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## **The Intra-firm Coordination in Highly Innovative SMEs: Evidences from the Brazilian Agri-food Sector**

### **ABSTRACT**

From an intra-firm perspective, Paruchuri (2010) argues that a firm that can improve the diffusion of knowledge, internally, will enhance its innovative activity. Aalbers (2015), reflecting on the governance of knowledge sharing inside organizations, suggests that knowledge may be difficult to transfer because of the boundaries dynamics. Due to this dynamic, innovation centered, it is important to create new ways of analyzing and developing the firm's activities, aiming to enhance its performance and to better understand the solution enablers for the new challenges to come. Therefore, the research question emerges: How can firms manage their intra-firm interactions to enhance the innovative activities? To answer this question, we designed and performed a qualitative study with 4 Highly Innovative Firms (HIF) from the agri-food sector, located in the south of Brazil. We used the dimensions of interactions and brokerage roles adapted from Aalbers (2015), Tsang (2015) and Indarti (2010) to develop a semi-structured instrument for the interviews. We analyzed the interactions that took place during a project of product development in each firm, and the interactions were classified according to: Hierarchy (Horizontal or Vertical); Reach (Unit or Cross-unit); Type (Formal or Informal) and we used Intensity (Frequency) as the base for the analysis. Our results showed two different forms of intra-firm coordination and one specific mechanism for the intra-firm coordination. We hope that this study can provide insights to the innovation studies and the agri-food sector. Defining the interactions was a first step and showcasing the intra-firm coordination, in a product development context, might help the firms to understand the importance that the different types of interactions have to manage the knowledge sharing processes.

**Keywords:** Innovation, Interactions, Intra-firm coordination, Knowledge.

## 1. INTRODUCTION

Combining a complex web of actions, variables and outcomes has been a big challenging for the researchers trying to understand the phenomenon of innovation. From a firm's perspective, in an ideal and utopic world, the team of workers would be composed by people with equal and complete knowledge about all the operations, methods, processes and techniques enrolled in the firm's activities. However, the reality points to a direction in which individuals hold the different types and amounts of knowledge. This knowledge, according to Indarti (2010) is the key to innovate, and how to access it, share it and make it flow in a continuum inside the firm is the hand that holds this said key.

In the intra-firm perspective, Paruchuri (2010) argues that a firm that can improve the diffusion of knowledge internally will enhance its innovative activity. Yet, Aalbers (2015), reflecting on the governance of knowledge sharing inside organizations, suggests that knowledge may be difficult to transfer because of the boundaries dynamics. These boundaries dynamics are based and built in interactions and due to this dynamic, innovation centred, it is important to create new ways of analysing and developing the firm's activities, aiming to enhance its performance and to better understand solution enablers for the new challenges to come.

Our main goal is the understanding of the innovation process from the intra-firm coordination point of view, using the theory of interactions (Becker, 1974; Indarti, 2010) to understand the boundaries dynamics inside a firm. Despite wide acceptance that intra-organizational networks are important for organizational and individual outcomes, we know surprisingly little about how intra-organizational relationships evolve over time or how a firm's interaction patterns can be influenced by managerial action (Balkundi and Kilduff 2005). Knowledge on this matter is particularly scarce when centring on intra-organizational innovation (Tortoriello 2007; Bartunek, 2011). Further research therefore can produce understanding of what constitutes success or failure of the intra-organizational innovation network by analysing several of its structural characteristics (Smith Doerr *et al.* 2004; Kijkuit and Van den Ende 2010).

To analyse the intra-firm coordination dynamic in an innovation centred environment, we performed a qualitative study with what we defined as highly-innovative firms located in the south of Brazil. We followed four firms in their product development process during the year of 2016. This study presents the partial results of a bigger project, involving companies located in South America and Europe. In the next sections we present the intra-firm coordination context, the relevance and motivation to study the Brazilian agri-food sector, the method, results and conclusions.

## 2. THE INTRA-FIRM COORDINATION AND THE INTERACTIONS

Digital age, multiple sources of information, non-stop knowledge being built in a borderless world causes the firm's task to realize, manage and coordinate its assets a complex and constantly changing task. We call this context: The intra-firm coordination problem. Firm's that are thirsty for innovation might have or might have not the knowledge needed to innovate, however to discover if the firm possess the knowledge and how to make use of it is basically a puzzle challenge.

