

A preliminary investigation on the cooperation in new product development in an automotive company: identification of key success factors

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Abstract: This paper describes a case study whose main objective is to identify the key success factors in new product development in an automotive company in Germany and in its subsidiary in Brazil, in the context of cooperation in new product development. The company chosen is a part of a large international automotive organization that produces cars and commercial vehicles. Empirical data was gathered through interviews at the subsidiary based on four main groups concerning the key success factors on new product development identified in the literature: firm-level, finances, product level and customer acceptance measures. The preliminary results indicate that the company focuses its key success factors on finances and customer acceptance measures, and on measures such as ‘time to market’. The concluding remarks points out that new product development process is assessed by some factors at the Brazilian subsidiary, but without a clear process of prioritisation. Further work of this investigation is to interview company members at the company headquarter in Germany as well as to perform a cross-analysis of the results.

Keywords: key success factors, new product development, automotive industry, cooperation in NPD.

1. Introduction

The automotive industry still holds a prominent place in the vanguard of technological and managerial innovations. As a result it has a permanent reference in the industrial world as a whole. The sector has also undergone substantial changes in the past 20 years and its current products are usually complex structures in various aspects such as design integration and physical functions (CAUCHICK MIGUEL; PIRES, 2006). Due to the increasing global complexity and competitiveness, automotive companies are looking for ways to increase its operations in the world in order to remain competitive (CAUCHICK MIGUEL, 2006). In the 80’s, the literature shows that most subsidiaries of automotive companies in the developing countries had a very limited role with regard to technological development in these countries (KATZ, 1987; LALL, 1992). The main reason this finding lies in the fact that such subsidiaries were totally dependent on their headquarters in the development of new products (CONSONI, 2004). However, this framework has changed. In this sense, Sugiyama and Fugimoto (2000) suggest four basic strategies in the development of new products: 1. Development of global products based on new platform, 2. Development of local product based on new platform; 3. Development of global product platform

based on existing platform; 4. Development of local product based on existing platform. In Brazil for instance, there have been some examples of development of new products. These have been represented by new products developed by Ford (*Ecosport*), GM (*Meriva*), VW (*Fox*) and, more recently by Renault (*Sandero*). Most of them are examples of ‘complete derivative’, i.e. although it is not a new platform, their extension of changes in the product and processes (manufacturing and assembly) specification goes beyond a typical adapted product developed in the country. Traditionally, engineering activities are usually more active in terms of the design of manufacturing design when establishing specifications for manufacturing and assembly specifications. This is corroborated by studies such as by Salerno et al. (2002) and Consoni (2004).

Considering that the development of new products is a complex task (ROZENFELD et al., 2006), especially in this international framework, the concept of “success or failure in the development of new products” has various dimensions that can be measured in different ways (GRIFFIN; PAGE, 1993). Success is not only hard to define but is multi faceted and difficult to measure (GRIFFIN; PAGE, 1996). Actually, a company can predict the success or failure of a

new product project in one or several measures, including customer satisfaction, financial return and technological advantage.

In this context, the present study aims at identifying the key success factors on new product development in an automotive company, within the context of a cooperation between an automotive company headquarter and its Brazilian subsidiary. The company has been mainly involved in design and manufacturing trucks and bus chassis. Case-based research is adopted as the methodological approach.

The paper has been structured as follows. Firstly, section 2 presents a brief overview of the literature related to new product development, while section 3 outlines some relevant aspects of automotive industry in Brazil. Then, section 4 summarises a picture of the literature with regard to key success factors at new product development. Next, section 5 presents the research design adopted to conduct this work and section 6 an analysis and discussion of preliminary results. Finally, section 7 draws some concluding remarks, and presents next steps and implications of this work in addition to some issues for further research.

