*Gest. Prod.*, São Carlos, v. 24, n. 2, p. 206-220, 2017
http://dx.doi.org/10.1590/0104-530X1048-13

# The impact of diversification in the operations strategy of capital goods companies

## *O impacto da diversificação na estratégia de operações de empresas de bens de capital*

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**Abstract:** Considering that the analysis of the specific areas technology and market is reported in the literature as the main elements in the decision making process of diversification and the operations strategy, these have to reconcile the technological base with the market demand. This paper examines the impact of diversification in operations strategy in 3 multinational leading capital goods companies. The main contribution of this study concerns the understanding that different processes of diversification can help to expand the share of the company in the same market with new products based on the same technology and can help the company to enter in a new market with new products, based on different technologies. Therefore, the process of diversification of firms should be analyzed from the perspective of a growth strategy based on knowledge, so that the management of this resource should occur in conditions of maximum efficiency.

**Keywords:** Diversification; Specialization areas; Technological base; Operations strategy.

**Resumo:** *Considerando que a análise das áreas de especialização, tecnologia e mercado nos quais a empresa atua, é apontada na literatura como elemento principal no processo decisório da empresa que pretende diversificar suas atividades e que a estratégia de operações tem como desafio conciliar a base tecnológica com as necessidades do mercado de atuação, este trabalho analisa o impacto da diversificação na estratégia de operações em 3 empresas multinacionais líderes de bens de capital que atuam no Brasil. A principal contribuição do estudo diz respeito ao entendimento de que diferentes processos de diversificação podem ajudar a expansão da empresa no mesmo mercado por meio de novos produtos baseados em diferente base tecnológica ou podem ajudar a empresa a entrar em um novo mercado com produtos totalmente novos e de diferentes tecnologias. Portanto, os processos de diversificação das empresas devem ser analisados sob a ótica de uma estratégia de crescimento baseada no conhecimento, de tal modo que o gerenciamento desse recurso deve ocorrer em condições de máxima eficiência.*

**Palavras-chave:** *Diversificação; Áreas de especialização; Base tecnológica; Base de mercado e estratégia de operações.*

## 1 Introduction

The increasing competition and the rise in global competitors have made it difficult for companies to grow. Frequently, they need to reduce their margins or apply efforts in strategic adaptations in order to be more competitive or strive in a specific market.

According to Paiva et al. (2009), an option that many companies choose when they want to grow is the diversification of activities, which may occur through the stretching of their product mix, market diversification or horizontalization.

The diversification process has internal and external implications to the company, which involves several aspects, from the availability of productive resources, such as machinery, processes, skills and materials, to the knowledge of the needs and demand of the new consumer market in which the company intends to operate (Penrose, 1959; Singh et al., 2010; Wiersema & Bowen, 2008).

The challenge to the companies that choose this process is mainly related to the coordination of their activities and the evaluation of the possibility of acquiring companies or product technologies for diversification. This way, they may effectively compete in several markets, which are oftentimes correlated

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Received Oct. 25, 2013 - Accepted June 18, 2015

Financial support: None.

due to the possible differentiated productive structure needs, as well as the behavior of the consumer market.

The main point in the diversification process is to identify in which way the relation between market and technological base will occur. According to Penrose (1959), these areas may take three forms:

a) Operation in a new market, with new products, using the same technological base;

b) Expansion in the market in which it operates, with new products, based on a technology that is different from its current one;

c) Introduction in a new market, with new products, based on a different technological area.

This study analyzes the impact of diversification regarding the operations strategy of 3 multinational market leaders of capital goods operating in Brazil. The analysis of the areas of specialization, technology and market in which the company operates is regarded as the main element in the decisive process of the company that intends to diversify its activities. The operations strategy also has the challenge to conciliate the technological base with the needs of the operating market.

To do so, this work evaluates the impact of resources and competencies (internal perspective) and the consumer market demand (external perspective) in the operations strategy of companies which have undergone diversification processes.

This paper is divided into seven sections. Section 2 reviews the literature on diversification, while Section 3 discusses the operations strategy. Section 4 describes the method applied in this research. Section 5 presents the compilation of the data, and Section 6 finally examines the results. The final considerations are presented in Section 7.

## 2 Productive diversification and RBV

Penrose (1959) states that companies diversify their productive activities whenever they start producing new products, without completely abandoning their previous product lines. These new products are sufficiently different from the ones produced in order to present some significant modification in the programs of production or distribution of the company. This way, diversification includes increments in the range of final products, vertical integration and number of basic areas of production in which the company operates.

The definition of diversification affirms that there is an increase in the number of basic areas of production in which the company operates. The way companies diversify their activities determines which will be the new basic areas. Subsequently, they carry out a diversification strategy due to the internal resources and market in which it is inserted.

According to Brost & Kleiner (1995), diversification can be simply defined as the beginning of a new business activity through an existing company or business unit. Thenceforth, the input method in the new business (acquisition, internal development, etc.), the driving forces for diversification (such as synergy, sharing of resources, risk reduction), and the relationship levels between the product line which of the company commercializes and the current market with the products and market of the new business are aspects that will determine all the process.

Several authors (Doving & Gooderham, 2008; Kor & Leblebici, 2005; Mota & Castro, 2004) mention the comprehension of the reasons why companies diversify and how it affects the management of their resources. These authors highlight that the strategic decisions for diversification tend to be oriented by organizational factors (internal resources), such as marketing structure, availability of their own technology, protection by patent and environmental factors (external) as a technological opportunity presented to result in a new product.