In this sense, the role of interactions is highlighted by Foss et al. (2010), the author suggest that knowledge may come to be sticky to transfer because of the dynamics among firm's groups. These in-group-out-group dynamics can create a border to share knowledge with individuals from other groups. While stickiness of knowledge is related to the social embeddedness of those who might partake in knowledge transfer, this intra-firm dynamic of knowledge exactly crosses boundaries that has not been the subject of much scholarly attention. Although, to Salancik & Pfeffer (1978), in order to realize its commercial objectives and expand its innovative activities a firm need to develop its own knowledge or acquire knowledge through the interactions within its own environment.

Lundvall (1985) was one of the first to point-out the advantages of interacting and the interactions as a big construct. The author put interaction defined as a 'mutual or reciprocal action' it refers to a continuous two-way transfer of information between two parties who have a close relationship. The idea of interaction as a two-way effect, opposed to a one-way causal impact, was present in the work of Wagner (1994). In the various sciences, interaction has differently tailored meanings. In a social perspective, Dyer (1996) argues that spatial and cultural proximity plays an important role in the formation of the informal network.

The importance of intra-firm coordination is discussed also at the work of Paruchuri (2010). The author states that a firm that can improve the diffusion of knowledge internally will benefit from enhanced innovative activity. Even as firms are urged to more readily allow innovative knowledge to cross firm boundaries, innovative knowledge may not easily move to where it can be used in the firm, however (AALBERS et al., 2013).

In an example of how complex the intra-firm coordination is, Henttonen (2010) argues that, in the multiple networks that constitute a firm, an individual employee may be relatively more internally orientated in one network while being relatively more externally oriented in another. A firm that seeks to benefit from enhanced innovative activity has to manage its intra-firm coordination, in a way that the interactions can provide boundaries that makes the knowledge flow in a proper way within its domain. The success of intra-firm coordination is

deeply related on how the firm manages its interactions and provide opportunities to the innovative behaviour rise. Thus, all these dynamics of intra-firm coordination and its interactions relies, essentially, on the rhythm of the knowledge flow inside the firm. With these authors' insights, we believe to be possible to answer the intra-firm coordination problem and to suggest the firms the ways to improve its innovative performance.

### **3. THE BRAZILIAN AGRIFOOD SECTOR**

In the last decade Brazil has become an agricultural powerhouse, and was the world's fourth leading exporter of agri-food and seafood products in 2015. The country is a dominant force in the sugar, coffee and orange juice markets, and is competing with the United States to be the world's largest soybean exporter (Euromonitor, 2016). The Brazilian agriculture sector employs 15.7% of the workforce and is estimated at 5.9% of GDP (World FactBook, 2016).

According to the CNAE (National Economic Activities Classification) the state we analysed, Rio Grande do Sul, count with 81 activities related to the food sector, which goes from slaughtering activities, rice growing to the production of "ready-to-eat" products. The relevance to study the state relies in the fact that the agriculture is the basis of the state's economy and the state produces a large variety of products such as soybean, rice, wheat, corn, barley, bean, grapes and apples. Considered the second largest grain producer in Brazil, the Rio Grande do Sul State produces 18.6 million of tons, equivalent to the fourth part of the country's entire grain production. Rio Grande do Sul also stands out for its animal production, which includes the cattle, swine and poultry, responding for 20% of national GDP.

The State Government adopts a development strategy that aims at strengthening the existing economic matrix and encouraging the installation of productive sectors considered equally strategic to complement the economic matrix, solve technological problems and generate jobs and income. According to the Brazilian Institute of geography and Statistics (IBGE, 2013), the state is the second largest rural producer; it has the second largest industrial park and the second trade center in Brazil. Responsible for almost 8% of the national production, it also has a GDP of US\$ 46.5 billion.

All these characteristics make the food sector of Rio Grande do Sul an important start-point in this work. These aspects, combined with the study of highly-innovative firms, in an innovative context, such as the product development, add to the chances of being successful when explaining the intra-firm perspective of the innovation process.

#### 4. METHOD

Our choice was to address the intra-firm coordination where the phenomenon is assumed to be more evident, thereby we decided to work with Highly Innovative Firms (HIF) and analyze a single project of product development.

We chosen to work with SMEs from the food segment and we chose four units of analysis. We performed what is called Qualitative non-interactive study with concept analysis, documental analysis and observation of the units.