2. Literature review

New product development can be characterised as a business process that changes an idea into a product to the market (KRISHNAN; ULRICH, 2001). It encompasses a series of sequential and parallel activities structured in a complex way in which its main characteristics differentiate from other processes (ROZENFELD et al., 2006): high degree of uncertainty and risk in its activities, difficulty in changing decisions taken in the initial phases, the activities follow a basic iterative cycle, and dealing with a high volume of data and information.

In general, a new product development process follows the sequence of generation of idea generation, concept definition, detailed design, production (manufacturing), and launching (CAUCHICK MIGUEL; SEGISMUNDO, 2006). Several proposals for new product development processes have been created in the past decades. Those contain guidelines and procedures to manage the development of new products (ENGWALL et al., 2005).

Cooper (1993) suggests four stages for a NPD: concept and development, product planning, product and process engineering, try-outs and ramp-up. The best practices of new product development can be supported by the implementation of the stage-gate approach (GRIFFIN, 1997). This approach divides the development of new products into discrete and identifiable stages. Each stage is multifunctional and designed to work the information needed for the progress of the project for the next stage after passing through a decision points (gates). The key stages are (COOPER, 1993):

- a) Preliminary investigation: a quickly research and generation of the preliminary scope of the project;
- b) Detailed investigation: a much more detailed research, including the definition and explanation of the project;
- c) Development: design and development of the product;
- d) Test and validation: tests in laboratory, at the market, or in the plant to verify and validate the new product, including its production and market;
- e) Production and launch: start of full production, marketing and sales campaigns.

Rozenfeld et al. (2006) also considers stages of “pre-development” and “post-development”, as illustrated in Figure 1.

For Griffin and Page (1996), the main outcome of a great NPD would be the perfect product (“silver shooting”), which would be fully accepted by customers, provide a huge financial return for the company and, additionally, be technically elegant and thus providing great competitive advantage for the company. However, this situations usually do not exist. Therefore, having success factors on new product development are extremely necessary (COOPER; KLEINSCHMIDT, 2007).

2.1. New product development in Brazil

The automotive industry represents one of the most prominent industries in Brazil (CAUCHICK MIGUEL; SEGISMUNDO, 2006). OEM (Original Equipment Manufacturers) settled productive plants in Brazil at the end of the 50th decade (Ford, GM, VW and Mercedes-Benz), and more specifically, the conditions for the Brazilian automotive industry development occurred after the installation of the Automobile Industry Executive Group (GEIA) in 1956, in the government of Juscelino Kubitschek (CONSONI, 2004).

Fiat began its operations in 1976 and was only in this decade that automotive companies installed in Brazil began to incorporate local requirements into their new product definition by modifying aspects of engine, body, chassis, and suspension, among others. These adaptation activities became known as ‘*tropicalization*’ (CONSONI, 2004).

Honda was the first plant installed after many years and was inaugurated in October 1997. Following, other assemblers installed plants in the country, particularly after 1998, such as: Audi, Mercedes-Benz (a plant in Juiz de Fora, State of Minas Gerais to produce cars), Mitsubishi, PSA-Peugeot/Citroen, Renault and Toyota. More recently other companies settled plants in the country, namely: Nissan and Hyundai. As a main consequence, the national automotive industry has become more international and more integrated with global supply chain. It is expected around US\$ 6 billion investment in the industry until