The issues of how and why an organization diversifies have indeed been the main area of study regarding strategy (Singh et al., 2010; Wiersema & Bowen, 2008). Diversification is related to how products and services are launched, based on the resources and capabilities of the companies (Penrose, 1959; Rumelt, 1974; Teece, 1982).

According to Penrose (1959), the relevant aspects in the process of diversification are: the analysis of the areas of specialization, the identification of specific opportunities for diversification, R&D, the use of sales efforts, the evaluation of the technological base and the acquisition of firms.

Penrose (1959) defends that the areas of specialization, i.e. resources and competences, may define the success of the diversification project. These areas are defined by the types of production and market in which the company has its base of operations.

Productive activities that use abilities, processes, raw materials, and specific machines for a production process are the base of production or technological base of the company. On the other hand, the group of consumers that the company intends to influence with the same program or sales plan is called market of operation.

Hence, the diversification process may involve the production of products that use the same technological base or their operation in a market where these products are already present. The evaluation of these aspects may be a defining factor in the process as it is directly related to the capacity the company has to explore its resources and competences.

The change in the productive processes of the suppliers, the knowledge acquired by the company, changes seen in the market, and innovation possibilities are specific opportunities for diversification. Said opportunities drive the companies to this process;

however, it is not possible to specify how profitable it will be to invest in new opportunities, which leads several of these companies to ignore these opportunities in order not to expose themselves to this risk.

Nevertheless, research for new materials and new methods and means of production, i.e. the exploration of dynamic capacities of the company, may generate new needs or anticipate tendencies in the market. These processes generate diversification through innovation by producing new versions of products.

The use of sales efforts to promote new products brings the advantage of a pre-established relationship with the client, which newcomers do not have. This relationship contributes to the diversification process due to the possibility to adequate, develop and offer recently purchased products, also solving customers' problems.

Despite the possibility of success of diversification based on its strong presence in a specific market, the company must have or seek development of its technological bases. In other words, it must improve its capacities in order to acquire abilities which support its entrance and positioning in new differentiated technology fields, whether it be materials, processes or products. In cases where changes in the technological base are needed, the acquisition of companies which have it is fairly common.

Therefore, the analysis of the specialization area is seen as a key element in the decisive process of the company that intends to diversify its activities. The challenge for the operations strategy is equalizing a possible trade-off between the technological base that involves capacities, resources and competences, and also the needs of the market.

## 3 Operations strategy and RBV

Slack & Lewis (2001, p. 15) state that:

> [...] operations strategy is the total pattern of decisions that forms the long-term capacities for any type of operation and its contribution for the whole strategy, through the conciliation of the needs of the market and operation resources.

This concept is illustrated in Figure 1.

This way, the operational strategic management must be alert of the needs of the market, and mainly to the capacities or operations resources which will allow such conciliation (Slack & Lewis, 2001).

Thus, we can see the concept of operations strategy comes from two theoretical fields: the market-oriented view basically represented by the work of Porter (1996) and the view based on resources, having the studies by Penrose (1959), Barney (1991) and Rumelt (1974) as pioneers.

Teece et al. (1997) indicate the importance of analyzing resources and capacities as core elements of the operational strategic management, quoting the need of analyzing how the performance and results of the company are related in order to align them to their strategic objectives.

In fact, as Santos et al. (2011, p. 793) state, "[...] using the principles of RBV does not mean abandoning the market-oriented view, but integrating both approaches in a more balanced (strategic) formulation process".

Performance criteria, also known as competitive dimensions or competitive priorities, were originally coined by Hayes & Wheelwright (1984), such as cost, quality, reliability and flexibility. Afterwards, Hill (2000) introduced the question related to speed. These criteria, which are originated from the market-oriented view, are the basic elements to guarantee competitive advantage from manufacture. This happens because, through its application, it is possible to transmit the important aspects regarding competitiveness to the clients, as well as determining the measure of performance and necessary improvements, assessing the competitors' performance (Slack et al., 2002). Dangayach & Deshmukh (2001) propose the introduction of the issue of innovation.

Paiva et al. (2009) discuss whether this would be a specific competitive criterion or a basic criterion

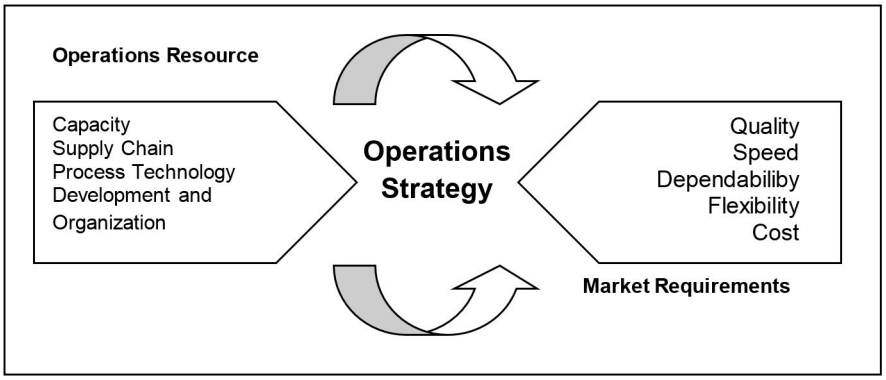


**Figure 1.** Operations strategy reconciles the needs of the market with operation resources. Source: adapted from Slack & Lewis (2001).

to support the others, in relation with innovation. On the whole, its application and results present improvements in the other criteria, i.e. the improvement of a specific criterion may be the result of some innovation applied to the process, or even to the product.

