep on innovating – and thus unbalancing in the following steps. These companies present higher levels on management and operations capabilities, but they still present the highest levels in technology development and transaction capabilities within the sample as well. As verified, formalization permeates all processes, from development to transaction, ensuring that each activity occurs as planned. Monitoring of technological and market trends allows these companies to keep up to date to the everchanging demands, profiting from that. Besides that, personnel are constantly trained and machines and equipment face also systematic improvement. Acting majorly in low-tech industries but presenting the major incidence of companies in high-tech industries also, these companies present some patents registered, reflecting their investments in R&D, which are high in comparison to the other groups. As organization hinges on what is developed and then transacted, these companies incur in high organizational costs, shown by their means. That is,

their organization is larger than firm – the turning point to achieve the right firm-organization balance. Thus, these companies should seek to diminish organizational costs regarding either management or operation capabilities or either enhance firm specificity. By doing so, it would be expected that technology development or transaction capabilities would be more significant in terms of performance over time, rather than management capability as it currently is.

Coming in second place in terms of performance, *firm-based companies* focus more on technology development capability than in any other capability. Different from nearly balanced companies, companies in this pattern have their performance mainly affected by technology development capability, which corroborates to the firm-based definition and highlights that they invest in exactly that capability that brings more positive outcomes. In that sense, they invest in other capabilities solely to the extent that is needed to support their development activities. By doing so, they are able to reduce organizational costs, whereas maintaining firm complexity adequate to ensure positive economic outcomes. It is remarkable their considerable investments in R&D and the consequent number of registered patents. Therefore, even though being more present in low-tech industries, this pattern also presents great incidence of companies acting in high-tech industries, ensuring technology specificity to products and, consequently, aggregating more value to them. Related to that is their highest potential to establish prices in the market. Considering that their focus is on development, they invest solely what is needed to ensure that operations capability supports what is developed. However, companies in this pattern have management capability as the less expressive one. Focusing on development, they put management aside. They present some sort of formalization and established procedures, but they still lack structuring in management, which is expected to change over time, so that it does not turn to be a bottleneck for growth.

Higher organizational levels are also seen in the so-called *advanced organization-based companies*. Companies in this pattern present higher means on operations and management capability and are, therefore, organization-based. They present low level of technology development capability and even lower of transaction capability. Such companies present developed managerial activities, which positively affect their performances. Thus, the idea that highly organization-based companies should not exist – given that organization, in fact, is dependent upon firm – can be revised through the lenses of this group's characteristics. It is not a problem to be organization-based, since the company can profit from it. Organization, through operations and management capabilities, must highly coordinate and align in-between process from production to sales, to enable firm to achieve efficacy levels even though the high costs and the low complexity. Presenting the highest mean in operations capability, these companies

are very good in producing, rather than developing. By doing so, they can be perceived as highly effective in ensuring that production is conducted as programmed, delivering products promptly to their customers and assessing high levels of product conformity. In consonance, the higher level of management capability elucidated that there is an adequate established structure that allows the company to act effectively. On the other hand, they lack technology development and transaction capabilities. Behaving similar to basic organization-based companies in terms of firm, advanced organization-based companies have low technology specificity and transaction complexity, since their strategy is also reactive. What differs them from that other group is their management capability, that ensures not a basic organization structure, but a well-structured company to attend several customers, with flexibility.

*Basic organization-based companies*, though, are those that represent the typical structure of reactive production service supplier companies. They not only have the lowest firm and organization means, but also the lowest performance mean within the sample. Being dependent on pre-established specifications, they were expected to present, aiming at a balanced structure, the lowest organizational cost function possible. Moreover, since they act in low specific traditional markets, they were expected to present a established organization that would allow them to profit from being less specific. That is not the fact, however. Organization hinders firm, instead of being a consequence of it and allowing its best working. Remarkable is, however, that are exactly the firm capabilities those that influence performance at most, which means, these companies are organization-based, when what actually brings positive economic performance are the firm capabilities – and not operations capability, their main focus. Although presenting management capability as the second most developed capability, these companies present solely the ideal management structure to make basic operations feasible and ensure its coherent course. It is just sufficient to establish the necessary set of tools, techniques, training and financial management to the company act. They have lower levels of product prototyping, development and launching in the market. Both technological and market trends monitoring are low, as well as project management formalization. In that sense, they present a transaction capability that allows them to simply deal with customers and deliver what has been previously defined. They have, thus, little power to negotiate and do not need to conduct formal research to monitor trends. The focus of companies in this pattern is large production scale, given the stable operational processes already achieved. These companies, however, are less flexible than others in terms of capacity expansion, which demonstrates that they can only produce what has been previously decided. Therefore, these companies solely produce



according to established product specifications. Within this pattern, machines and equipment are more important than research and development.

Results show, thus, that performance is higher when, having firm highly developed, a company tends towards nearly balanced companies or firm-based companies. On the other hand, when organization is highly developed, companies with high performance tend towards nearly balanced companies or advanced organization-based companies.

### 6.1 Further Remarks

By detailing the different patterns of company, it is possible to understand what lies behind innovation and disorganization within the analyzed companies. The four identified patterns suggest that companies may act towards efficacy, stability or fulfilling their innovative potential over time.

Focusing more on operations and management capabilities, *basic and advanced organization-based companies* prime for *efficacy* rather than development. By doing so, such companies become capable of producing and achieving the desired result constantly. However, organizing firms in such pattern may put company away from market dynamics, if it does not act in service of promoting changes towards better organizational procedures. To be organization-based means having a firm acting in a constant way and an organization that works to ensure efficacy to what has been developed. In that sense, organizational innovations should be the first milestone to be reached by these companies, since firm has already changed – or presents no planning for changes in the short term. Consequently, their organization would bring more positive outcomes and allow a subsequent firm expansion, with more innovation.