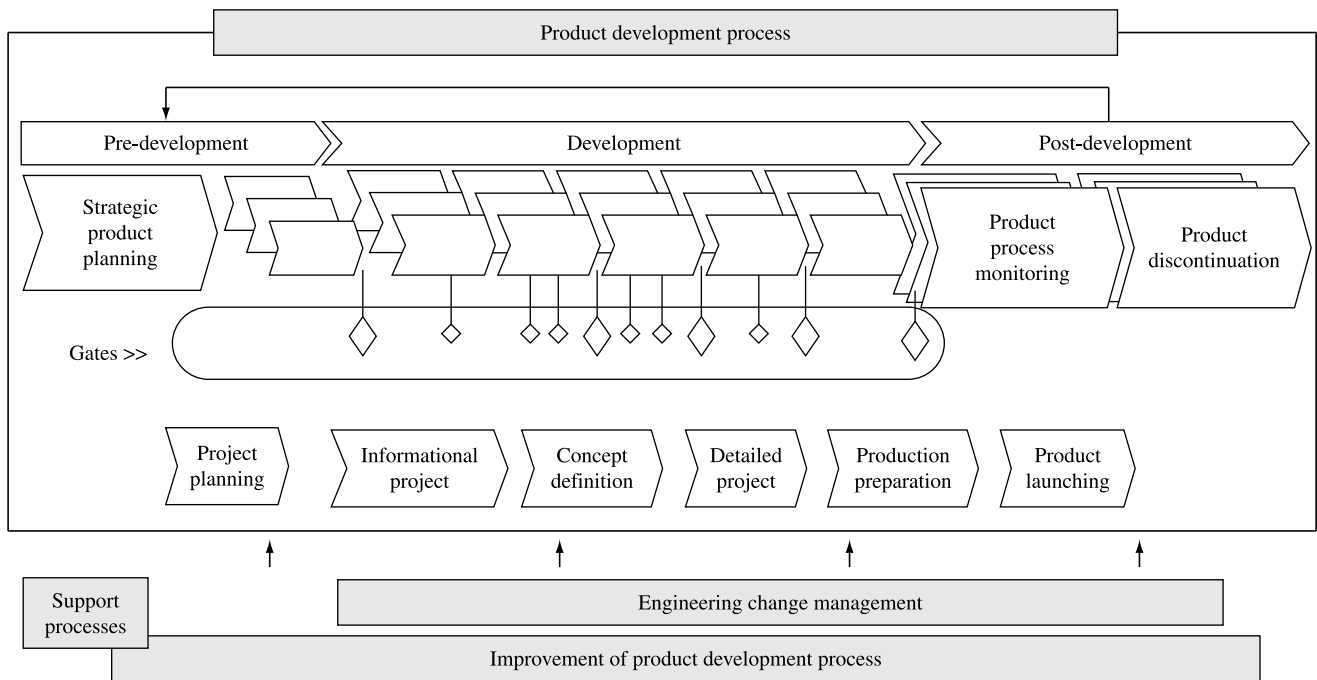


Figure 1. Reference model for new product development (ROZENFELD et al., 2006).

2011 (CAUCHICK MIGUEL; SEGISMUNDO, 2006). Nevertheless, this figure might be reduced due to the global financial crisis in 2008-2009.

In this context, new product development activities assumed a greater role through the introduction of the ‘global platform’ development strategy. Indeed, the most common strategy is to adopt a global platform that allows adaptations requested for local markets needs (HUMPHREY; LECLER; SALERNO, 2001). This strategy increases the possibility of redirecting new product development activities in emerging countries, resulting in positive effects in terms of attraction of new investment and achievement of greater strategic importance for operations in Brazil (SALERNO et al., 2002).

As a consequence, a number of technological and design centres for new product development centres have been introduced in the country over the past 5 to 10 years, as already identified (CAUCHICK MIGUEL, 2006). This initiative opens up a series of opportunities of research on new product development, particularly in the international scenario, which is the scope of this study. One of the issues concerns the key factors when developing new products, as highlighted next.

2.2. An overview of key success factors in new product development

One of the key factors to maintaining a competitive position in the market is the ability to repeatedly commercialising new success products (GRIFFIN; PAGE, 1996). Since the first report on product failures prevention,

from the *Industrial Conference Board* in the USA in 1968, research has been carried out regarding to new product development success. However, Cooper (1999) argues that even so, project leaders and teams usually fall into the same traps that their predecessors of the last decades.

Taking into account the research of PDMA (Product Development and Management Association) on best practices, innovative firms showed that among companies with better performance, 49% of its sales are from new products launched in the past 5 years (DI BENEDETTO, 1999). Considering the complexity of the new products development, especially in this international framework, it is possible to conclude that the concept of ‘success or failure in the development of new products’ can be very complex and divided into various dimensions and each can be measured in different ways (GRIFFIN; PAGE, 1993).

