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The influence of the specifics of small businesses on innovation

A multiple case study of the Brazilian metal-mechanical industry

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Abstract

Purpose – Based on a multi-case analysis of small businesses in the metal-mechanical industry in the region of Sorocaba, State of São Paulo, Brazil, the purpose of this paper is to analyze how small businesses (in terms of the owner, business, and influences exerted by the environment) influence innovation.

Design/methodology/approach – Six case studies are used to analyze the Brazilian metal-mechanical industry. The data are collected through semi-structured interviews and direct observations. In addition, innovations over the previous five years are evaluated in order to establish a comparative pattern between companies.

Findings – This study examines how facilitating factors are related to the owners of small businesses. These factors include owners' personal ambitions, the centralization of decisions, and their confidence in their ability to make effective decisions. Factors related to the organization that favor innovation include a simple and streamlined structure and fewer levels of bureaucracy, whereas low capital intensity limit innovation. While some factors related to the environment favor innovation, others have a limiting effect (e.g. short-term horizons and a lack of formal strategic planning).

Originality/value – The main contribution of this research is to show that innovation is not synonymous with financial investment. Strategic reorganization and the rationalization of productive resources through competitive priorities may lead to innovation in different spheres, helping to increase the competitiveness and strength of the national economy.

Keywords Innovation management, Small business, Industrial policy

Paper type Research paper

1. Introduction

Several authors (Raymond and St-Pierre, 2010; Gibson and Naquin, 2011; Sener and Saridogan, 2011; Soriano and Peris-Ortiz, 2011; Ganther and Hecker, 2012; Casanueva *et al.*, 2013) have pointed to innovation as a strategic key factor in organizations maintaining their competitiveness.

Under the current economic conditions, science, technology and innovation geared toward a strategy of competitiveness have become the most important factors for companies and countries, not only to strengthen their global competitiveness, but also as a way to sustain growth (Gibson and Naquin, 2011; Sener and Saridogan, 2011).

Some authors (Banerjee, 2000; Casanueva *et al.*, 2013) also argue that among the most important strategic factors in the current stage of global competitiveness is an



organization's ability to absorb new knowledge, both for its products and for their respective processes through technological innovations.

However, even if the importance of innovation is recognized, some authors (Jong and Marsili, 2006; Laforet, 2008; Forsman, 2011) claim that few works focus on innovation in small businesses.

With regard to the importance of innovation to ensuring competitive conditions and, thus, the survival of small businesses in the market, Brazilian entrepreneurs who own such businesses generally adopt a technology strategy of imitation or copy, with no real transfer of technology. This avoids high-cost investments with high risk and uncertainty.

However, Jong and Marsili (2006) and Raymond and St-Pierre (2010) argue that the ability to develop new products and innovate is at the core of value creation: small businesses must continuously improve their manufacturing processes in order to ensure their long-term survival.

According to SEBRAE (2017) (Brazilian Micro and Small Business Support Service), in 2015, micro and small businesses represented, on average, 99 percent of establishments and 53.9 percent of the formal jobs generated by non-agricultural private establishments. Innovation is a key factor related to the maintenance and survival of these small businesses (SEBRAE, 2017).

Freel (2005) argues that in spite of there being some studies addressing the adequacy of small firms to innovation, many points are still obscure. According to Lima and Müller (2017), the way in which small companies interact in their productive processes are decisive elements in their innovation activities. This means analyzing specific aspects of small businesses that go beyond data on R&D expenses and patents or investments in new equipment.

Therefore, we aim to contribute to the understanding of innovation in the context of Brazilian small businesses by examining the following research question:

RQ1. Which specific characteristics of Brazilian small businesses in the metal-mechanical industry are facilitating factors or limiting factors to innovation?

It is important to highlight a geographical issue when analyzing a developing country, which has a productive park in this type of industry that is relevant from an economic point of view, but which has little innovation. For Jones and Basso (2017), in general, Brazil is one of the countries in which investments in R&D are smaller than in other emerging countries. Both the R&D investment rate and the high technology export rate are lower in relation to GDP. According to the authors, the study, which compares Brazil and France, reveals a vast field for Brazilian researchers with regard to innovation.

Thus, it is believed that understanding the specificities of Brazilian small businesses that lead to innovation can contribute to the literature on stimulating innovation in this size of company in countries such as Brazil.

The choice of the metal-mechanical industry was because of its relevance to the region of Sorocaba (State of São Paulo, Brazil). According to Neto (2009), industrial activity in the Sorocaba region focuses on the metal-mechanic industry, and is especially geared to key sectors of the economy, such as machinery and equipment, and the automotive and electrical sectors. Small and medium enterprises are considered a strong point in the region, as they meet the demand for support services, contributing to operational efficiency.

The paper is divided into four sections. The first section discusses the theoretical framework of innovation in small businesses and the particularities of Brazilian small businesses. The second section presents the research method. The third section presents the results. Finally, the fourth section presents the conclusion.