The authors also highlight that improvements in quality performance, cost, speed, reliability and flexibility are related to process innovation, while product innovation, such as the company's objective, would qualify it as a criterion of competitive performance, with defined goals regarding the development of new products.

According to Paiva et al. (2009, p. 45), it is important to understand that the company must guide its decisions and internal actions coherently, due to the strategic approach of operations and the practical definition presented by Slack et al. (2002), in which operations strategy is outlined through the choice of the most relevant performance criteria to meet the needs of the market. This should be done so that, over time, these actions and decisions become a source of competitive advantage in that dimension or in the dimensions that the company chose to compete.

The needs of competitive advantage focus on the performance objectives to be achieved by the operations area. In order for these objectives to be achieved, it is necessary to develop a standard of actions related to a set of decisions (Maia et al., 2005).

Wheelwright & Hayes (1985) classify decisions into nine categories (structural and infrastructural), as described below:

a) Capacity: related to the capacity of the installations, determined by the plan, equipment and human resources;

b) Facilities: related to the decisions on geographical place, type of productive process, volume and lifecycle;

c) Equipment and technological processes: they range from the equipment used to productive processes (by project, job shop, assembly line or continuous flow);

d) Vertical integration and relationship with suppliers: related to the decision between producing and purchasing;

e) Human resources: they operate on existing policies in order to keep staff motivated and working in teams to achieve the company's goals;

f) Quality: there should be a management which specifically assigns responsibilities, tools for decisions, measurements and control that will be used and which training systems will be instructed to promote continuous improvement;

g) Scope and new products: they refer to the management and introduction of new products and operations from the product range and processes used;

h) Managerial systems: they must support the decisions taken and their implementation. They require planning, control, operational policies, lines of authority/responsibility;

i) Inter-functional: related to the managerial systems and mechanisms which enable the integration with several functional areas.

Based on the relevant performance criteria for the company to meet the needs of the market and the resources that the company has, strategic management will be able to evaluate each category and make the appropriate decisions. Still according to Wheelwright & Hayes (1985), the categories of decision will allow companies to evaluate the necessary time to advance within the identified changes, establishing an action plan in order to reach and keep the levels established for performance criteria.

Therefore, according to the view of RBV, operations strategy is related to decisions, management and the exclusive mix of resources, competences, capacities, processes, and technology in order to create products and services which meet the consumer's needs (Maia et al., 2005).

## 4 Methodological procedures

This study was defined as a qualitative and exploratory research considering the way of approaching the problem under study, which discussed the impact of the internal and external variables in the operations strategy of companies that were undergoing a diversification process.

The qualitative research presents the following characteristics: the research observes the facts from the view of a person within the organization, the research seeks a profound comprehension of the context of the situation and the research emphasizes the process of happenings, i.e. the sequence of facts along the time (Flick, 2004).

Concerning the means, we used a case study with in-depth face-to-face interviews complemented by bibliographical researches in journals, research reports and class institutions (Voss et al., 2002). According to Yin (2007), the essence of a case study is that it tries to enlighten a decision or a set of decisions: why they were made, how they were implemented and which result they obtained.

The criticisms regarding the method chosen are mainly related to the impossibility to replicate the scientific research and generalize results. However, the objective of the method is to allow theoretical generalizations, which may be achieved by carrying out another case (Easterby-Smith et al., 2002; Voss et al., 2002).

The companies participating the study are from the sector of capital goods due to the particular characteristics of this sector, described by Avelar (2008), such as the diversification of products.

The strong correlation between capital goods companies and their customers contribute to the understanding of other correlated sectors, and its role as a broadcaster of new technologies and facilitator of economic growth, as it participates in all the productive chains of the economy by supplying machinery and equipment. The outcomes due to the manufacture of capital goods result, in a higher or lower degree, in the incorporation of new technologies which are transferred to their clients.

In order to mitigate the possibilities of distortion in information capitation, as recommended by Eisenhardt (1989), 15 face-to-face interviews were carried out. They were later complemented by e-mails and phone calls with executives from different hierarchical levels of the companies (top and middle management) related to manufacturing and sales. These executives were aware of the strategic vision and history of the company involved in the diversification process and adaptation of its operations strategy.

Initially, the 5 market-leading companies, with innovation in CNAE 291 (motors, pumps and compressors) operating in Brazil were invited to participate in this study. However, only 3 of them agreed to take part. All the companies are from the metallurgic area, manufacturers of middle-range and large machinery and equipment, and companies B and C also operate in the mechanic area.

We agreed not to disclose the names of the companies, as well as their brands; however, all information described in the studies resulted from the interview, observation and institutional material obtained in the researcher-company interaction.

Company A, a multinational that belongs to a Scottish group, manufactures middle-range machinery, besides manufacturing and commercializing hydraulic equipment. It has 2 factories located in the state of São Paulo. One unit manufactures centrifugal slurry pumps, centrifugal pumps for clean products and hydrocyclones; the other produces valves, rubber parts used in centrifugal slurry pumps and hydrocyclones, as well as rubber liners.

Company B, a German multinational, designs, produces and commercializes centrifugal pumps for the industry and mining, gate valves, sphere valves, ball valves, globe valves, butterfly valves and retention valves, hydraulic systems and related services.

It has factories in Várzea Paulista, Barueri, Americana and Vinhedo; regional offices in Belo Horizonte, Fortaleza, Macaé, Manaus, Recife, Rio de Janeiro and Salvador; and it has service centers in São José dos Campos, Manaus and Recife.