Cheng (2000) states that there are three main sources of knowledge on success criteria when developing new products. The first is the *Product Development Management Association* (PDMA), particularly through the studies from Griffin and Page (1993, 1996, 1997). The second source is based on the research of the Canadian group of the Marketing Department at the University of McMaster, Hamilton, which results are documented in Cooper (1999) and Cooper and Kleinschmidt (2007). The third source is the work of Brown and Eisenhardt (1995), which proposes the construction of a network of factors, quite complete, through the division of the new product development management in

three different currents: rational planning, communication network and systematic problems resolution.

According to Griffin and Page (1996), previous publications determined that the success of a project consists of three independent dimensions: customer based success, financial success and technical success. In addition, the authors consider a strategic level, called ‘firm level’, which transcends the development of a new product. In this tri-dimensional classification, the authors generate the assumption that the most appropriate set of factors to measure the success of a new product depends on the strategy of the project, and that the factors to measure success on new product development (or program of products) depends on the innovation strategy of the company. Thus, these the authors propose a model to determine and classify factors of success on new product development based on a classification of project strategy. This is adapted from Ansoff’s matrix (ANSOFF, 1957) that considers product/market analysis and on business strategy, adapted from Miles and Snow (1978) and McDaniel (1987). Figure 2 illustrates this proposal.

In relation to the business strategy, companies can be classified as follows (GRIFFIN; PAGE, 1996):

- a) Prospectors to the risk: the value of ‘being the first’ with new products, markets and technologies, even without the certainty yet to be profitable. Those respond quickly to opportunities. In the automotive industry the authors cite Chrysler and Honda as examples;
- b) Analysers: rarely are the first on the market with new products. However, through careful monitoring of the main competitors, they can rapidly achieve the “Prospectors”. Examples are Ford and Toyota;
- c) Defenders: meet the local demand and keep a market niche relatively stable of products or services. They protect their niche offering quality or superior services, or even, lower prices. Examples are General Motors, Nissan and Mazda; and
- d) Reactors: are not aggressive even in keeping their markets under threat from competitors. They respond only on high pressure. The automotive company Subaru is an example of reactive company.

As a result, Griffin and Page (1993, 1996) conclude that the factor of success more widely used by large companies is ‘technical’ or ‘based on the process’, which connected to performance measurement during the evolution and development of a product. However, the factor based on the customer satisfaction presented greater importance by the interviewees, but it is rarely used in practice. Financial factor is widely used, but not always effectively, given the complexity of the costs analysis (several iterations, suppliers, prototypes, etc.).

Cooper and Kleinschmidt (2007) propose nine factors of success on new product development; the first four have a role more important than the others:

- a) A high quality process for definition of new products: a system that provides clear definition of activities, a clear product definition from the begging, clear points of decision clear, quality in implementation, yet flexible;
- b) A defined strategy of new products set for the business unit: there is a long term plan, goals for new products, the role of the new products are clearly communicated;
- c) Sufficient resources of people and budget: high management prove resources and budget needed for the projects in development;
- d) Expenditure on research and development to the new products development (considered as a percentage of sales revenue);
- e) High quality project teams;
- f) High management involved and committed to the new products;
- g) Innovation culture and environment;
- h) The use of cross-functional teamwork;
- i) Responsibility of the high-manage regarding the results of the new products.

In addition to those factors, Cooper (1999) considers that two classes of criteria of success are not treated in the literature: the first one is related to ‘make the right projects’ and the second one to the ‘do the projects right’. The first one can be well compared to the dimensions proposed by Griffin and Page (1993, 1996), related to business and projects strategy. Additionally, Montoya-Weiss and Calantone (1994) suggest 16 factors grouped into: strategic, development processes, market and organizational. These classifications of success factors are presented in Table 1. The success factors are grouped according the categories and the authors and categories. Factors are allocated in each row in order to show where the similarities or gaps among

		Newness to the market	
		Low	High
High		New-to-the-company	New-to-the-world
	Newness to the firm	Product improvements	Add to existing lines
Low		Cost reduction	Repositionings

Figure 2. Project strategy typology (GRIFFIN; PAGE, 1996).