On the other hand, *nearly balanced companies* also focus more on operations and management capabilities, but present higher performance. These capabilities are developed in a way to ensure *stability* to the company. Having organization capabilities affecting more performance than the firm capabilities, these companies are seen to have achieved stable procedures and are expected to move forward a disequilibrium in the next step, caused by some technological or marketing innovation related to the firm sphere.

*Firm-based companies* are seen to act exploring its *innovative potential*, considering they present high technology specificity and transaction complexity, but low organizational structure. However, as the technology develops, different knowledge is needed demanding

changes in the structure, authority, and complexity of tasks. Thus, it is expected that these companies look for an organization that sustains their firm strategy – reaching some stability in production and coordination over time, given that operations is the second more developed capability within this group – and enables them to achieve new innovative outcomes again.

Therefore, as the present study portrays a static view of the analyzed companies, it is possible to suggest, based on its results, the dynamic in firm organization that lies behind organized innovative firms. Companies that are *firm-based* as a result of technological or marketing innovation may develop an organizational structure over time, aiming at stability in processes and coordination, as a way to ensure long-lasting positive outcomes, until the next innovation takes place.

Once the company achieves a *balanced structure*, as proposed by the literature under the notion of a well-tuned company, it achieves stability. The right balance, thus, illustrates the ideal type of organized firm acting in a stable way. In this type of company, no matter which level of firm and organization it has, its performance fulfills the strategic expectations. However, that does not mean it should remain still. Given the decreasing returns of organization and technology, the company that does not innovate will succumb. That means, these companies should always keep on changing their firm and, thus, keep on changing their organization. In other words, these companies should always keep on innovating, and, thus, promoting new disequilibrium in their firm organization.

If that does not happen, companies will face an *organization-focused* arrangement of their capabilities. By doing so, these companies may remain performing just the same as in previous times, seeking for standardization instead of innovation. If it is aligned with company's strategy, this pattern of company may be required. However, it can work for a while, but companies that do not change over time are destined to fade.

Thus, disorganization appears whenever firm and organization are unbalanced. However, that may be momentary, as a natural consequence of innovation, or permanent, as a consequence of internal inefficiency. As a conclusion, it is possible to suggest that there is no single best firm-organization combination, but there are different combinations for different positionings and, thus, different performances. In that sense, the disorganized firm is the firm that does not have the adequate organization that guarantees its best outcomes at a given moment.

### 6.1.1 Remarks for Brazilian S,T&I Policies

It is remarkable that every region around the world presents its idiosyncrasies, which influence in the natural governance cost of companies that choose to act there – as consequence of firm complexity possibilities. That is not different in Brazil.

The so-called ‘Brazil Cost’ is a generic term, which is used to describe the set of structural, bureaucratic and economic difficulties that make investments in Brazil more expensive, hindering national development, increasing unemployment, informal work, evasion of taxes and evasion of foreign exchange. Therefore, it is pointed out as a set of factors that compromise the competitiveness and the efficiency of the national industry, making Brazilian goods and services more expensive compared to other countries.

This scenario is even more emphasized given the lack of technological specificity which permeates Brazilian industry. As could be seen in the present study, most of the companies act in low-technology industries and are organization-based. Thus, on one hand, organizational costs are high, and on the other hand, technological specificity is low.

That emphasizes that organizational costs in Brazil surpass the specificity of technology a firm presents. That means, it is costly to offer even low-tech products – and that may be the reason why Brazil is not very competitive, incurring in the ‘Brazil Cost’. That brings to light some issues on the Science, Technology and Innovation (S,T&I) policies in Brazil.

Considering organization as a function of the firm, it is fruitless to first establish requirements related to organization, through regulatory agencies, rather than initiatives that promote technological advance. That will only enhance governance costs, without enhancing firm complexity. S,T&I policies should, in turn, focus first on technological development and, consequently, on transaction capability, so that companies could act in the frontier of knowledge.

That means, to increase Brazil’s competitiveness, S,T&I policies should be planned in a way to favor new product development, formalization in the product development process, constant update of the technology used and launching of own products by companies. On the transactional side, enhancing the power of negotiation of these companies is crucial, as well as their update to market trends and ability to define their prices based on that.

Those actions should be then accompanied by the development of organizational capabilities, aiming at ensuring the adequate support structure to the firm. That is achieved

through the formalization of productive and managerial processes, constant update of machines and equipment and constant training of personnel.

By doing so, high levels of firm-organization capabilities arrangement would be encountered in such companies. Thus, rarity and specificity would be expected, and so would higher costs and, consequently, higher prices. Higher performance would then reflect the higher level of firm-organization capabilities.

## **6.2 Study Implications and Future Research**

This study may help managers understand that being an organization-based company is risky if firm does not present an adequate and aligned level of development. The study elucidates directions to be followed by companies that aim at advancing their firm complexity towards a more balanced company, and future directions to those companies that already present satisfactory outcomes, according to each positioning.

As a counterpoint, the study also sheds light on the importance of alignment between regulatory agencies and the direction of a nation's competitiveness. By doing so, the study can help make policy makers aware that S,T&I policies should focus on innovations primarily focused on the firm sphere, to, later, organization be structured – and not vice versa.

To deeper explore the different patterns of company identified in this study, future studies could be conducted through case studies, exploring each pattern with more details. Besides that, the reapplication of this study in countries with different conjunctural configurations could provide interesting insights on the differences of patterns according to the location companies are inserted in.