The research instrument is based on the dimensions proposed by Indarti (2010) and Aalbers (2015) with some specific additions regarding innovation and intra-firm interactions. A semi-structured instrument was used, as well complimentary questionnaires and checklists during the observation period. The interviews were performed in English and Portuguese, the content was recorded, translated to English, validated by the reversal translation method and by specialists. Finally, the interviews were analysed by using the software N-vivo and the content analysis method.

We chose to use content analysis because as a method it has systematic and objective means of describing and quantifying a phenomenon (Krippendorff 1980, Downe-Wamboldt 1992, Sandelowski 1995). It is also known as a method of analyzing documents. **Content analysis allows the researcher to test theoretical issues to enhance understanding of the data.**

As for the units selection, we used the multistage sampling, derived from the cluster sampling method and judgment sampling technique as previously stated. A sample is, according to Field (2005) “*a smaller collection of units from a population used to determine truths about that population*”. In cluster sampling, the cluster, i.e., a group of population elements, constitutes the sampling unit, instead of a single element of the population. The complex form of cluster sampling in which two or more levels of units are embedded one in the other is called multistage sampling.

Multistage sampling refers to sampling plans where the sampling is carried out in stages using smaller and smaller sampling units at each stage. Multistage samples are used primarily for cost or feasibility reasons. Our first clusters are SMEs, second cluster is the food industry, third Brazilian firms from the food industry, fourth Highly innovative firms, which means firms that released at least 1 product new to the market in the last two years. From this point, we mapped out the firms and we intentionally selected four firms to compose our sample.

The four firms we selected had unique products developed, the products were awarded in recognized fairs in Brazil. We focused our interviews in each process of product development, its general context, interactions, main units involved and the responsible for the ideas and to

lead the project. Table 1 describes the sector, country, number of units, the presence or not of a R&D department and the size of each firm, as well as the code we use do refer to each firm, from A to D.

<i>Firm</i>	<i>Type</i>	<i>Units</i>	<i>R&amp;D</i>	<i>Size</i>
<i>A</i>	Animal Origin Products	8	Yes	Medium
<i>B</i>	Dairy Products	8	Yes	Medium
<i>C</i>	Dairy Products	8	No	Medium
<i>D</i>	Grains	6	No	Medium

**Table 01: Firms analyzed in the study**

**Source:** The authors

The dimensions of the dynamics of Intra-firm Interactions are shown in the table 02:

<i>Dimension</i>	<i>Variation</i>
<i>Interaction Type</i>	Horizontal
	Vertical
<i>Interaction Reach</i>	Unit/Intra-unit
	Cross-unit
<i>Interaction Mechanism</i>	Formal
	Informal
<i>Interaction Intensity</i>	Frequency

**Table 02: The intra-firm interactions dynamic**

**Source:** Based on Becker (1974); Indarti (2010); Aalbers (2015).

We followed the suggestions of Tsai (2001), Wong & Singh (2004), Aalbers (2015) and Tsang (2015) as taking these dimensions to the development a new product introduced to the market, exploring the whole development.

- **Type of Interaction:** The type of interaction is important to verify how the coordination intra-firm is influenced by the hierarchy structure, it might be:

*Horizontal* - Same hierarchical level or

*Vertical* - Different hierarchical level

- **Interaction Reach:** According to Tsang (2015) the reach of interactions may define the knowledge flow along the units, it is divided as:

*Intra-unit* – Interactions in the same unit or

*Cross-Unit* – Interactions between different units

- **Interaction Mechanism:** The Interactions may occur through two mechanisms:

*Formal* - By schedule and contracts or

*Informal* - With no obligations

- **Interactions Intensity:**

*Frequency* – Quantity of Interactions along time

The horizontal and vertical interactions are important to verify how the coordination intra-firm works along the hierarchy structure. As the reach of the interactions, Tsang (2015) argues that cross-unit interactions are important to guarantee the knowledge flow and access to all units, and in times this flow occur in an informal way by a single agent. To verify the existent mechanisms could help us to understand what a firm can make to assure that the knowledge will be available to all units. Finally, the interactions intensity will help us to verify how far the influence of these interactions goes to the innovative process of the agri-food SMEs

Regarding the Hierarchy, several authors discuss its influence on what is called *Relational/Structural Embeddedness*. It is argued that there are several advantages conferred by a structural embeddedness, provided most of the time for organizations with a strong hierarchy established, by manipulating the configuration of an actor's network of contacts. Among these advantages, those that come from having contacts who are more or less connected to each other have received perhaps the most attention. With this type of structure, the instrumental value to managers of having such sparse social networks accrues largely from privileged access to information and greater control over its use. These advantages should also enable managers to create more value for their firm.