Table 1. New product development success factors based on the literature.

Griffin and Page (1993)	Montoya-Weiss and Calantone (1994)	Cooper and Kleinschmidt (2007)
	Strategic factors	Defined new product strategy
	Product advantage	
	Marketing synergy	
	Technology/manufacturing synergy	
	Availability of resources	
	Strategy of the new product	
	Development process factors	High quality NPD process
	Proficiency of technology activities	
	Proficiency of marketing activities	
	Proficiency of up-front activities	
	Top management support	Senior management commitment
		Senior management accountability for new products results
Speed (speed) to market	Time (speed) to market	
Development costs % of sales by new products	Proficiency of financial/business analysis	R&D spending for NPD (as a % of sales)
Financial performance measures		
	Marketing environmental factors	
	Market potential/size	
	Market competitiveness	
	External environment	
	Organizational factors	
	Internal/external team relations	
	Team organization	The use of cross-functional project teams
		High-quality new product project teams
		Adequate resources of people
Customer acceptance measures		

authors. It is worth observing that for Griffin and Page (1996) the organizational issue is not evident, while for Cooper and Kleinschmidt (2007) the customer satisfaction also appears not so explicit, but as a consequence of other factors.

Success factors by Griffin and Page (1993) are detailed in Table 2.

3. Research methods

This work can be categorised as an empirical research and it is a preliminary part of a major project on the investigation of new product development process in companies with business units operating in Brazil. Its general objective is to identify and analyse the key success factors in new product development in an automotive company. The methodological adopted approach was case-based research. Firstly, the research has been carried out by analysing current publications related to the objectives as well as by gathering empirical non-structured data through non-and

semi-structured interviews. Figure 3 illustrates the analytical process framework adopted. It consists of identifying issues to be investigated, next what the literature establishes, followed by data collection about each situation, and, finally, data analysis supported by the theory. The cycle is closed and continuously restarted.

3.1. Company selection and research context

The company was selected based on the following criteria: the history, competence and importance of the new product development of the subsidiary, and data access. It is part of an international large automotive organization, producing trucks and cars. The truck group is the world's leading manufacturer, and boasts six strong independent and complementary vehicle brands. The main business units for new product development, located in Brazil, comprise truck development, bus development and component development. This study is limited to the truck business unit that consists of about 30 models of trucks divided into four

Table 2. Success factors of Griffin and Page (1993).

Dimension	Measures
Customer acceptance	Customer acceptance
	Customer satisfaction
	Met market share goals
	Met revenue goals
	Met unit sales goals
	Revenue growth
Financial performance	Attain margin goals
	Attain profitability goals
	Break-even time
	ROI
Firm-level	Percentage of sales by new products
Product level	Development cost
	Launched on time
	Met quality guidelines
	Speed to market

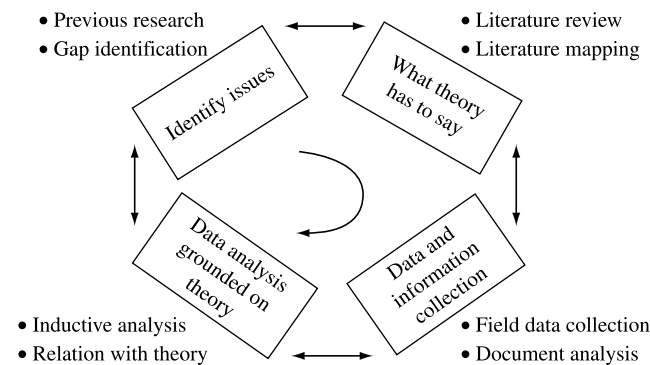


Figure 3. Research project cycle.

families of products in Brazil. There are about 40 models divided into three families in Germany. One of the brand (or business unit) is within the scope of the present study. The main business units for new product development, located in Brazil, comprise trucks, busses and power train development.