## **6.3 Study Limitations**

The identification of institutional constraints configures a limitation of this study, since it was not included in the questionnaire used – although that was an adequate research instrument to define different patterns of company, considering firm-organization combinations. Another limitation concerns the fact that the questionnaire, given the way

research is conducted in Social Sciences, is based on respondent's opinion, and, therefore, answers are narrowed to that point of view. That may cause biased scores, considering that value perception may vary from one respondent to another. However, this limitation has not affected the results in the study, since significant differences were verified among scores. Finally, the method used in the cluster analysis may configure another limitation to the study, given that different clustering methods can generate different grouping results, and thus different patterns of company could be verified.

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## Appendix A - Questionnaire

Questionnaire of the project entitled “Paths of Innovation in the Brazilian Industry” coordinated by the NITEC Innovation Research Center.

### Os Caminhos da Inovação na Indústria Gaúcha



A. De 0 a 5 quão inovadora é sua empresa?

B. Das palavras abaixo, quais são, em sua opinião, as três que melhor definem “inovação”?

- |  |  |
|--|--|
| 1. <input type="checkbox"/> Desenvolvimento do processo          | 7. <input type="checkbox"/> Sistema de informação    |
| 2. <input type="checkbox"/> Aquisição de máquinas e equipamentos | 8. <input type="checkbox"/> Consultor externo        |
| 3. <input type="checkbox"/> Desenvolvimento de produto           | 9. <input type="checkbox"/> Novas técnicas de gestão |
| 4. <input type="checkbox"/> Mudança de layout                    | 10. <input type="checkbox"/> Design e Embalagem      |
| 5. <input type="checkbox"/> Contratação de mão de obra           | 11. <input type="checkbox"/> Pontos de venda         |
| 6. <input type="checkbox"/> Novos fornecedores                   | 12. <input type="checkbox"/> Novos clientes          |

C. Agora, levando em conta a SUA empresa, quais são as três opções que, de fato, caracterizam a inovação para ela?

- |  |  |
|--|--|
| 1. <input type="checkbox"/> Desenvolvimento do processo          | 7. <input type="checkbox"/> Sistema de informação    |
| 2. <input type="checkbox"/> Aquisição de máquinas e equipamentos | 8. <input type="checkbox"/> Consultor externo        |
| 3. <input type="checkbox"/> Desenvolvimento de produto           | 9. <input type="checkbox"/> Novas técnicas de gestão |
| 4. <input type="checkbox"/> Mudança de layout                    | 10. <input type="checkbox"/> Design e Embalagem      |
| 5. <input type="checkbox"/> Contratação de mão de obra           | 11. <input type="checkbox"/> Pontos de venda         |
| 6. <input type="checkbox"/> Novos fornecedores                   | 12. <input type="checkbox"/> Novos clientes          |

Você pode perceber que falar de inovação é falar em novidade. Mais do que isso, é falar em novidade no âmbito das empresas. Entretanto, para ser inovação de verdade, a novidade precisa gerar retorno positivo. O presente questionário tem por objetivo detalhar os procedimentos e técnicas, rotinas e resultados de sua empresa de modo a perceber o quão inovadora é a sua empresa.

Para responder a esta pesquisa, considere a **principal unidade de negócios da empresa no Rio Grande do Sul**.

A seguinte pesquisa está dividida em 3 blocos: (1) caracterização da empresa e descrição das áreas; (2) desempenho da empresa; e (3) informações gerais.

Ressaltamos que será mantido o total anonimato da empresa e do respondente.

1. Todas as empresas podem ser divididas em quatro áreas: (1) Desenvolvimento, (2) Produção, (3) Gestão, (4) Comercial. Enumere as áreas abaixo em ordem de ocorrência da maior parte das novidades da sua empresa, sendo que 1 é onde mais acontecem e 4 onde menos acontecem mudanças.

- |                      |  |
|----------------------|--|
| <input type="text"/> | DESENVOLVIMENTO (Projetos, desenvolvimento de produtos, processos e tecnologias)           |
| <input type="text"/> | PRODUÇÃO (Planejamento e controle da produção, qualidade, manutenção, almoxarifado)        |
| <input type="text"/> | GESTÃO (Estratégia, integração e coordenação de áreas diretas e de suporte)                |
| <input type="text"/> | COMERCIAL (Marketing, compras e vendas, distribuição e logística, atendimento e pós-venda) |

## BLOCO 1

Indique o grau de concordância com as afirmativas abaixo, onde 1 significa Discordo totalmente e 5 Concordo totalmente.

GESTÃO - A sua Empresa...	Discorda Totalmente  Concorde Totalmente				
	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
20. Define formalmente seus objetivos estratégicos anualmente.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
27. Inclui a responsabilidade socioambiental na pauta estratégica.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
21. Integra todos seus setores com o uso de informática.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
22. Padroniza e documenta os diferentes procedimentos de trabalho.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
23. Atualiza suas técnicas e ferramentas de gestão..	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
24. Mantém a capacitação de pessoal adequada para as diferentes funções da empresa (treinamento...)	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
25. Utiliza práticas modernas de gestão financeira	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

Influência	Baixa Influência <span style="float: right;">Alta Influência</span>				
	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
Em que medida a atividade de gestão influencia nos lucros da sua empresa	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

28. A tomada de decisão está condicionada:

1.  À tradição
2.  Ao histórico de desempenho recente
3.  Às informações passadas pelos clientes
4.  Às informações observadas dos concorrentes
5.  Ao novo conhecimento desenvolvido internamente
6.  Às informações obtidas dos fornecedores

29. As mais recentes melhorias relacionadas à gestão ocorreram

1.  Nos sistemas, técnicas e ferramentas utilizadas
2.  Na estratégia corporativa
3.  No organograma (hierarquia e departamentos)
4.  Na estrutura de cargos e salários
5.  Na diretoria e gerência
6.  Na infraestrutura administrativa (base física e equipamentos)

30. O principal foco da gestão é:

1.  Redução de custos
2.  Ganho de eficiência
3.  Melhoria contínua
4.  Cumprimento de objetivos e metas
5.  Integração entre as áreas
6.  Investimento em mudança

31. Quanto ao modelo de Gestão, pode-se dizer que é:

1.  Personalizada, centralizada na figura do(s) proprietário(s) (Familiar)
2.  Organização com cargos executivos familiares
3.  Organização familiar profissionalizada
4.  Organização Profissional
5.  Governança Cooperativa

Indique o grau de concordância com as afirmativas abaixo, onde 1 significa Discordo totalmente e 5 Concordo totalmente.