Moreover, a more horizontal and open hierarchy is related to *relational embeddedness*, one that establishes how much of the firm's potential will be realized. In other words, the quality of social interactions influences which of those resources that are within reach will be accessed, and to what extent. Although an actor may have access to several people who are potentially critical sources of information, personal experience and the quality of past interactions will often influence whom he or she is likely to approach and engage. In this sense, a firm with more soft hierarchy may enhance its interactions disregarding the difference among position levels, making possible that solutions emerge as results of free interactions within the firm.

Regarding the mechanism or nature of the interactions, the relation of formal and informal knowledge sharing might be exemplified, for instance, a strong corporate culture that stresses general sharing behaviour (e.g. in the form of organizational behaviour) may *substitute* (within certain ranges) for explicit incentive pay (formal incentive, formal interaction) for knowledge sharing. Formal organizational arrangements and informal organizational practices may be *complementary* to each other with respect to their impact on knowledge sharing.

For example, the effect of explicit incentives on knowledge sharing may be increased by the presence of a culture that accepts substantial pay differences across employees. On the other hand, studies have documented that formal organizational mechanisms (introducing extrinsic rewards in terms of payment) may act against existing informal patterns and practices (intrinsically motivated organizational members) and such a combination may destroy



knowledge sharing behaviour and cause irreversible, long-term negative effects on organizational behaviour (Osterloh and Frey, 2000; Robertson and Swan, 2003).

As for the intensity, Indarti (2010) points out that the frequency of interactions might be a good indicative on how much innovative a firm can be. Although it is important to highlight that it is possible that the effectiveness of interaction have a decay level, which means that along the time if repeatedly without any space of a time the knowledge sharing might be compromised and give space to meaningless interactions with lack of information exchange. The same applies at intra-unit interactions, once that the knowledge inside the unit are easily spread, due to closeness it is safe to assume that a balance between cross-unit interactions and intra-unit might be necessary. We can also speculate that the use of instrumental-formal and expressive-informal communication to stimulate interactions can be explored as option to reach this desired balance.

## 5. RESULTS

The product development projects are described in table 03:

<i>Firm</i>	<i>New Product</i>	<i>Project Duration</i>	<i>Units involved</i>	<i>External Partners</i>
<i>A</i>	Pasteurized whole egg	6 months	3	Yes
<i>B</i>	Lacose free milk	6 months	1	No
<i>C</i>	Vitamin/Collagen	24 months	3	No
<i>D</i>	Champagne Biscuit	3 monts	3	No

**Table 03: Project of Product Development Characteristics**

**Source:** The authors

It is important to mention that all the firms in this study export their products and invest at least 2% of their revenue in R&D projects. The table 04 show the most important details of the projects developed by the firms:

Firm A	Firm B
<ul style="list-style-type: none"> <li>• Hierarchy developed for the project. <ul style="list-style-type: none"> <li>• Cohesion at the intra-firm coordination.</li> </ul> </li> <li>• Product Development was broadly discussed inside the firm.</li> <li>• Formal mechanisms used to share the information. <ul style="list-style-type: none"> <li>• The structure used for the project remains to new projects.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Product development was faster than predicts, from 10 months to 6 months. <ul style="list-style-type: none"> <li>• A single unit was developing the product.</li> </ul> </li> <li>• Informal intra-unit and cross-unit interactions were the core of the coordination. <ul style="list-style-type: none"> <li>• The centrality was the key during the whole development and allowed the firm to make use of the informal interactions.</li> </ul> </li> </ul>
Firm C	Firm D
<ul style="list-style-type: none"> <li>• Highly complex product development project.</li> <li>• Several tools used for the intra-firm coordination.</li> <li>• Multiple mechanisms both to formal and informal interactions. <ul style="list-style-type: none"> <li>• Low influence of the hierarchy during the project.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Independent centralized management of the interactions. <ul style="list-style-type: none"> <li>• Low relevance of the hierarchy</li> <li>• Freedom for the Innovation</li> <li>• The product received an award</li> </ul> </li> <li>• The development was planned for 6 months and finished in 3 months.</li> </ul>

**Table 04: Main facts about of Product Development Project**

Source: The authors

### 5.1. Types of Interactions

With the protocol that was previously established in our methodology, a series of interactions were found in the four companies. According to the interactions pattern we observed in the product development project, by analysing the documents, videos, meetings reports and interview with the managers we found similarities in the type of intra-firm coordination adopted by the firms. To better express the results we found, we named the general orientation of the interactions. In this study we present two types, one oriented to a vertical pattern of interactions, taking the hierarchy as an important part of the innovation process and the second one, that had informal interactions as dominant among the units focusing on the knowledge, with less importance to the hierarchy.