Company C, currently a Finnish multinational, has been in Brazil since 1919, when it began its casting activities. Acquisitions from other groups promoted diversification processes, which resulted in its current framework. The company now operates as a manufacturer of equipment for the segments of mining, construction and recycling.

Its industrial park is located in Sorocaba, in an area of 44,000 $m^2$ – considered its headquarters in South America; however, the company has sales outlets and service centers in Pará, in the cities of Belém and Parauapebas, and in Minas Gerais, in the city of Belo Horizonte.

A research protocol based on the theoretical propositions discussed throughout this text was elaborated to construct the data analysis plan, as the dimensions of the diversification process and operations strategy have been investigated. A semi-structured interview script was used to guide the interviews considering the following constructs, which would be object of the investigation (Chart 1).

As it was exposed in the theoretical framework, the diversification process is characterized by how companies operate from their specialization areas – market base and technological base, which determine the type of diversification. The market base represents the market in which the company operates or intends to do so, characterizing the external variables of the diversification process, while the technological base represents the internal capacities that the company has, characterizing the internal variables.

This way, in this study, the analysis of the impact of the internal and external variables in the operations strategy of companies which were in a diversification process was initially carried out by identifying the type of diversification. Afterwards, its influence in the operations strategy was identified.

The relation between the areas of specialization and operations strategy was measured through competitive criteria and categories of decision. The competitive criteria sought to translate the needs of the market in which the diversified company operates – market base, focused on manufacture performance, while the decision categories contributed to evaluate the changes in the company's technological base.

We used the competitive criteria proposed by Slack & Lewis (2001), specifically, by the conciliation approach between manufacture resources and the needs of the market. Aspects related to innovation were considered as base criteria of performance, source of improvement for the competitive criteria.

## 5 Compilation of cases

In spite of not having an identical diversification history, the companies under study present some similarities regarding their diversification processes. Due to the several types of products, the analysis was carried out in two stages: the first was type of occurrence, verified throughout the history of the

company, mentioned by Paiva et al. (2009) as a stretching of product mix, market diversification or horizontalization; the second was the relation between the areas of specialization, market base and technological base, mentioned by Penrose (1959). The latter focused on products and current operation markets.

Table 1 shows the diversification process of the companies under study regarding the type of occurrence. It is important to highlight that a company may be classified as different types, given the diversity of products and diversification sources.

Regarding the areas of specialization, Table 2 presents the operation based on the parent products produced, i.e. the settings variations and the operation markets of the company were not taken into consideration. This indicates in which bases diversification occurs by each product.

In order to properly classify the relation among product, company and diversification process, we used the letter "x" to indicate, in the diversification process, in which diversification area the company operates for the product of the line in reference. The white cells show that the company does not operate in that specialization base for that product. Number "0" indicates that the company considers the product part of its main business, and it does not result from any diversification process and "NA" shows that the company does not produce the product from the line in reference.

After identifying the type and occurrence, and also the relations among the specialization areas, another relevant aspect we need to observe in the diversification process is its source. This analysis was carried out based on the elements indicated by Penrose (1959). For the products identified as result from diversification (Table 2), Table 3 classifies these elements as: analysis of specialization areas (SA); identification of specific opportunities for diversification (SO); industrial research (IR); use of sales efforts (SE); evaluation of the technological base (TB); and acquisitions (AC). The '0" indicates that the product is considered by the company as a parto f your core business and not a resulto f some diversification process.

**Chart 1.** Research protocol.

| Research context | Unit to be studied | Elements of Analysis |
|---|---|---|
| Three capital goods companies from the state of São Paulo.<br>Sources of information:<br>(a) consultation of documents from Abimaq and the companies.<br>(b) face-to-face interviews with manufacture and sales executives | Unit of analysis: diversification process analyzed through the aspect of operations strategy of the companies. | (a) Types of occurrence: stretching of the product mix, market diversification or horizontalization.<br>(b) Relation among areas of specialization, market base and technological base: products and operating markets.<br>(c) Sources: areas of specialization, identification of opportunities, industrial research, sales efforts, evaluation of the technological base and acquisitions.<br>(d) Performance objectives: quality, speed, reliability, flexibility and costs.<br>(e) Categories of decision: capacity, installations, equipment and processes, vertical integration and relationship with suppliers, human resources, quality, new products, managerial systems and inter-funcionality.<br>(f) Innovation and learning: sources and types of innovation, types of registrations and staff capacitation. |

Source: Authors.

**Table 1.** Diversification process of the companies under study regarding occurrence.

| | Company A | Company B | Company C |
|---|---|---|---|
| Stretching of product mix | x | x | x |
| Market diversification | x | x | x |
| Horizontalization | x | - | x |

Source: Authors.

**Table 2.** Diversification process of the companies under study regarding areas of specialization.

| Parent product | Company A | | Company B | | Company C | |
|---|---|---|---|---|---|---|
| | Market | Technological | Market | Technological | Market | Technological |
| Water pumps | x | x | 0 | 0 | | NA |
| Gear pumps | x | x | | | | NA |
| Slurry pumps | | | - | x | - | x |
| Valves | x | x | - | x | - | x |
| Hydrocyclones | | | | NA | | NA |
| Mills | | NA | | NA | - | x |
| Mill liners | - | x | | NA | - | x |
| Crushers | | NA | | NA | - | - |
| Sieves and screens | - | x | | NA | - | x |
| Second crushers | | NA | | NA | x | x |
| Impact crusher | | NA | | NA | x | x |
| Ore conveyor | | NA | | NA | - | x |
| Metal grinder | | NA | | NA | x | x |
| Metal press | | NA | | NA | x | x |
| Recyclable materials separation | | NA | | NA | x | x |
| Dust protection | | NA | | NA | x | x |
| Spare parts | - | x | - | | | |
| Rubber parts | x | x | - | | | |
| Rubber liners | x | x | | NA | x | x |
| Cast parts | | NA | - | x | | |

Source: Authors.