COMERCIAL - A sua Empresa	<b>Discorda Totalmente</b>	←————→			<b>Concorda Totalmente</b>
36. Realiza pesquisas para medir a satisfação de seus clientes	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
32. Realiza pesquisas formais para monitorar o mercado	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
33. Impõe as condições de negociação com seus fornecedores	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
34. Impõe seus preços no mercado	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
35. Impõe as condições de negociação com seus clientes	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
37. A empresa utiliza critérios formais para a seleção de seus fornecedores.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

Influência	Baixa Influência				Alta Influência
Em que medida a atividade de comercial influência nos lucros da sua empresa	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

39. Qual o canal de distribuição mais utilizado

1.  Vendas diretas para outras empresas industriais
2.  Vendas por representantes
3.  Vendas para distribuidor
4.  Vendas para varejista
5.  Vendas diretas ao consumidor final

40. Como o preço é definido

1.  Preço da Concorrência
2.  Custos
3.  Preço determinado pelo Cliente
4.  Marca
5.  Mark up

41. Onde acontecem as principais mudanças relacionadas à área comercial

1.  Atendimento
2.  Negociação
3.  Canais de venda
4.  Distribuição de produtos
5.  Formação de preços
6.  Processo de compras
7.  Processo de vendas
8.  Pós-vendas

Indique o grau de concordância com as afirmativas abaixo, onde 1 significa Discordo totalmente e 5 Concordo totalmente.

PRODUÇÃO - A sua Empresa...	<b>Discorda Totalmente</b> ←————→ <b>Concorda Totalmente</b>				
	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
11. Formaliza os procedimentos de PCP	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
12 Mantém controle estatístico do processo	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
12.1 Utiliza equipamentos atualizados na fronteira da tecnologia no setor	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
12.2 Mantém o nível de estoques de materiais adequado ao processo	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
13. Realiza o processo produtivo conforme o programado	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
14. Estabelece uma rotina produtiva que não gera retrabalho	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
15. Entrega os produtos pontualmente	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
16. Consegue expandir a capacidade instalada sempre que necessário	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
16.1 Consegue garantir o processo para não ter devolução	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

Influência	Baixa Influência ————— Alta Influência				
Em que medida a atividade de produção influencia nos lucros da sua empresa	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

18. A programação da produção é feita segundo:

1.  A capacidade instalada
2.  O histórico de produção e vendas passadas
3.  A previsão de vendas futuras (considerando cenário, tendências do mercado)
4.  Os pedidos colocados
5.  O ritmo das vendas presentes (JIT)
6.  Os contratos fechados

19. As mais recentes melhorias na produção foram em:

1.  Processos
2.  Máquinas e equipamentos
3.  Sistema de produção
4.  Layout
5.  Nova planta

Indique o grau de concordância com as afirmativas abaixo, onde 1 significa Discordo totalmente e 5 Concordo totalmente.

DESENVOLVIMENTO - A sua Empresa...	<b>Discorda Totalmente</b> ←————→ <b>Concorda Totalmente</b>				
	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
2. Realiza a concepção original dos seus próprios produtos	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
3. Monitora as últimas tendências tecnológicas do setor	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
5. Adapta as tecnologias em uso para as suas necessidades	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
7. Desenvolve produtos em parcerias com ICTs	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
6. Realiza a prototipagem de seus produtos	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
4. Utiliza metodologias formais de gestão de projetos (Stage-Gate, PMBOK, Funil da Inovação, etc)	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
8. Lança seus próprios produtos	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

Influência	<b>Baixa Influência</b> ————— <b>Alta Influência</b>				
	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
Em que medida a atividade de desenvolvimento influencia nos lucros da sua empresa	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>



## 9. Disparo do desenvolvimento

1.  Atendimento a requisitos legais
2.  Solicitação de cliente
3.  Melhoria de produto existente
4.  Aumento do portfolio de produtos
5.  Invenção

## 10. Como o desenvolvimento acontece

1.  Informalmente para resolução de problemas de rotina
2.  Ocasional por "força tarefa"
3.  Fragmentado em meio às atividades rotineiras da empresa
4.  Constantemente por pessoal especializado e dedicado exclusivamente a essa tarefa.

O próximo bloco busca avaliar o desempenho da empresa em cada uma das áreas (Desenvolvimento, Produção, Gestão, Comercial). Nas questões a seguir, avalie como está a sua empresa em relação ao mercado em que atua.

## BLOCO 2

DESEMPENHO	<b>Discorda Totalmente</b>	←————→			<b>Concorda Totalmente</b>
42. O lucro líquido da empresa vem crescendo de forma contínua nos últimos três anos.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
43. O percentual de participação da empresa no mercado vem crescendo de forma regular nos últimos três anos.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
44. O faturamento da empresa vem crescendo de forma contínua nos últimos três anos.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
45. Os rendimentos da empresa são decorrentes de desenvolvimento de novos produtos.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
46. Os rendimentos da empresa são decorrentes de aumento de produtividade.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
47. Os rendimentos da empresa são decorrentes dos investimentos em ganhos de eficiência.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>
48. Os rendimentos da empresa vem crescendo em razão dos preços praticados.	1. <input type="radio"/>	2. <input type="radio"/>	3. <input type="radio"/>	4. <input type="radio"/>	5. <input type="radio"/>

O próximo bloco se destina a levantar informações gerais sobre a sua empresa.