2. Theoretical references

2.1 Innovation in small businesses

Fagerberg *et al.* (2006) claim that innovation is particularly important for small businesses because there is a great need to compensate for their shortage of internal resources. For the authors, small businesses need to have an optimal interaction with all actors in the chain, because the increasing complexity of the knowledge bases required for innovation mean knowledge is developed in an incremental way.

In order to avoid it becoming just a fad, efforts in innovation, not only for small businesses, but especially for them, should consolidate a genuine innovation culture in the country, encouraging R&D. This will require the mobilization of various sectors of society: public and/or private, and domestic or international investment in small businesses that have expertise in developing and delivering innovative and competitive products and services using their own knowledge and internal experience.

Rosenbusch *et al.* (2011) corroborate this view, showing that innovation has a positive effect on the performance of small businesses. While innovation may initially involve high and continuous investments, risks, and uncertainty, benefits such as the differentiation from competitors, customer loyalty, awards for innovative products, and entry barriers for potential imitators seem to outweigh the costs. These factors can be potentially beneficial for small businesses.

However, it is important to note that, unlike larger organizations, smaller enterprises do not possess substantial resources to devote to innovation, normally do not have a structured R&D sector, are weakened by uncertainty and changes in economic policy and by competition from large competitors (Laforet, 2008; Van de Vrande *et al.*, 2009), have low levels of staff training, and their owners show a high level of reluctance to delegate tasks (Massa and Testa, 2008).

Moreover, large companies command a larger set of knowledge, skills, and other resources for success (Ganther and Hecker, 2012). Freel (2005) argues that small businesses commonly neglect financial planning and evaluation, and show inadequate delegation of tasks, lack of functional expertise and personnel management, and insufficient marketing efforts.

Despite these limitations, small businesses have advantages, especially related to their flexibility, adaptability, possibility of developing diversified structures that favor rapid response to market changes (Rosenbusch *et al.*, 2011; Ganther and Hecker, 2012), ability to use external contact networks, little paperwork, and technical expertise on the part of the managers (Massa and Testa, 2008).

For Laforet (2008), in general, innovation in small companies is driven by a number of factors, among which the following stand out: the prolonging of the life cycle of a product; increasing short-term gains; continuously improving product quality, process, and supply of skilled manpower; ensuring satisfaction and personal pride in success; improving working conditions; and, especially, seeking a higher profit margin.

However, as stated by Zeng *et al.* (2010), not all government policies are conducive to innovation. Some policy initiatives are effective when they focus on the need to promote cooperation between innovative SMEs and their partners.

Thus, those who create policy to stimulate innovation should emphasize creating effective institutional mechanisms to facilitate the creation of local cooperation networks for these SMEs, and establish a platform for cooperation to achieve mutual learning between partners, research institutions, and universities (Zeng *et al.*, 2010). This implies that cultivating the ability to absorb external knowledge becomes a must for small businesses that demand innovation (Fagerberg *et al.*, 2006; Forsman, 2011).

Finally, it is a common approach of innovation policies to consider small businesses as a homogeneous group. However, evidence in the literature suggests that there are significant differences between small businesses and, thus, diversity in the sectors should be taken into account (Freel, 2005; Forsman, 2011).

Some small businesses, for example, survive by competing in a niche market, while others seek more radical innovations. This diversity cannot be reduced easily to a general model (Jong and Marsili, 2006). Furthermore, according to Casanueva *et al.* (2013), the way a company presents itself before its network of suppliers and customers in certain geographic clusters may affect innovation.

Romero and Martínez-Román (2012) also claim that prior research links specifics of businesses to innovation. These characteristics are usually related to the personal characteristics of the owner, the organizational structure of the company (which includes the company's size), and environmental variables (Laforet, 2008; Romero and Martínez-Román, 2012).

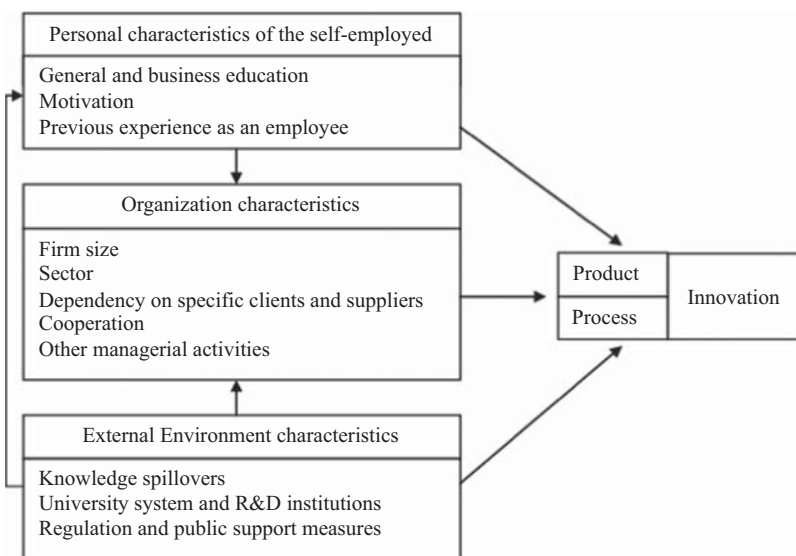
Figure 1 illustrates these characteristics.