Similarly to the previous table, the cells with "x" indicate the diversification process, which are the sources that generated it.

Identifying the type of diversification, its source and the relations among the specialization areas, it was necessary to understand how they relate to the operations strategy of the company. We initially evaluated, through competitive criteria, how companies analyze the performance of their manufacture when they begin a diversification process in detriment to the needs of the market and the performance of the competitors.

Based on the interview, it is possible to represent the aspects considered by the companies, and also ponder the order of importance given by each of them. The unchecked frames in Table 4 represent criteria which were not directly evaluated in their plans.

Bearing in mind the range of products and the characteristics observed in Table 2, the analyses carried on considering the product centrifugal pump, as it is a common product to all the companies and has the highest sales percentage.

For company A, which has centrifugal pumps as its main product, the diversification process for centrifugal water pumps was evaluated. For companies B and C, the process for centrifugal slurry pumps was evaluated.

The data from the interview were organized in Tables 5, 6 and 7 – each table respectively presents the relations evaluated for each company, indicating the needs of the market converted into competitive criteria. Therefore, it is possible to evaluate the adaptation of the operations strategy to the diversification process.

The need of the market was identified based on the characteristics described by the companies, which were identified in the requests they receive from their clients. The position of the company was determined by observing the productive processes, the view of the company regarding its performance and the analysis of the processes which were lost to the competition.

Tables 5, 6 and 7 contributed to show whether the actions taken in the operations strategy allowed the adaptation of the technological base, based on the position of the respective companies to each competitive criterion.

As Tables 8, 9 and 10 show, the actions taken in order to adapt the technological base were evaluated based on the criteria observed.

The evaluation of the productive structure has not been carried out for the last products attached to the current scope. The last verification of the productive structure based on the comparison between the current structure and the needs identified by the market, through the categories of decision, took place to implement a new factory. In this regard, we can see an adaptation of the technological base for all the categories of decision (Table 8).

**Table 3.** Sources of diversification processes of the companies under study for each product.

| Parent product | Company | Diversification sources | | | | | |
|---|---|---|---|---|---|---|---|
| | | SA | SO | IR | SE | TB | AC |
| Bombas de água | A | - | - | - | x | x | x |
| | B | 0 | 0 | 0 | 0 | 0 | 0 |
| Bombas de engrenagens | A | - | - | - | x | - | x |
| Bombas de polpa | A | 0 | 0 | 0 | 0 | 0 | 0 |
| | B | x | x | - | x | - | x |
| | C | - | x | - | x | - | x |
| Válvulas | A | x | | - | x | - | x |
| | B | x | x | x | x | x | - |
| | C | - | - | - | x | - | x |
| Hidrociclones | A | 0 | 0 | 0 | 0 | 0 | 0 |
| Moinhos | C | x | x | - | x | x | - |
| Revestimento de moinho | A | - | x | x | x | x | - |
| | C | x | x | x | x | x | - |
| Britadores | C | 0 | 0 | 0 | 0 | 0 | 0 |
| Peneiras e telas | A | - | x | x | x | x | - |
| | C | - | x | x | x | x | - |
| Rebritadores | C | x | x | - | x | x | - |
| Impactadores | C | x | x | - | x | x | - |
| Transportadores de minério | C | x | x | - | x | x | - |
| Trituradores de metal | C | - | x | x | - | x | x |
| Prensas de metal | C | - | x | x | - | x | x |
| Separação de recicláveis | C | - | x | x | - | x | x |
| Proteção contra pó | C | - | x | x | - | x | x |
| Peças de reposição | A | x | x | - | x | x | - |
| | B | x | x | - | x | x | - |
| | C | 0 | 0 | 0 | 0 | 0 | 0 |
| Peças de borracha | A | x | x | x | x | x | - |
| | B | - | x | - | x | - | x |
| | C | 0 | 0 | 0 | 0 | 0 | 0 |
| Revestimento de borracha | A | x | x | x | x | x | - |
| | C | x | x | x | x | x | - |
| Peças fundidas | B | x | x | - | - | - | x |
| | C | 0 | 0 | 0 | 0 | 0 | 0 |

Source: Authors.

**Table 4.** Aspect and importance of competitive criteria for the companies.

| | Company A | Company B | Company C |
|---|---|---|---|
| Quality | 1.º | 1.º | 1.º |
| Speed | 3.º | 3.º | 3.º |
| Dependability | - | - | 2.º |
| Flexibility | - | - | - |
| Cost | 2.º | 2.º | 4.º |

Source: Authors.

For Companies B and C, the proper adaptations were described to address the shortcomings identified in the competitive criteria for these items, in addition to the items already shown (see Tables 9 and 10).

Regarding the presence of innovation and organizational learning, the data were organized according to the sources and ways of introduction and innovation identified for each of the companies, described in Table 11.