### BLOCO 3

50. Número aproximado de colaboradores em:

<input type="text"/>	Desenvolvimento (de produto e/ou de processo)
<input type="text"/>	Produção
<input type="text"/>	Administrativo
<input type="text"/>	Comercial
<input type="text"/>	Total

51. Qual foi o faturamento bruto da empresa em 2013?

52. Qual é a margem (em percentual)?

53. Qual é o percentual de investimento em Pesquisa e Desenvolvimento no faturamento bruto da empresa?

 %

54. Qual o total de patentes registradas pela empresa?

55. Qual o total de produtos que a empresa oferece?

56. Qual o número de novos produtos lançados em 2013?

57. Qual é o percentual do faturamento decorrente de novos produtos lançados em 2013?

 %

58. A empresa lança um novo produto a cada

  dias  semanas  meses  anos

59. Qual é o tempo médio de desenvolvimento de produto?

  dias  semanas  meses  anos

60. Qual o percentual de utilização da capacidade instalada da empresa?

 %

61. Qual é o percentual de devolução dos produtos?

 %

62. Qual foi a última ação tomada pela empresa que resultou em aumento do lucro?

### CONTATO

Conforme já informado no início desta entrevista, o anonimato dos respondentes e das empresas será respeitado. Os respondentes que desejarem, receberão os resultados da pesquisa bastando, para isso, informar o contato ao final do questionário. Da mesma forma, todas as informações individuais serão estritamente confidenciais e usadas somente para o envio dos resultados.

Você deseja receber os resultados da pesquisa por e-mail?

1.  Não
2.  Sim (todas as informações individuais serão estritamente confidenciais e usadas somente para o envio dos resultados)

Nome da empresa

Nome do respondente

Cargo

E-mail

Telefone

Você deseja acrescentar algum comentário?

Entrevistador

Appendix B – Factor Analysis Tables

Table 21 – Determinant Matrix

		Correlation Matrix <sup>a</sup>																				
		TDC1	TDC2	TDC6	TDC3	TDC5	TDC7	OC5	OC6	OC7	OC8	OC9	MC1	MC5	MC6	MC7	TC2	TC3	TC4	TC5	TC6	
Correlation	TDC1	1.000	.458	.478	.470	.509	.536	.240	.211	.225	.301	.230	.191	.244	.205	.251	.290	.166	.195	.244	.175	
	TDC2	.458	1.000	.519	.623	.483	.395	.314	.257	.227	.355	.287	.224	.296	.249	.318	.379	.191	.155	.240	.222	
	TDC6	.478	.519	1.000	.474	.518	.440	.287	.280	.246	.417	.302	.259	.356	.303	.419	.434	.250	.243	.382	.360	
	TDC3	.470	.623	.474	1.000	.498	.343	.340	.301	.267	.345	.344	.209	.331	.245	.248	.267	.119	.132	.206	.168	
	TDC5	.509	.483	.518	.498	1.000	.507	.309	.263	.307	.309	.292	.126	.190	.216	.145	.237	.024	.078	.151	.131	
	TDC7	.536	.395	.440	.343	.507	1.000	.182	.188	.199	.242	.166	.126	.171	.176	.180	.245	.038	.135	.166	.106	
	OC5	.240	.314	.287	.340	.309	.182	1.000	.442	.427	.396	.408	.178	.238	.231	.237	.218	.092	.102	.204	.162	
	OC6	.211	.257	.280	.301	.263	.188	.442	1.000	.440	.401	.487	.117	.215	.211	.195	.204	.071	.118	.187	.131	
	OC7	.225	.227	.246	.267	.307	.199	.427	.440	1.000	.430	.450	.080	.155	.121	.122	.122	.030	.089	.190	.082	
	OC8	.301	.355	.417	.345	.309	.242	.396	.401	.430	1.000	.453	.151	.307	.255	.290	.318	.206	.262	.373	.252	
	OC9	.230	.287	.302	.344	.292	.166	.408	.487	.450	.453	1.000	.112	.223	.224	.193	.220	.126	.125	.236	.184	
	MC1	.191	.224	.259	.209	.126	.126	.178	.117	.080	.151	.112	1.000	.425	.331	.434	.271	.274	.167	.165	.243	
	MC5	.244	.296	.356	.331	.190	.171	.238	.215	.155	.307	.223	.425	1.000	.429	.546	.316	.207	.188	.251	.232	
	MC6	.205	.249	.303	.245	.216	.176	.231	.211	.121	.255	.224	.331	.429	1.000	.413	.264	.172	.121	.172	.236	
	MC7	.251	.318	.419	.248	.145	.180	.237	.195	.122	.290	.193	.434	.546	.413	1.000	.420	.273	.180	.285	.328	
	TC2	.290	.379	.434	.267	.237	.245	.218	.204	.122	.318	.220	.271	.316	.264	.420	1.000	.358	.306	.390	.443	
TC3	.166	.191	.250	.119	.024	.038	.092	.071	.030	.206	.126	.274	.207	.172	.273	.358	1.000	.472	.454	.416		
TC4	.195	.155	.243	.132	.078	.135	.102	.118	.089	.262	.125	.167	.188	.121	.180	.306	.472	1.000	.534	.356		
TC5	.244	.240	.382	.206	.151	.166	.204	.187	.190	.373	.236	.165	.251	.172	.285	.390	.454	.534	1.000	.432		
TC6	.175	.222	.360	.168	.131	.106	.162	.131	.082	.252	.184	.243	.232	.236	.328	.443	.416	.356	.432	1.000		
Sig. (1-tailed)	TDC1		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
	TDC2	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	TDC6	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	TDC3	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	TDC5	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.212	.004	.000	.000
	TDC7	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.096	.000	.000	.000
	OC5	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.000	.000	.000
	OC6	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.008	.000	.000	.000
	OC7	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.003	.000	.000	.000	.000	.000	.156	.001	.000	.003
	OC8	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	OC9	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	MC1	.000	.000	.000	.000	.000	.000	.000	.000	.003	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
	MC5	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	MC6	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
	MC7	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	TC2	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
TC3	.000	.000	.000	.000	.212	.096	.001	.008	.156	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	
TC4	.000	.000	.000	.000	.004	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	
TC5	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	
TC6	.000	.000	.000	.000	.000	.000	.000	.000	.003	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	