On the other hand, each country has unique social, economic, and cultural conditions. Upon analyzing the theme in the Spanish context, for example, Romero and Martínez-Román (2012) considered small businesses to be those with fewer than 100 employees.

In the Chinese context, Zhu *et al.* considered small businesses to be those with fewer than 1,000 employees. Moreover, innovation policies commonly consider small businesses to be a homogeneous group. Evidence in the literature suggests that there are significant differences between small businesses and, thus, diversity in the sectors should be recognized (Forsman, 2011).

Finally, Raymond and St-Pierre (2010) state that innovation has been regarded as a key factor for the survival, growth, and development of small businesses. For La Rovere (1999), in Brazil, small businesses are unaware of the potential gains in competitiveness from new business opportunities associated with innovation, and only seek innovation when they are under pressure from customers and suppliers, or when business opportunities are evident.

Although the metal-mechanical sector is considered important in the Brazilian economy (Severo *et al.*, 2015, 2017) and this type of industry is examined in the literature (Kaminski *et al.*, 2008; Bouzon *et al.*, 2015; Severo *et al.*, 2017), few studies examine metal mechanics, small businesses, and innovation in a Brazilian context.



Source: Romero and Martínez-Román (2012, p. 179)

Figure 1.
Factors that influence
innovation in small
companies

2.2 *Small businesses in Brazil*

In Brazil, there are a variety of ways in which to define a small business: by specific legislation and by official financial institutions and government representative bodies. However, two different ways to classify the size of a company are considered (SEBRAE, 2003).

One follows the National Status of Micro and Small Businesses, and takes into account the annual gross income of the business for tax purposes. The other criterion adopted is the number of employees and is used especially for banking purposes, technology actions, and academic research in Brazil. The Brazilian academic criterion considers micro enterprises to be those with up to 19 employees, small enterprises to be those with 20-99 employees, medium-sized enterprises to be those with 99-499 employees, and large enterprises are those with over 500 employees (SEBRAE, 2003).

One of the major ongoing studies on entrepreneurial dynamics in the world, sponsored by Global Entrepreneurship Monitor (GEM) (2010), shows that Brazil has the largest number of new business entrepreneurs among the 17 member countries of the G20 that participated in the survey. However, SEBRAE (2011) notes that the mortality rate of businesses in the State of São Paulo (the most developed and industrialized state in Brazil) is 27 percent in the first year of activity and, in cumulative terms, 37 percent in the second year and 46 percent in the third year.

Of the 13 million Brazilian projects analyzed, 85 percent were unable to expand in the market, did not use cutting-edge technology, and did not offer innovative products, which represents a low level of competitiveness and, therefore, compromises their long-term survival (GEM, 2010).

In addition, in Brazil, small businesses have some particularities that influence their performance and demand a differentiated management process. It is important to highlight that these characteristics may vary depending on the heterogeneity between different industries.

On the other hand, for Leone (1999), even though there is great heterogeneity among small-sized domestic enterprises, it is possible to determine their most striking features. Table I presents a summary containing the main Brazilian studies on the specifics of small domestic companies.

It is important to emphasize that Table I was created from a reference that contemplates the specificities of Brazilian small businesses.

On the specifics mentioned above, note that they are not necessarily all the solutions within the reach of the administrative capacity of the small business owner. The possibility that more efficient and effective actions will arise must be reflected by the interrelationships and interdependencies among the specifics of small businesses.

Specifics related to the owner of the small business	Specifics related to the form of organization of the business	Specifics related to the influence exerted by the environment
Aspirations, ambitions and personal goals	Centralized management	Low capital intensity
Identity between the individual and the corporation	Lack of organizational maturity	Lack of market information and new products
Non-differentiation between social equity and personal wealth	Short-term time horizon	Difficulty in obtaining financing for new projects
Centralization of decisions	Lack of quantitative data	Difficulties of access training resources
Reliance on own experience to make decisions	Simple and streamlined structure	Competition with larger companies established in the market
	High degree of decisional autonomy	
	Lack of formal strategic planning	
	Less bureaucracy	

Sources: Based on Leone (1999), Terence (2002), and Migliato and Escrivão Filho (2004)

Table I.
Specifics of the small business used in the research

However, this attitude is related to the environmental specifics of the small businesses, over which they have little control, which has an impact on how they are managed (Migliato and Escrivão Filho, 2004).