**Table 5.** Competitive criteria translating the needs of the market – Company A, Water pumps.

| Performance Objectives | Market Requirements | Company's position |
|---|---|---|
| Quality | Qualifying criterion. | Defined by construction regulations and standardized tests, equally for all competitors. |
| Speed | Immediate for standard pumps and up to 45 days for special ones. | Produces all pumps by request, with delivery times which vary from 60 days for standard pumps and 120 days for special pumps. |
| Dependability | High. Generally, these are reposition purchases (scheduled maintenance stops or due to break) or installation in new projects, with deadline for conclusion. | Low, as it produces by request, without keeping stocks of pieces or subset, subject to variations from its suppliers and production uncertainties. |
| Flexibility | Moderate, both for product configuration (materials and assembly) and delivery. | Presents low flexibility. |
| Cost | Low. Due to the increasing offer of similar pumps, the market is able to find offers with lower prices. | High, as it manufactures individually, losing scale gains. It is more prone to variations generated by the demand for producing by request. |

Source: Authors.

**Table 6.** Competitive criteria translating the needs of the market – Company B, Slurry pumps.

| Performance Objectives | Market Requirements | Company's position |
|---|---|---|
| Quality | Criterion attributed by the client and related to the reliability and durability of the equipment, measured by application references. | Difficulty to create the application references, invests in technical quality to overtime said difficulty. |
| Speed | Standard pumps in 60 days and special days in 120. | Produces standard pumps in 60 days and special pumps in 120-180, due to the importation of components for the latter. |
| Dependability | High. Generally, these are reposition purchases (scheduled maintenance stops) or installation in new projects, with deadline for conclusion. | Medium, because it is necessary some imported special items. |
| Flexibility | Medium, in terms of product configuration (materials and assembly) and delivery. | Low flexibility due to imported special items and restrictions imposed by headquarter (holder of the techonology). |
| Cost | Low due to the increased competition in the slurry pump market. | Low for standard pumps produced in Brazil and medium/high in imported equipment (because of fluctuations in exchange). |

Source: Authors.

**Table 7.** Competitive criteria translating the needs of the market – Company C, Slurry pumps.

| Performance Objectives | Market Requirements | Company's position |
|---|---|---|
| Quality | Criteria given by the client and related to the reliability and durability of the equipment, measured by application references. | It presents as references its mining equipment and invests in technical quality. |
| Speed | Standard pumps in 60 days and special days in 120. | Produces standard pumps within 50 days and special pumps within 120, due to import program. |
| Dependability | High. Generally, these are reposition purchases (scheduled maintenance stops) or installation in new projects, with deadline for conclusion. | High. There is a specific area for production of domestic item and an efficient import program. |
| Flexibility | Medium, in terms of product configuration (materials and assembly) and delivery. | Medium, due to the limitated special imported items. |
| Cost | Low due to the increased competition in the slurry pump market. | Low. The company do not indicate if it is because of the others subsidized imported equipment. |

Source: Authors.

**Table 8.** Categories of decision and adaptation of the technological base – Company A.

| Manufacturing Decisions | Adaptation of technological base |
|---|---|
| Capacity | Revaluation of the capacity of installation, quantity and types of equipment. |
| Facilities | New installations with the project of the new factory, bearing in mind improvements of the productive process, lay out planning. |
| Equipment and technology process | Change in the productive process and variation of the production method according to the type of pump produced, as well as the adaptation of equipment consistent with each type produced. |
| Vertical Integration and Supplier Relationship | Vertical integration with regard to casting, contemplated in the new factory, as well as the definition of supply contracts for parts and machining of non-technologically strategical parts. |
| Work Force | Integration of all operations in the new factory, with the identification and implementation of peculiar "best practices" for each type of equipment. |
| Quality | Quality system implemented and certified. |
| Scope and New products | Implementation of a multifunctional team to define the scope of new products or diversify in order to improve products, as well as the evaluation of the current product mix. |
| Managerial Systems | Managerial support to implement operational strategy, with a system of planning, control, establishment of well-established operational policies and responsibilities. |
| Cross-functionality | Review of departmental procedures to clearly define its interfaces, in order not to present gaps which generate doubt regarding authorship and responsibility in the execution of the tasks. |

Source: Authors.

**Table 9.** Categories of decision and adaptation of the technological base – Company B.

| Manufacturing decision | Adaptation of technologival base |
|---|---|
| Capacity | Capacity adapted to the market, confirmed by the condition of delivery of standard items, manufactured in Brazil. |
| Facilities | Installations suited to the market, confirmed by the condition of delivery and cost of standard items, manufactured in Brazil. |
| Equipment and technology process | Equipment and processes suited to the market, confirmed by the condition of delivery, cost and technical quality of standard items, manufactured in Brazil. |
| Vertical Integration and Supplier Relationship | The company vertically integrated cast and has contracts with sub-suppliers to acquire accessories for their equipment, which aim at obtaining more competitive prices and conditions, as well as assured quality. |
| Work force | Contemplated item, once it establishes policies and work procedures for each new process, as well as offering financial incentive and career plan possibilities to drive motivation for strategic positions, especially in new challenges. |
| Quality | Quality system implemented and certified. |
| Scope and New products | Contemplated item, as it verifies the commercial or technical compatibility with the current products, in order to verify synergies, avoid cannibalization of products or classify them to meet specific markets more competitively. |
| Managerial Systems | Solid managerial system, with planning, control, establishment of well-defined operational policies and responsibilities. |
| Cross-functionality | Presents clear definition of departmental interfaces, its procedures determine the responsibility in planning, execution and control of the tasks. |

Source: Authors.