a. Determinant = .001

**Table 22 – KMO and Bartlett's Test**

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.905
	Approx. Chi-square.	8143.555
Bartlett's Test of Sphericity	df	190
	Sig.	.000

**Table 23 – Measure of Sampling Adequacy**

		Anti-image Matrices																			
		TDC1	TDC2	TDC6	TDC3	TDC5	TDC7	OC5	OC6	OC7	OC8	OC9	MC1	MC5	MC6	MC7	TC2	TC3	TC4	TC5	TC6
Anti-image Covariance	TDC1	.560	-.032	-.042	-.083	-.093	-.183	.000	.011	-.012	-.010	.003	-.014	-.002	.008	-.020	-.010	-.035	-.026	-.014	.017
	TDC2	-.032	.499	-.058	-.200	-.055	-.046	-.029	.006	.012	-.029	.001	-.006	.010	.003	-.033	-.074	-.034	.018	.010	.008
	TDC6	-.042	-.058	.477	-.040	-.118	-.068	.018	-.014	.007	-.052	-.003	-.003	-.016	-.008	-.081	-.046	-.010	.011	-.063	-.070
	TDC3	-.083	-.200	-.040	.504	-.076	.025	-.037	-.025	.004	-.005	-.053	-.016	-.072	-.003	.030	.023	.014	-.003	.003	.009
	TDC5	-.093	-.055	-.118	-.076	.517	-.127	-.042	.004	-.055	.000	-.022	.002	.013	-.039	.065	-.006	.044	.017	.022	-.001
	TDC7	-.183	-.046	-.068	.025	-.127	.608	.021	-.016	-.015	-.002	.028	-.003	.011	-.017	.000	-.032	.057	-.035	-.001	.031
	OC5	.000	-.029	.018	-.037	-.042	.021	.662	-.127	-.122	-.060	-.061	-.035	-.002	-.029	-.027	-.009	.012	.018	-.016	-.012
	OC6	.011	.006	-.014	-.025	.004	-.016	-.127	.642	-.116	-.055	-.156	-.037	-.009	-.029	-.007	-.022	.021	-.017	.008	.012
	OC7	-.012	.012	.007	.004	-.055	-.015	-.122	-.116	.645	-.118	-.120	-.011	.002	.036	.009	.034	.027	.007	-.031	.020
	OC8	-.010	-.029	-.052	-.005	.000	-.002	-.060	-.055	-.118	.591	-.100	.040	-.041	-.026	-.016	-.027	-.002	-.044	-.068	-.003
	OC9	.003	.001	-.003	-.053	-.022	.028	-.061	-.156	-.120	-.100	.617	.022	-.007	-.037	.010	-.010	-.019	.022	-.019	-.024
	MC1	-.014	-.006	-.003	-.016	.002	-.003	-.035	.007	-.011	.040	.022	.716	-.130	-.081	-.115	-.016	-.093	-.015	.043	-.032
	MC5	-.002	.010	-.016	-.072	.013	.011	-.002	-.009	.002	-.041	-.007	-.130	.588	-.127	-.178	-.012	.016	-.023	-.019	.023
	MC6	.008	.003	-.008	-.003	-.039	-.017	-.029	-.029	.036	-.026	-.037	-.081	-.127	.724	-.094	-.006	-.011	.012	.020	-.043
	MC7	-.020	-.033	-.081	.030	.065	.000	-.027	-.007	.009	-.016	.010	-.115	-.178	-.094	.545	-.088	-.017	.039	-.016	-.038
	TC2	-.010	-.074	-.046	.023	-.006	-.032	-.009	-.022	.034	-.027	-.010	-.016	-.012	-.006	-.088	.621	-.061	-.025	-.048	-.131
	TC3	-.035	-.034	-.010	.014	.044	.057	.012	.021	.027	-.002	-.019	-.093	.016	-.011	-.017	-.061	.631	-.165	-.104	-.102
TC4	-.026	.018	.011	-.003	.017	-.035	.018	-.017	.007	-.044	.022	-.015	-.023	.012	.039	-.025	-.165	.629	-.199	-.055	
TC5	-.014	.010	-.063	.003	.022	-.001	-.016	.008	-.031	-.068	-.019	.043	-.019	.020	-.016	-.048	-.104	-.199	.558	-.091	
TC6	.017	.008	-.070	.009	-.001	.031	-.012	.012	.020	-.003	-.024	-.032	.023	-.043	-.038	-.131	-.102	-.055	-.091	.657	