In addition, small businesses may be dependent or independent. Dependent businesses are functional, and directly or indirectly complement large companies by carrying out one or several operations involved in the manufacturing process of a product. Independent businesses, on the other hand, do not maintain a direct connection with large businesses and there is no single explanation for their inclusion in the market (Souza and Mazzali, 2008).

Semensato *et al.* (2012) study small businesses in the Brazilian metal-mechanical industry from the perspective of production process dimensions. They state that, from the point of view of production process dimensions, these businesses seek to improve production processes and product quality as factors of differentiation in the marketplace.

In addition, the technical standards of the ISO series have guidelines that allow significant changes in terms of improved product quality and increased credibility of a company. In an organizational context, managers of small businesses need to verify their main competitors, which are usually large companies.

3. Research method

3.1 *Type and approach of the research*

According to the classification proposed by Cervo *et al.* (2007), this research is exploratory because it seeks familiarity with the phenomenon (practice of innovation in small businesses) through the description of a situation and the discovery of relationships among its elements (i.e. the relationships between the specifics of small businesses and the practice of innovation).

In this case, the emphasis of the research lies on the individual's perspective and what is sought is to interpret the environment in which the phenomenon occurs, which, according to Bryman (1989), characterizes the research as being qualitative in nature. The research environment (small businesses) is a natural environment for individuals.

3.2 *Using case studies as a procedure method*

The choice of the procedure method resulted from the search for deeper, broader, and more detailed knowledge using few objects (six small businesses) (Gil, 2009).

For Yin (2003), this method involves an in-depth investigation of a contemporary phenomenon (in our case, the practice of innovation in small businesses), especially when the boundaries between the phenomenon (practice of innovation) and the context (the context of small businesses/specifics) are not clearly evident. Furthermore, Yin (2003) points out that a case study involves more variables of interest than data points, multiple sources of evidence, and that it benefits from proposals for the formulation of propositions.

According to Eisenhardt (1989) and Yin (2003), there is no consensus on the optimal number of companies in a case study, but there seems to be a consensus of between four and ten companies for multiple cases. The number of six companies was set based on the researchers' time availability for visits and for the analysis of the obtained information.

Because of the heterogeneity in the metal-mechanical industry, chosen for its relevance in the region of Sorocaba/SP, we opted for businesses operating in three different areas. It is noted that the choice was made in such a way as to allow comparison, because there are two companies from each of these areas. Table II summarizes the main characteristics of the analyzed companies.

The companies were selected from the public database of the regional branch of FIESP (Federation of the Industries of the State of São Paulo) in Sorocaba. Scheduled visits

Table II.
General characteristics
of the analyzed
companies

General characteristics	Company					
	A	B	C	D	E	F
Company's age (years)	18	30	10	8	17	25
Total number of owners	1	2	1	1	1	1
Total number of employees	75	30	48	22	36	72
Main field of work	Equipment	Equipment	Service provider (machining)	Service provider (machining)	Valves	Valves
Main products	Equipment for drying areas in the ceramics industry	Thermal accumulation tanks and pressure vessels	Machining services for third parties, focusing on heavy machining	Machining, assembly and technical assistance services to third parties	Orifice plates, flow meters and valves	Orifice plates, flow meters, and valves

Source: Self-elaboration

were planned with the owners or, in their absence, the production managers. To define the size of the business, the criterion of number of employees adopted by SEBRAE was used. Thus, small businesses are those that have between 20 and 99 employees.

In this context, Yin (2003) addresses six sources of evidence commonly used in the case studies: interview, direct observation, participant observation, documents, record-keeping in archives, and physical artifacts. The author also emphasizes that the triangulation between these raises the reliability of the research, because it allows several evaluations of the same phenomenon or object.

The data were collected through semi-structured interviews and direct observations. The interviewees, as shown in Table III, were nominated by the companies and were prepared to provide the information needed to answer the research problem. Interviews with only one respondent in each case were considered sufficient owing to the size of the companies. The interviewees were shown to have the knowledge necessary to achieve the purpose of the study.

In planning the case study, prior to drafting the interview scripts, a protocol of the case study was developed. The protocol included the following: the main goal of the case study, the subject of the study (general characteristics of the enterprise), innovation and specifics of small businesses, the unit of measurement (in this case, the small company), their required information (total number of employees, major products, major customers, annual sales, source of capital, employment and personal history of the owners that led to the emergence of the company; general questions about products, processes, organizational and marketing innovation, according to OECD (2005); and specifics of the owner of the small business, those focused on the form of organization, and those focused on the influence exerted by the environment, as per Leone (1999), Terence (2002), and Migliato and Escrivão Filho (2004)). Finally, it includes sources of information on the owner of the small business or the representative appointed by the company.

Given that the subject of the case study is innovation, innovations in the last five years were evaluated in order to establish a comparative pattern between companies.