## 6 Discussion

The types of diversification observed in the companies show that the companies operated with diversification processes in all possible ways to stretch their product mix, market diversification and horizontalization. The only exception was Company B, which did not diversify through horizontalization, i.e. it did not seek to improve its participation in the market by acquiring direct competitors.

This way, it is possible to state that this process may be characterized as concentric diversification (Britto, 2013) as it is directed to a restrict core of

**Table 10.** Categories of decision and adaptation of the technological base – Company C.

| Manufactuirng decicions | Adaptation of thecnological base |
|---|---|
| Capacity | Contemplated item, i.e. capacity is in accordance with the requirements of the market. |
| Facilities | Contemplated item, i.e. installations support the operations of the company. |
| Equipment and technology process | Contemplated item, as it usually verifies the current structure and the need to develop a new productive process or merge with a new one. In its diversification planning, several processes were developed and implemented, as well as the construction of new areas within its plant. |
| Vertical Integration and Supplier Relationship | Contemplated item, as the company has sought the integration of several processes in its diversification process, in order to consolidate control over technologies that are primordial to maintain its competitive advantage. Among these processes, it is possible to highlight casting, technology to develop wear materials, production of rubber parts, pilot plant with analysis laboratory and test center. |
| Work force | Contemplated item, once the company verifies the needs to train staff or hire qualified resource in the market, as well as offering qualified staff to operate in the new challenge, professional growth opportunity. This motivates both the current teams and those created to meet the diversification process. |
| Quality | Quality system implemented and certified. |
| Scope and New products | Contemplated item, as the company verifies the viability of introducing new products, whether they be: for changes in equipment and processes, for having sufficient similar products, for not having competitive conditions for the new product compared to its competitors. It also evaluates the maintenance of manufacturing old products, their synergy with specific markets, as well as the synergy of the processes of manufacture, distribution and sales. |
| Managerial Systems | Contemplated item, as the company has a managerial support team for implementation, responsible for planning, development of control system and establishment of operational policies with well-defined responsibilities. |
| Cross-functionality | Presents clear definition of departmental interfaces, as its procedures determine the responsibility in the planning, execution and control of the tasks. |

Source: Authors.

**Table 11.** Sources of Innovation × company.

| INNOVATION SOURCES | Type | Company A | Company B | Company C |
|---|---|---|---|---|
| Suggestions from staff | Process | x | - | x |
| Continuous improvement | | x | x | x |
| Relationship with suppliers | | - | - | x |
| Customizations | Product | x | - | x |
| Suggestions from clients | | x | - | x |
| Solutions of problems of equipment | | x | x | x |
| Solutions of problems of the client | | x | x | x |
| Development team | | - | x | x |
| Other units of the group | | x | x | x |
| Description in the company values | | - | - | x |
| R&D Laboratory | | - | - | x |
| Partnership with universities and research centers | | - | - | x |
| Growth policy | | - | - | x |

Source: Authors

activities that are compatible with the competences defined by the base of technological specialization and market of the company. This affirmation is in accordance with the level of similarity between the original and post-diversification activities of the companies, in terms of resources and competences required by the diversification process.

Regarding the areas of specialization, we observed in Table 2 that Company C presents the highest number of products resulting from diversification processes – 13 of them – while Company A has 8 and Company B only 5, considering the products that are currently manufactured and commercialized by the companies. It is also possible to see in Table 2 that all

**Table 12.** Percentage observed the diversification of sources for each company.

| Company | SA | SO | IR | SE | TB | AC |
|---|---|---|---|---|---|---|
| A | 28.6 | 22.7 | 33.3 | 38.1 | 31.6 | 25.0 |
| B | 28.6 | 22.7 | 8.3 | 19.0 | 10.5 | 25.0 |
| C | 42.8 | 54.6 | 58.4 | 42.9 | 57.9 | 50.0 |

Source: Authors.

the diversification processes by the companies under study were considered to be out of their technological base. The value related to the market base varies 20% for Company B, which presents the smallest number of products resulting from this process; 53.8% for company C, which presents the highest number of products resulting from diversification; and 62.5% for company A, which presents an average number of products resulting from diversification.

This result is in accordance with the literature because the capacity a company has to diversify, and the direction of this diversification, will be conditioned by the specialization areas. By introducing new products or seeking new markets, the company must respect the limits of its specialization boundary, not distancing itself from its specialization base, at the risk of losing efficiency due to the progressive reduction of productive synergies as it moves farther from this boundary. Thus, it is possible to conclude that these diversification processes are part of a strategy in which the company explores its resources, capacities or competences in the search for competitiveness and reduction of risks, based on the similarity among products, services, markets and processes (Barney & Hesterly, 2011).

Regarding the main sources of the diversification processes, Table 3 presented the following distribution: a) analysis of specialization areas, shown as SA: 14% of the products; b) identification of specific opportunities for diversification, shown as SO: 22% of the products; c) industrial research, shown as IR: 12% of the products; d) use of sales efforts, shown as SE: 21% of the products; e) evaluation of the technological base, shown as TB: 19% of the products; and f) acquisitions, shown as AC: 12% of the products.

In order to identify possible particularities of the diversification process, the sources were separated regarding the occurrence for each company in Table 12. It can be observed that company C presents the highest rates, followed by company A, considering that both are more diversified than company B, which has the lowest rates.

Considering the data on the main sources observed, specific opportunities and sales efforts have the highest rates. These sources are related to the change in productive processes and suppliers, knowledge acquired by the company, changes seen in the market and innovation possibilities.