Anti-image Correlation	TDC1	.919 <sup>a</sup>	-.060	-.082	-.156	-.172	-.313	-.001	.018	-.019	-.017	.005	-.023	-.003	.013	-.036	-.016	-.059	-.043	-.024	.029
	TDC2	-.060	.909 <sup>a</sup>	-.119	-.399	-.107	-.084	-.050	.011	.021	-.054	.002	-.010	.019	.004	-.064	-.133	-.061	.031	.019	.014
	TDC6	-.082	-.119	.939 <sup>a</sup>	-.081	-.237	-.127	.032	-.026	.012	-.097	-.006	-.004	-.030	-.014	-.158	-.084	-.019	.020	-.121	-.124
	TDC3	-.156	-.399	-.081	.895 <sup>a</sup>	-.149	.045	-.064	-.043	.006	-.010	-.095	-.026	-.132	-.005	.057	.041	.025	-.005	.005	.016
	TDC5	-.172	-.107	-.237	-.149	.900 <sup>a</sup>	-.226	-.072	.007	-.095	.000	-.039	.003	.023	-.064	.123	-.010	.077	.030	.040	-.003
	TDC7	-.313	-.084	-.127	.045	-.226	.880 <sup>a</sup>	.034	-.025	-.024	-.004	.045	-.004	.018	-.026	.000	-.052	.092	-.057	-.001	.049
	OC5	-.001	-.050	.032	-.064	-.072	.034	.930 <sup>a</sup>	-.195	-.186	-.097	-.096	-.051	-.003	-.043	-.045	-.014	.018	.028	-.026	-.019
	OC6	.018	.011	-.026	-.043	.007	-.025	-.195	.905 <sup>a</sup>	-.180	-.089	-.248	.011	-.014	-.043	-.012	-.034	.033	-.027	.014	.019
	OC7	-.019	.021	.012	.006	-.095	-.024	-.186	-.180	.886 <sup>a</sup>	-.191	-.191	-.016	.003	.053	.014	.054	.042	.011	-.052	.030
	OC8	-.017	-.054	-.097	-.010	.000	-.004	-.097	-.089	-.191	.942 <sup>a</sup>	-.166	.061	-.070	-.040	-.028	-.044	-.003	-.072	-.119	-.005
	OC9	.005	.002	-.006	-.095	-.039	.045	-.096	-.248	-.191	-.166	.910 <sup>a</sup>	.033	-.012	-.056	.016	-.015	-.030	.036	-.032	-.038
	MC1	-.023	-.010	-.004	-.026	.003	-.004	-.051	.011	-.016	.061	.033	.896 <sup>a</sup>	-.200	-.112	-.185	-.024	-.139	-.022	.068	-.047
	MC5	-.003	.019	-.030	-.132	.023	.018	-.003	-.014	.003	-.070	-.012	-.200	.890 <sup>a</sup>	-.195	-.315	-.021	.026	-.038	-.033	.037
	MC6	.013	.004	-.014	-.005	-.064	-.026	-.043	-.043	.053	-.040	-.056	-.112	-.195	.928 <sup>a</sup>	-.150	-.009	-.016	.018	.032	-.062
	MC7	-.036	-.064	-.158	.057	.123	.000	-.045	-.012	.014	-.028	.016	-.185	-.315	-.150	.883 <sup>a</sup>	-.151	-.028	.066	-.029	-.063
	TC2	-.016	-.133	-.084	.041	-.010	-.052	-.014	-.034	.054	-.044	-.015	-.024	-.021	-.009	-.151	.939 <sup>a</sup>	-.097	-.040	-.081	-.206
	TC3	-.059	-.061	-.019	.025	.077	.092	.018	.033	.042	-.003	-.030	-.139	.026	-.016	-.028	-.097	.865 <sup>a</sup>	-.263	-.174	-.159
TC4	-.043	.031	.020	-.005	.030	-.057	.028	-.027	.011	-.072	.036	-.022	-.038	.018	.066	-.040	-.263	.840 <sup>a</sup>	-.337	-.085	
TC5	-.024	.019	-.121	.005	.040	-.001	-.026	.014	-.052	-.119	-.032	.068	-.033	.032	-.029	-.081	-.174	-.337	.887 <sup>a</sup>	-.150	
TC6	.029	.014	-.124	.016	-.003	.049	-.019	.019	.030	-.005	-.038	-.047	.037	-.062	-.063	-.206	-.159	-.085	-.150	.913 <sup>a</sup>	