As a pre-test, pilot studies were conducted in two companies, which, despite having between 20 and 99 employees, were linked to large head offices. Based on the work of Marconi and Lakatos (2003), this step demonstrates the validity and reliability of the interview script, taking into consideration the time of interview, the commitments and restrictions of each question, and the operability and ease of understanding of technical terms.

Specifics	Company A	Company B	Company C	Company D	Company E	Company F
Centralization of decisions?	Centered on the figure of the director	Centered on the figure of the director	Decentralized	Centered on the figure of the director	Centered on the figure of the director	Centered on the figure of the director
Lack of formal strategic planning?	No transmission to the functional areas	Managers are responsible for the transmission	Transmitted via monthly meetings with departments	No transmission to the functional areas	No transmission to the functional areas	Transmitted via annual meetings with all employees
Simple and streamlined structure for innovation?	Structure promotes communication and new ideas, only	Structure needs for an employee dedicated just for this purpose	Yes, the transition of control of the company contributed to certain innovations	No, the company considers it necessary to make further investments in this direction	Yes, as there is an employee responsible for this in each sector of the company	Yes, as there is an employee responsible for this in each sector of the company
High degree of decisional autonomy?	Autonomy to change the tooling	Autonomy to stop the machine, change the process and the tooling	Autonomy to stop the machine, change the process and the tooling	Autonomy to stop the machine and change the tooling	Autonomy to stop the machine, change the process and the tooling and request inputs	Autonomy to stop the machine, change the process and the tooling
Difficulties of access training resources?	Elementary school or, depending on activity, high school	Elementary school and course by Senai or high school	Elementary school or, depending on the activity, high-school	High school and prior experience in the activity	High school	Elementary school or, depending on activity, high school
The employees work for innovation?	No. They are only involved in production	No, they just execute production orders	Yes, some are teachers at Senai and assist on innovations	No, they just execute production orders	No, they just execute production orders	Yes, but only in specific sectors of the company
Communication flows formally or informally?	Informal for production, problem solving, and information exchange	Informal for production, problem solving, and information exchange	Formal for production and informal for problem solving and information exchange	Formal for production and informal for problem solving and information exchange	Formal for production and informal for problem solving and information exchange	Formal for production and informal for problem solving and information exchange
Reliance on one's own experiences to make decisions? Lack of quantitative data?	No use of these tools	Monitoring of business performance and production	Monitoring of business performance and production	No use of these tools	Monitoring of business performance and production	Monitoring of business performance and production

Source: Author

Table III.
Specifics of the small
businesses studied

After collecting data through semi-structured interviews and direct observations conducted during visits to the companies, the analysis was carried out as follows:

- (1) the construction of the general narrative of each case through the transcription of the recordings one day after the interview, at most, and through notes taken from the observations;
- (2) data reduction through the creation of categories, taking into account the characteristics of the small business according to their specifics and type of innovation (product, process, marketing and organizational);

- (3) generation of a demonstrative board which allowed viewing and relating, for each case, the defined categories; and
- (4) the six cases studied were compared.

The data triangulation was then applied from the two different sources of data, in order to complement and assist the understanding of the real-world context, from the perspective of the researcher.

The procedures involved in the conduction of the case studies explained in this section sought to ensure the criteria of validity and reliability pointed by Yin (2003).

4. Presentation and analysis of results

4.1 *Innovation in the small businesses studied*

With regard to product innovation, only companies B, E, and F launched at least one new product in the previous five years. Companies E and F were driven by specific demands by Petrobras (*Petróleo Brasileiro S.A.* is a corporation whose majority shareholder is the Government of Brazil and is one of the leading and largest companies in the country). Company B developed new products by its own initiative in order to conquer new markets, leveraging its existing structure.

In all three companies, the products were developed mainly by the companies themselves. Company F has partnerships with IPT (Technological Research Institute), an institute linked to the Secretariat for Economic Development, Science, Technology, and innovation of the State of São Paulo, and has been collaborating for the development of the country for more than 100 years. However, specifically for Petrobras, the new product was developed exclusively by the company.

These companies were also responsible for substantial improvements in their products. In the case of companies B and E, the improvements were in order to significantly change the existing project to meet changing market demands. One of the main advantages of innovation was pointed out by Company B: “[...] when customers notice the company is innovating, they come to us, even if it is only to get a quote.”

For company F, improvements resulted from observations by the field technicians, aiming at improving the quality of the product offered to the client. The participation of field technicians in the product innovation process was considered essential by company F. This reinforces the lack of market information and new products as one of the main elements of the specifics related to the influence exerted by the environment, according to the framework shown in Table I.

None of the companies have obtained patents, to date. Although the products are innovative for the companies, they are not innovative in the market. However, company E is developing a specific valve for the auto industry, which will generate a patent and will allow the beginning of serial production. With respect to the percentage of capital reserved for new product launches, companies B and E say they invest around 8 to 10 percent, respectively, in internal research for new product launches.