Therefore, it is possible to state that the diversification process is directly related to a growth strategy based on knowledge, once the diversification sources raised in the field are directly related to this resource. Besides the diversification sources, the characteristics of the process also depend on the evaluation of the company in relation to the needs of the market and its productive capacity, verified in this study through competitive criteria.

Based on the competitive criteria, it is possible to affirm that all of them look extremely similar, with the quality being presented in all cases as a qualifying characteristic, once the products are certified and standardized. Speed is considered to be important and the companies work with deadlines that meet the needs of the market. The cost is shown as relevant for Companies A and B in detriment of reliability for C; however, it presents a disparity in practice, as B and C present a similarity (the market demands low cost and the company is able to meet it), while company A understands cost as important but admits a high cost.

Reliability is the competitive criterion that present the most discordance among the companies. It is extremely low in Company A, as it produces on request, without keeping a stock of parts or subset, thus being subject to the variations of the suppliers. It is seen as moderate in Company B because it depends on the importation of parts. However, Company C is the only that adapted its processes to meet the requirements imposed by the market when it created a specific area to produce national items, planned its stock and conducted an efficient importation program.

Finally, flexibility is the last importance criterion; however, the only company that presents a moderate flexibility is Company C. The other ones admit having low flexibility, mainly related to issues regarding the clearance of imported products. In other words, similarly to the analysis of performance in competitive criteria, each company verified the actions taken to adapt the operational strategy through the categories of decision. Companies B and C already operate in a planned way and have clear and precise policies in all categories of decision. The same does not happen to Company A, which

did a total revision of the categories of decision, and then had to readapt all its technological base due to the opening of a new factory. Therefore, it is possible to affirm the presence of important similarities among the competitive criteria and categories of structural and infrastructural decisions of the companies under study.

In relation to policies and infrastructural systems, the similarity among quality tools, human resources policies, vertical integration, scope of new products and production planning can be attributed to the great dissemination of operations management tools. It is possible to highlight the best practices from world-class companies that implemented these tools, especially the capital goods industry in order to guarantee a sustainable competitive advantage.

In spite of the study not expanding on the evaluation of innovation sources or organizational learning, this research superficially evaluated how the innovation process occurs in the company, its direction, as well as the presence of procedures that contribute to organizational learning. It sought evidences that qualify the presence of this learning in order to relate it to the characteristics found in the diversification processes.

Company C is the only one which presents 100% of the innovation sources identified in the interviews and listed for each company, while Company A presents 53.8% and Company B 38.5% of them. If evaluated as indicated by the companies, as innovations of process or product, it is not possible to see any alteration in positions, only small variations in percentage.

The data related to innovation and organizational learning contribute to the diversification process, given that they corroborate in some cases, as for Companies A and C, which present most of these traces and also the highest number of diversified products.

This way, is it possible to state that the knowledge resource, whether it be tacit or explicit and anyhow leading to innovation, represents an important asset to the companies.

## 7 Final considerations

This study aimed to raise some questions regarding the impact of diversification in operations strategy through the conciliation among the areas of specialization, which are linked to the resources of the companies and their operations strategies, based on the view of the market.

The diversification process found in the cases is concentric, as it is directed to a core of compatible activities with competences that are well defined by the base of technological specialization and market of the company. Therefore, it is possible to affirm that the diversification process is directly related to a growth strategy based on knowledge, responding to the chosen theory to support the argumentation of the empirical results.

In this regard, we chose to use the theoretical RBV framework basically founded by the seminal work by Penrose (1959), which inspired the development of an approach that is essentially directed to the internal affairs of organizations. RBV is confronted with a perspective that attributes a higher level of responsibility to the external environment, regarding the strategical options which may lead companies to a superior performance in the market. Even with the apparently paradoxical dichotomy between the two approaches, it is possible to observe, based on the practice and empirical studies, efforts that seek to develop an integrating approach between them. These efforts seek to better understand the elements that support a long-lasting and sustainable competitive advantage.

Regarding the diversification strategies of the companies under study, it is possible to state that they occur according to the opportunity costs when the company starts a new business. The company then believes that it is not possible to invest its capital, nor will another business provide the same return compared to the one the company decided to invest in. Another important aspect is the economies of scope and scale obtained through the diversification processes. It is important to highlight that said economies are crucial to keep the competitiveness of the companies.

The main contribution of Penrose's study for this work is in regard with the understanding that different diversification processes may help expand the company in the same market through new products based on a different technological base. These processes may also help the company enter a new market with products that are brand new and from different technologies. Therefore, the diversification processes of the companies must be analyzed under the view of a growth strategy based on knowledge, in such a way that the management of this resource occurs under conditions of maximum efficiency. This is necessary because this knowledge is directly related to the efficient control of the competences and technical knowledge in specialized areas of manufacture.

It was possible to see that the demands of competition and the existence of specific problems provided the companies with reasons to diversify their activities, in addition to diversification opportunities which arise from experience and knowledge from previous operations. It is valid to highlight that the use of the case study reinforced the importance to conciliate the needs of the market

and the technological base through the operations strategy in the diversification process. This happens by defining the existence and cause of problems which arise from incorrect interpretation or lack of observation of the specialization areas in which the company applies diversification. With the categories of decision, it is possible to identify the necessary changes for adaptation, considering the existing resources and needs of the market.

This study is a precedent to apply a model which structures and quantifies the evaluation issues in order to formulate the operations strategy for companies that will start or are currently in a diversification process. Thus, it allows a more precise analysis of the relevant aspects regarding the market, client and competitors, with a weighting of the required competences and necessary level of service for the technological base.

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