Typical company new product developments include platform and derivative projects. During the past years the company has consolidated the implementation of a local technological centre for developing new products. This enables the automaker to design and launch truck and bus platforms as well as components (engines, gearboxes, axles). The Brazilian technological centre employs more than 500 people and there are around 1800 people in its correspondent in Germany. The product development process was created in its headquarters and is based on ten stages and gates. The NPD process is a structure similar to Cooper' stage-gates but requirements of APQP (Advanced Product Quality Planning) are also considered. Gates decision meetings are based on a number of criteria in a

document called 'delivery fulfilment list'. This document considers costs, quality and performance objectives including risk analysis.

The management of projects of new products is based in concepts and areas of knowledge proposal by PMBOK. The maturity (as proposed by Project Management Maturity Model) of the technological centre located in Brazil is level 2 – basic, as earlier identified (CARVALHO; SEGISMUNDO, 2006).

3.2. Data collection and analysis

As mentioned, case study methodological approach was employed. In order to answer the main research question, how is the current practice regarding new product development efficiency measurement, semi-structured interviews (YIN, 1994) were conducted with new product development senior managers of the two plants of the same business-unit – one plant located in Germany and its subsidiary located in Brazil. This work focuses on the analysis of the interviews at the Brazilian subsidiary. Next steps of this study (out of the scope of this paper) is to interview the main company in Germany and cross-analyse the results identifying similarities and improvements opportunities.

A first interview was done with a member of the senior management of the Brazilian subsidiary technological centre, based on Griffin and Page (1993). This reference was used since it is more clearly established through specific measures. The objective was also to validate the research method.

The sixteen critical success factors on new product development were assessed through closed questions, considering: if they are known and disseminated throughout the company, concerning its current use (if they are or not applied), and if there is the intention to apply them as performance measures for the NPD process. Those results are presented next.

4. Preliminary results and discussion

Based on the model of Griffin and Page (1993), a first interview was done with a member of the senior management of the Brazilian subsidiary technological centre, with the main objective to validate the method.

The sixteen critical success factors on new product development were carefully described and, through closed questions, classified as: if these are known and disseminated in the culture of the company, concerning its current use (if they are or not actually applied) and if there is the desire to apply then as performance metrics for the new product development process. Table 3 shows the assessments first results.

As can be seen in Table 3, the company use, even if not completely, 12 success factors, while the literature identifies

Table 3. Responses from the assessment of the sixteen critical success factors.

Dimension	Measures	Known measure	Current use	Intention to use (or continue)
Customer acceptance	Customer acceptance	Yes	Yes	Yes
	Customer satisfaction	Yes	Yes	Yes
	Met market share goals	Yes	Yes	Yes
	Met revenue goals	Yes	Yes	Yes
	Met unit sales goals	Yes	Yes	Yes
	Revenue growth	Yes	Yes	Yes
Financial performance	Attain margin goals	Yes	Yes	Yes
	Attain profitability goals	Yes	Yes	Yes
	Break-even time	Yes	Yes	Yes
	ROI	Yes	Yes	Yes
Firm-level	Percentage of sales by new products	Yes	No	Yes
Product level	Development cost	Yes	Yes	Yes
	Launched on time	Yes	No	Yes
	Met quality guidelines	Yes	Yes	Yes
	Speed to market	Yes	No	Yes

the use of 4 main success factors in average (GRIFFIN; PAGE, 1993; COOPER; KLEINSCHMIDT, 2007).

Currently, strategic factors have not been identified as to be applied (in the level of the firm). The same occurs with three factors associated with the product: launched on time, product performance level and speed to market.