a. Measures of Sampling Adequacy (MSA)

**Table 24 – Total Variance Explained**

Component	Total Variance Explained								
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of variance	% cumulative	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	6.250	31.252	31.252	6.250	31.252	31.252	3.341	16.706	16.706
2	2.189	10.946	42.199	2.189	10.946	42.199	2.832	14.160	30.865
3	1.595	7.974	50.172	1.595	7.974	50.172	2.766	13.831	44.697
4	1.440	7.202	57.375	1.440	7.202	57.375	2.536	12.678	<b>57.375</b>
5	.783	3.916	61.291						
6	.752	3.762	65.053						
7	.687	3.437	68.490						
8	.657	3.285	71.775						
9	.592	2.961	74.735						
10	.587	2.933	77.669						
11	.537	2.684	80.353						
12	.509	2.544	82.896						
13	.490	2.450	85.347						
14	.486	2.428	87.775						
15	.470	2.349	90.123						
16	.443	2.217	92.340						
17	.433	2.164	94.503						
18	.410	2.051	96.555						
19	.356	1.780	98.335						
20	.333	1.665	100.000						

Extraction Method: Principal Component Analysis.

### Appendix C – Correlation Analysis Result

**Table 25 – Correlation between Firm and Organization**

		Mean Firm	Mean Organization
Mean Firm	Pearson Correlation	1	<b>.612**</b>
	Sig. (2-tailed)		,000
Mean Organization	Pearson Correlation	<b>.612**</b>	1
	Sig. (2-tailed)	,000	

\*\* . Correlation is significant at the 0.01 level (2-tailed)



## Appendix D – Scheffé Test Tables

**Table 26 – Scheffé Test between Innovation Capabilities and Clusters**

Scheffe

Dependent variable	(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Technology Development	1	2	.1297	.05251	.107	-.0173	.2767
		3	1.0634*	.05507	.000	.9092	1.2176
		4	1.1975*	.04640	.000	1.0676	1.3274
	2	1	-.1297	.05251	.107	-.2767	.0173
		3	.9337*	.06013	.000	.7653	1.1020
		4	1.0678*	.05231	.000	.9213	1.2142
	3	1	-1.0634*	.05507	.000	-1.2176	-.9092
		2	-.9337*	.06013	.000	-1.1020	-.7653
		4	.1341	.05488	.114	-.0195	.2878
	4	1	-1.1975*	.04640	.000	-1.3274	-1.0676
		2	-1.0678*	.05231	.000	-1.2142	-.9213
		3	-.1341	.05488	.114	-.2878	.0195
Operations	1	2	.5767*	.03714	.000	.4728	.6807
		3	.1514*	.03896	.002	.0423	.2604
		4	.8351*	.03282	.000	.7432	.9270
	2	1	-.5767*	.03714	.000	-.6807	-.4728
		3	-.4254*	.04254	.000	-.5445	-.3063
		4	.2584*	.03700	.000	.1548	.3620
	3	1	-.1514*	.03896	.002	-.2604	-.0423
		2	.4254*	.04254	.000	.3063	.5445
		4	.6838*	.03882	.000	.5751	.7925
	4	1	-.8351*	.03282	.000	-.9270	-.7432
		2	-.2584*	.03700	.000	-.3620	-.1548
		3	-.6838*	.03882	.000	-.7925	-.5751
Management	1	2	.7675*	.04306	.000	.6470	.8881
		3	.2433*	.04516	.000	.1169	.3697
		4	.9734*	.03805	.000	.8669	1.0800
	2	1	-.7675*	.04306	.000	-.8881	-.6470
		3	-.5242*	.04932	.000	-.6623	-.3862
		4	.2059*	.04290	.000	.0858	.3260
	3	1	-.2433*	.04516	.000	-.3697	-.1169
		2	.5242*	.04932	.000	.3862	.6623
		4	.7301*	.04501	.000	.6041	.8561
	4	1	-.9734*	.03805	.000	-1.0800	-.8669
		2	-.2059*	.04290	.000	-.3260	-.0858
		3	-.7301*	.04501	.000	-.8561	-.6041
Transaction	1	2	.1665*	.04608	.005	.0375	.2955

	3	1.0085*	.04833	.000	.8732	1.1438
	4	1.0004*	.04072	.000	.8864	1.1144
	1	-.1665*	.04608	.005	-.2955	-.0375
2	3	.8420*	.05277	.000	.6943	.9898
	4	.8339*	.04591	.000	.7054	.9624
	1	-1.0085*	.04833	.000	-1.1438	-.8732
3	2	-.8420*	.05277	.000	-.9898	-.6943
	4	-.0081	.04816	.999	-.1430	.1267
	1	-1.0004*	.04072	.000	-1.1144	-.8864
4	2	-.8339*	.04591	.000	-.9624	-.7054
	3	.0081	.04816	.999	-.1267	.1430

\*. The mean difference is significant at the .05 level.

**Table 27 – Scheffé Test Between Performance and Clusters**

Dependent variable: Performance

Scheffe

(I) Two-step cluster	(J) Two-step cluster	Mean Difference (I-J)	Std. Error	Sig.	Confidence Interval 95%	
					Lower Bound	Upper Bound
1	2	.2897*	.06020	.000	.1211	.4582
	3	.5636*	.06314	.000	.3868	.7403
	4	.7886*	.05324	.000	.6395	.9376
2	1	-.2897*	.06020	.000	-.4582	-.1211
	3	.2739*	.06895	.001	.0809	.4669
	4	.4989*	.06001	.000	.3309	.6669
3	1	-.5636*	.06314	.000	-.7403	-.3868
	2	-.2739*	.06895	.001	-.4669	-.0809
	4	.2250*	.06296	.005	.0488	.4013
4	1	-.7886*	.05324	.000	-.9376	-.6395
	2	-.4989*	.06001	.000	-.6669	-.3309
	3	-.2250*	.06296	.005	-.4013	-.0488

\*. The mean difference is significant at the .05 level.

## Appendix E – Regression Analysis Tables

**Table 28 – Multiple Regression Analysis for Cluster 1 (Nearly Balanced Companies)**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.820	.562		3.236	.001
1 Technology	.110	.079	.082	1.386	.167
Operations	.128	.104	.077	1.232	.219
Management	.241	.089	.166	2.716	.007
Transaction	.009	.074	.007	.119	.905

Dependent Variable: Performance

**Table 29 – Multiple Regression Analysis for Cluster 2 (Firm-based Companies)**

Modelo	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.702	.512		1.370	.172
1 Technology	.445	.112	.297	3.977	.000
Operations	.115	.109	.074	1.048	.296
Management	.109	.092	.087	1.193	.234
Transaction	.068	.096	.049	.710	.478

Dependent Variable: Performance

**Table 30 – Multiple Regression Analysis for Cluster 3 (Advanced Organization-based Companies)**

Modelo	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.510	.727		.701	.484
1 Technology	.042	.086	.041	.488	.626
Operations	.006	.145	.003	.043	.966
Management	.629	.137	.362	4.602	.000
Transaction	.047	.096	.036	.489	.626

Dependent Variable: Performance

**Table 31 – Multiple Regression Analysis for Cluster 4 (Basic Organization-based Companies)**

Modelo	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.186	.384		3.089	.002
1 Technology	.193	.067	.186	2.857	.005
Operations	-.080	.093	-.053	-.867	.387
Management	.125	.083	.096	1.512	.131
Transaction	.410	.081	.317	5.079	.000

Dependent Variable: Performance