The other companies do not have specific percentages reserved for such activity. Company F claimed to develop new products according to sales prospects: “[...] in this case, to support the decision of whether or not to launch a new product, feasibility studies are carried out taking into account the costs of processes and internal tooling and equipment needs.”

Concerning process innovations, all studied companies presented some degree of innovation, from launching a new product or substantially improving an existing product, starting from the perspective of a manufacturing method or production of goods. It is important to stress that none of the new products boosted their innovation processes. In particular, this issue demonstrates low capital intensity, related to the influence exerted by the environment according to Table I.

Process innovation did not require large amounts in terms of equipment except for company B, but a greater technical expertise was demanded from employees due to the introduction of the submerged arc welding system.

Although company B did not acquire new equipment, it developed a new internal process to paint the inside of welded parts to protect the inner part of the equipment from rusting. This measure was a condition established by Petrobras to keep company B as the supplier and aims to meet the safety regulations for their employees during field activities.

On the other hand, for company C, the acquisition of new equipment allowed its entry into the segment of heavy machining, but it was necessary to make a considerable investment in equipment and training in order to adapt to this new market. This reinforces the difficulty of obtaining financing for new projects, according to Table I.

As for substantial improvements, companies A and D perfected their methods of internal logistics with the introduction of new forms of handling materials. Both made considerable improvements with their new internal logistics methods. Company A, for example, said that “before these changes they had five employees and deadlines were often not met. Today they have three employees, who manage to meet the deadlines.”

For company F, the innovation processes made the company competitive. The manufacturing process of one of their products, the plate holder, was completely reworked with the purchase of CNC equipment, changes in the physical arrangement, and in the staff. The production time of the product decreased by around 16 hours.

With regard to technological innovations, it is worth mentioning the role played by Petrobras, which, on the one hand acts as a financial partner for the development of new products and process innovations in the studied companies (B, E, and F), and on the other, exercises predatory pricing in relation to these companies.

Company E’s statement summarizes this point: “[...] Petrobras is an important partner to take on new product development contracts, however, profit margin with them is minimal or nonexistent, but it is still important to have them as customers because it works as a business card – if we can supply to Petrobras, we can supply to any company in Brazil.” This shows a dependence on a large client-partner, a specificity not identified at first in Table I.

On issues related to organizational innovation, only company A did not develop any initiatives or have any interest in developing a new business model. The other companies have this concern, and pointed to the importance of efforts to make it effective.

Company B has plans to develop a hyperbaric clinic linked to the medical field, and this represents the entrance of the company into a completely different segment of activity to the current metal-mechanical field of activity of the company.

Companies C and D argued that because they do not have their own products, they constantly have to develop new businesses owing to market fluctuations. In addition to having entered the heavy-machining segment, which demanded large effort in terms of investment and training, company C is entering the business of providing boiler services. Despite being linked to the activities of the metal-mechanical industry, these services demand different labor from that in machining services.

According to company C, the implemented organizational innovations have had a great impact on the quality of the company: “[...] all of these actions are geared towards having a better and faster quality of information. To increase the company’s flexibility and reduce losses, one needs to have quality and speed of information.”

Company D, in turn, is beginning to provide technical assistance for the equipment it manufactures to its major customer. Currently, the company is the largest specialist in band saw machines in Latin America and has expanded to a new type of service, owing to this specialty.

Company E is at development phase of a project to launch its pioneering service in serial form for the automotive industry. According to the company, if the project is confirmed,

there will be considerable changes in the company's businesses, particularly in terms of investment in equipment, certifications and training of plant staff.

Company F, in turn, will launch a new form of work organization for special projects. According to the company, demand with defined deadlines are common and, as a way to balance the hiring and firing of employees due to fluctuations in the demand for labor force, it will resort to ad hoc teams. Both companies E and F reinforced that the search for new business models is a key factor for business survival.

With regard to the implementation of a new marketing method, it was possible to notice that, except for company F, little has been done to achieve significant improvements or innovations in product design, packaging, promotions or new sales platforms.

Companies A and D carried out specific actions, such as the creation of a promotional video and of a site, respectively. However, neither of the companies pointed out a specific marketing plan, or new actions planned for the following year. Companies B and E said that in recent years they invested heavily in product, processes, and training of their employees and consider they have reached a level where they can intensify investments on marketing.

Company C showed changes in the way they present their product to customers by developing a new packaging label and logo of the company in order to promote product quality, according to the respondent, though there was no explicit customer demand for this.

In turn, company F has sought a closer relationship with their customers and to create new ways of promoting their products, and so adopted a policy, according to the company, "of starting in loco testing of their new products as a way to improve them and disclose them in the industry in which they intend to invest."

In general, we found few instances of training focused on innovation. The main difficulty in conducting such training is the high cost of a professional expert and the difficulty in finding someone with knowledge that will add something new to these companies. Furthermore, it was observed that companies practice an informal policy of promoting internal training, where more experienced employees teach those who are less experienced about the equipment to ensure minimal operational flexibility in the production.