This result agrees with the literature (GRIFFIN; PAGE, 1993, 1996). The survey conducted by the authors identified as most used customer measures (market share, volume, customer acceptance and customer satisfaction) and financial measure (margin level). However, more recently publications (DI BENEDETTO, 1999; COOPER; KLEINSCHMIDT, 2007) identified a change. There is a trend to apply strategic factors (e.g. ‘percentage of sales by new products’) and the factors related to a high-quality product development process (‘sharp and early product definition’, ‘better defined go/kill decisions points’, ‘speed to market’, and so on.). As a consequence, a consistent financial return becomes more feasible.

Figure 4 shows the distribution of the sixteen factors of success in relation to their knowledge, their current and desired usage at the studied Brazilian subsidiary.

The assessment shows that although it seems that most success factors are adopted by the company investigated, it has a clear focus at the financials and customers related measures, instead of strategic and efficiency factors at the NPD. This is consistent with the issue that a formal prioritisation of new products at the company portfolio is relatively recent and still in underway of an internal acceptance by company employees (CAUCHICK MIGUEL; SEGISMUNDO, 2006). One hypothesis that also probably contributes to this focus at the financials and customers related measures may be the relation between this behaviour

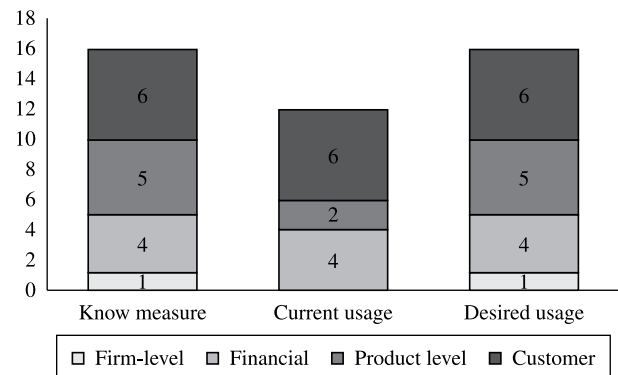


Figure 4. Responses distribution by category of success factor.

of the Brazilian subsidiary and its degree of autonomy delegated of the headquarters. These relations between both units are under investigation and should integrate as next steps of this work.

Moreover, the interviews identified there is no clear prioritisation or different weight among the success factors. A detailed investigation of possible informal prioritisation and its relation with the criteria adopted at the headquarters are also the next steps of the current research. In addition, more empirical data should be gathered to validate and amplify the analysis of the current findings.

5. Concluding remarks

Since this work is not fully completed, the conclusions of this research are limited. However, some concluding points can be raised. At a general level, key success factors in new product development are identified at the Brazilian subsidiary of the investigated company. The evidence shows

that the new product development process is assessed by several factors, but without a clear weight or prioritisation among them. In addition, there is an emphasis in more traditional success factors such as financial return and customer acceptance. The lack of a success criterion at the strategic level is consistent with the issue that a formal prioritisation of new products at the company portfolio is relatively recent and still in the process of internal acceptance by company employees.

It is also evident also that there is an intention to use the success factors of 'speed to market' and 'launched on time'. However, they are not formally considered in the actual practice on new product development at the subsidiary. This fact needs to be further investigated and may be considered as part of the next steps of this work.

Further work of the research is to deepening the study in the subsidiary with further data collection. In addition, data should be gathered in the headquarters to compare the success factors found out in the subsidiary. Then, the cooperation 'headquarter-subsidiary' in NPD might be deeper investigated with focus at the degree of autonomy of the Brazilian subsidiary delegated from the headquarters.

6. Acknowledgements

The authors wish to thank CNPq (National Council for Scientific and Technological Development) as well as the company where the study was conducted. However, this paper reflects only the view of the authors, not the official view of the organisation. Finally, one of the authors is also affiliated to the Federal University of Santa Catarina (UFSC) and acknowledgment to this institution should also be made.

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