The first form of Intra-firm coordination with our analysis was named the *Hierarchy Oriented Coordination*, as the name says in this type of coordination the firms focus on the hierarchy to assure the product development project to be performed. In the firm A and B, we found an extremely similar type of intra-firm coordination, the pattern of interactions had the hierarchy as basis to the organizational structure used in the project. The top management had direct contact with the Researchers and the interactions jumped levels to centralized the knowledge at the upper hierarchical levels and the interactions happened mainly as formal interactions. Reports, meetings and emails were broadly used the head of R&D and the Head of the project.

*“I controlled our product development from the start and I had to make reports to the board so I usually go direct in the source, ask everything and then I send the reports with copy to everyone, ideas are always welcome”*

**Firm A**

The second type of intra-firm coordination we found was called the *Knowledge Flux Coordination*, it is a form of intra-firm coordination in which the firms organize a new structure to the development of the innovation, they settle the employees in the most comfortable position in order for them to interact and make the knowledge flow. It differs from the interactions oriented coordination because there is a change in the structure and in the positions occupied by the employees, rather than just ignoring it.

*(...) Ah, we have our whatsapp group for the company and also facebook groups, we know it maybe something that has nothing to do with the project but we use it to share news about technology, new discovers and regular daily stuff, sometimes business opportunities and new ideas come from the group and for sure makes our employees to think more because they love the group. There is the facebook group also, but they use more for each unit and they don't cheap chat, it is just people posting news and asking questions regarding work, our researchers sometimes run some pools to know people opinion”*

**Firm C**

With the analysis highlighted by using the case of firm C we can make a case for the use of specific tools for the intra-firm coordination. New technologies in the field of Information Technology emerge every day and firms that wants to innovate should understand the benefits they can have by using these tools. A proper intra-firm coordination requires established mechanisms and mechanisms requires tools, finally tools require capable individuals to understand how to benefit from it.

## **6. CONCLUSION**

The intra-firm coordination may vary a lot from firm to firm, managers can use different tools, mechanisms and express their creativity in order to foster innovation. One of the highlights of our study was that it was not found a single unit based only on informal interactions, regardless if cross-unit or intra-unit interactions. This agrees with the management literature, since the work of Rothschild-Whitt (1979), authors argued that it is not possible to work without a minimum level of hierarchy sense, in the paradigm we live in. This allowed us to observe the possibility of existence of a limit to both informal and formal interactions, and firms should benefit if able to balance it and increasing both levels together. This should ease the process of innovation and knowledge absorption, making it seems natural for people.

The Brazilian companies highly value the product development, providing the units with more assets after the idea and the concept of the product is already conceived. As stressed during this entire study, the hierarchy plays a central role in the interactions, but due to the characteristics of the firms we studied (Highly innovative, which means, here, more than 2 products launched in the last year) it was not possible to visualize and exploit the results.

The literature points in the direction that hierarchy may interfere negatively in the process, which means it can shrink the frequency and reach of interactions. As for what we seen in the firms from our sample, the formal interactions seem to have a peak, and after this peak it loses its value and does not add knowledge. Informal interactions seem to make it possible to surpass particular obstacles, and may come in hand at special situations.

Laukkanen et al. (2015) highlight that the intra-firm coordination can be understood as a catalyst for the innovative activities inside the firm. The main concern is related to how to manage the intra-firm coordination for a better knowledge flow. The interactions shine in this sense, understanding how the dynamics of changing the way that the employees interact may make them more inclined to share their knowledge may be the solution countless firms were looking for.

As for the future research we suggest, first, studies involving a broader sample and diverse methods. Second, we expect firms to incorporate the mechanisms and tools cited in this thesis and be aware that intra-firm coordination can lead to innovation and to the solution of several daily problems. One of the topics that recently gained strength in the field of innovation is the study of the innovation capabilities. In this sense, we suggest that each firm's capability could need a specific type of interaction to be developed, studies in this sense could help firms to understand better the relation interactions x innovation.

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