These factors are related to the form of organization of the business. Although the high degree of decisional autonomy is a characteristic identified in the literature in Table I, in the present research, low autonomy of decision-making was identified for the employees, and the difficulty in finding qualified professionals or providing adequate training reinforce these barriers.

Similarly, although all companies claimed that their factory employees are eligible to contribute directly or indirectly to the development of innovations, it was not possible to verify innovations derived from the factory or to verify the existence of a formal program of collecting contributions from the production team by the management.

Finally, in relation to the specifics of the studied companies, Table III summarizes the main information obtained.

4.2 Specifics of small businesses as limiting factors for innovation

All of the categories studied are facilitating factors. The first category, which focuses on the owner of small businesses, showed the aspirations, ambitions, and personal goals of the owner as important stimuli for innovation, whether as an attempt to promote growth or to strengthen the company. This factor, along with the centralization of decisions and their confidence in using their experience to make decisions, reinforces the figure of the business owner and their importance.

Because the studied companies possess technical knowledge on the business and the power to decide on investments, the owners of these small businesses become a central element in the whole innovation process. This can be summarized by the response obtained from company A: "[...] the company owner had been the designer for a competitor in the same field.

Because he had the technical knowledge for the product, he decided to start his own business. Initially, the machines were small and he had few employees. Currently, the company diversified its production and has more than 70 employees.”

Moreover, the specifics with regard to business organization, such as the simple and streamlined structure of the companies and their less bureaucratic functioning, favor the relationship and communication among departments, as well as the innovation process, which corroborates the issues identified in the literature through Table I.

The answers obtained suggested that the division of the organizational structure into departments establishes well-defined functions and facilitates the exchange of information and experiences, being a contributing factor to innovation.

The answer provided by the owner of Company D represents this view: “[...] I consider the agile communication and the leaner and more centralized structure of the company one of the main advantages over large companies. It is one thing to talk directly to the owner, and another to have to go to a departmentalized business that demands multiple acceptances. Besides, one may speak directly to those who hold the technical knowledge and avoid delay in getting a response, as they do not have to wait for several technical consultations with other departments. This allows technical suggestions to be made directly to whom holds the power of decision on investments.”

However, with regard to the centralization of decision-making by the director, as identified in Table I, there is no consensus in the responses obtained on whether this centralization promotes or hinders innovation: it sometimes accelerates project development and production, depending on the owner’s expertise, and sometimes works as a barrier, as pointed by companies A and F: “[...] when decisions necessarily need to pass through the approval of the owner, things are held back in their absence, or when they travel or have other commitments and there is no one else with the power of decision to replace them.”

Specifics with regard to environmental influences were also present in virtually all businesses, especially with regard to competition with large, established companies in the market. In addition, albeit on a smaller scale, there is also an influence exerted by customers in relation to specific product demands or organizational adjustments.

For the surveyed companies, Petrobras’s approval of the supplies was a major commercial milestone for the companies within the metal-mechanical industry. Although the companies have high technical standards and supply requirements, three of the companies surveyed (B, E, F) stimulated new training and encouraged innovation activities.

Barriers to innovation related to environmental influences include low capital intensity, lack of market and new product information, difficulty in obtaining funding for new projects, and difficulty of access to sources of training, and were recurrent in all studied companies.

Responses obtained from company C “[...] we work with large pieces that require space. The greatest difficulty is comes from the fact that the company does not have a proper shed, which hinders the internal expansion of the company. Externally, the main difficulties concern the government, who does not stimulate activity through incentives that would facilitate investments on innovation” and company D “[...] the company needs more investments, however there is the fear of not having the expected return or of making a high investment in a single project or in a single purchase and the customer not returning to buy the same product” illustrate this perspective.

In addition to these specifics, those related to the organization of the business are also barriers to innovation, including the lack of organizational maturity, the short-term time horizon, the lack of quantitative data, and the lack of formal strategic planning.

The exchange of information with key customers in order to develop new projects occurs through reactive actions, depending on customer demand, with intense exchange of technical specifications, questions, and constant renegotiations on design and delivery deadlines.

Company C summarized this view in the survey: “[...] the customer needs something and you need to quickly answer yes or no during the negotiation. If the answer is yes, we then need to see the necessary steps to deliver it.”

On the other hand, suppliers were considered by the companies to be their partners in terms of innovation, regardless of the size of the business. However, the contributions observed were to reduce costs, replace materials, and respond to operational questions.

This relationship is illustrated by the responses obtained from both company A “[...] there is not a chain. We buy from those with the best possible price, terms of payment and delivery. We aim at some warmth and flexibility with our customers because they may change suppliers. So, I don’t see a relation of partnership with customers or suppliers”, and company F “[...] in relation to suppliers, we have some specific partners, but we generally buy from the cheapest and the one with the shortest delivery periods and so I do not consider suppliers to be our partners in the development of innovations.”

Management software is noted as an important element for cost reduction in materials management, optimization of activities by employees, and improving the quality of products and processes. Apart from the software, the acquisition of equipment allows companies to enter new markets, which is a major driver of growth. However, there is a lack of knowledge with regard to possible funding sources for the acquisition of new equipment aimed at innovation.

Similarly, in relation to the specifics related to the environment, the availability of capital is shown to be a decisive element in the research. The rate of return on investment in innovation activities was a recurring theme, owing to the low intensity of capital and difficulties in obtaining financing. Furthermore, there seems to be a consensus on the part of these entrepreneurs that the government offers little support for small businesses in terms of innovation.

Figure 2 consolidates the results obtained by the research.

5. Conclusion

The main goal of this study was to identify the factors in Brazilian small businesses in the metal-mechanical industry facilitate or hinder innovation.

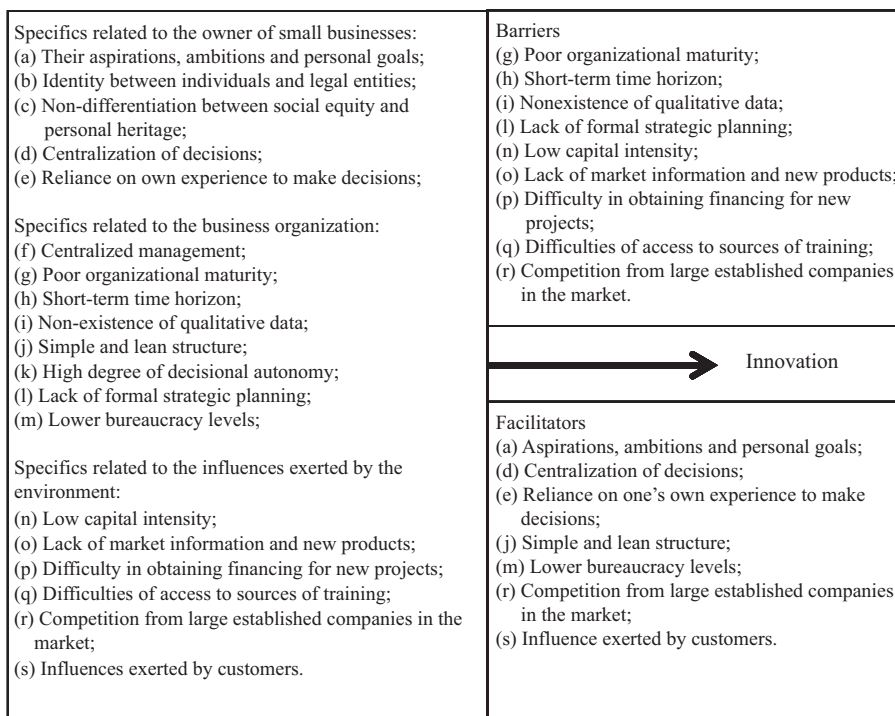
In general, small businesses fail to meet the conditions necessary to fund internal research and development activities, either because of a lack of resources or a lack of production scale to justify the costs and risks of R&D. The results of the study reveal the factors that can boost or block innovation in small enterprises in Brazil.

The lack of strategic planning for innovation by the studied companies points, among other factors, to the lack of a culture focused on innovation. These companies are primarily manufacturers (A, B, E, and F) and service providers to manufacturers (C and D). Innovation is seen as a necessary risk, but when there is a market or demand, innovation is relegated to the background.

The strategic reorganization and rationalization of productive resources through competitive priorities may lead to innovation in different spheres, as was observed in some of the studied companies, helping to increase the competitiveness of the enterprises and to strengthen the national economy.

Moreover, a better understanding of the context of small businesses, given their fragility in the input of capital, contributes to new perspectives of better development and the strengthening of these companies, both from a national and an international perspective. The need for a program to publicize opportunities for capital to small businesses in Brazil is evident, given the ignorance of the companies in that respect.

Another contribution of the research is that it provides a basis for future public policies in Brazil to stimulate innovation in small businesses. This will establish a possible gap with regard to the lack of knowledge/publicity of public programs of incentives for innovation,



Source: Author

Figure 2.
Influences on product
innovation

the difficulty in finding technical training programs and managerial programs, and the existing gap between companies and research centers and universities.

Furthermore, the potential of partnerships with large state enterprises and public policies to stimulate innovation can be better used to enhance outcomes in small enterprises in Brazil.

The findings are not conducive to generalization. Although a multi-case study was carried out, there is a great diversity when it comes to companies in the metal-mechanical industry. However, it is believed that the work complied with the proposed objective, even if it is possible to delve deeper into the complex relationship between the specifics of small businesses and innovation.

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