

An analysis of portfolio management in new product development: a case study in a truck company

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Abstract: The purpose of this paper is to describe a case study in portfolio management and new product development in an automotive company in Brazil. Empirical data was obtained by a number of sources mostly collected by one of the authors who is part of the company staff. At the time of study, the company had twenty projects in its portfolio, from which two platform and twelve derivative projects were being simultaneously developed. After presenting the context of the study, an analysis of the company portfolio management was carried out. This analysis was based on the literature considering issues such as portfolio performance results, importance of portfolio management, its characteristics, methods employed, and criteria to rank projects against each other. Results show that some of the issues related to portfolio management are well aligned with the literature and just a few of them are not. The paper concludes that portfolio management methodology is essential to the future of the Brazilian business unit although there are still some opportunities for improvement.

Keywords: portfolio management, new product development, automotive industry

1. Introduction

Most organizations have far more projects and investment opportunities than resources to fund them. Due to the increasing levels of competitiveness those organizations realise the importance of managing its portfolio. In simple words, portfolio management is about allocating resources, i.e. deciding or choosing among opportunities competing for scarce resources. Today, choice of a product portfolio is an essential factor influencing company chance for success.

Over the decades, the literature suggests a number of issues under the general term of portfolio management. Early studies named portfolio management as project selection (DANILA, 1989). Later on, portfolio management has surfaced under the term of prioritizing product development (TATIKONDA, 1999; COOPER et al., 2000), and, more recently, multiple project management (DOOLEY et al., 2005). Actually, recent years have witnessed a heightened interest in portfolio management. Despite its growing popularity, benchmarking studies (COOPER et al., 1997a; 1997b) have identified portfolio management as one of the weakest areas in managing new product development.

In this context, this papers aims at presenting a case study on portfolio management conducted in a company from the automotive sector in Brazil. The company has been mainly involved in design and manufacturing trucks and bus chassis. The main driver for introduction of portfolio

management was to align new product development to the headquarter strategy.

The paper has been structured as follows. Section 2 contains a brief review of the literature related to portfolio management. Section 3 outlines some aspects of the presence of the automotive industry in Brazil. Section 4 describes the research design adopted to conduct this work and section 5 presents an analysis and discussion of results. Finally, section 6 draws the conclusions and implications of this work in addition to some issues for further research.

2. Portfolio management

This section presents the theoretical background of this work. It outlines the concepts of portfolio management in addition to some concepts related to new product development.

Portfolio management is a dynamic decision process wherein a list of active new products and development (R&D) projects is constantly updated and revised (COPPER et al., 1997a). In this process, new projects are evaluated, selected and prioritized. New projects might be introduced and existing projects may be suspended, aborted, or de-prioritized. Those decisions are important to allocate resources to the active projects. Some of the problems that arise when portfolio management is lacking are (COPPER et al., 1997a):

- There are limited resources available and far too many projects to develop;
- Projects to be developed do usually not reflect the business' strategy so many projects are disconnected to the strategic priorities of the business;
- Go/kill decision points are weak so poor projects are often not killed; and
- Wrong projects are selected so the portfolio's quality is poor.

To address this issue, companies should choose the right projects to have an enviable portfolio of high value projects. Besides the portfolio should be properly balanced and most importantly support the business strategy. Hence, the broad macro goals are (COPPER et al., 1997a): value maximization, balance, and strategic direction.

The strategic alignment in portfolio of projects requires general approaches such as (COPPER et al., 1997b): building strategic criteria into project selection (incorporating numerous strategic criteria into the go/kill and use of prioritization models) and application of top-down strategy models (setting funds for different types of projects).

One of the most useful categorization to classify development projects is according to the degree of change represented by the project. In this sense, the types of projects can be divided into breakthrough, platform, and derivatives (CLARK & WHEELWRIGHT, 1993), as illustrated in Figure 1. It is important to consider a mix of development projects that builds both market position and desired development capabilities. Nevertheless, companies need

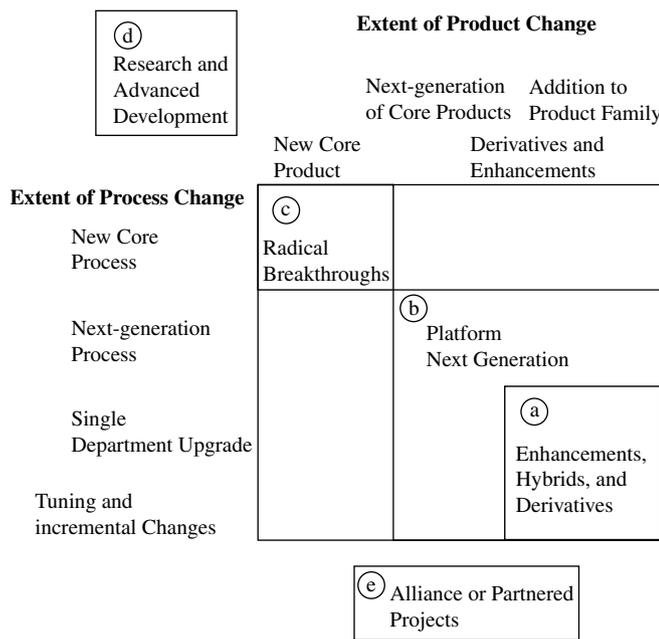


Figure 1. Types of projects (CLARK & WHEELWRIGHT, 1993).

projects to yield major breakthroughs and real competitive advantage. In addition, balance among the projects is important, namely: the optimal investment mix between risk versus return, maintenance versus growth, and short-term versus long-term new products projects (COOPER et al., 1997a).

Another important issue is concern resources for developing new products. They should be split across product lines. Figure 2 depicts a number of projects being developed at the same time. Some of projects are currently being developed while others were cancelled or on hold. A scoring model to allocate resources across product lines might be used for this task (COOPER et al., 1997b).

An important portfolio management goal is to have a balanced portfolio in place. It consists of a balanced set of development projects in terms of a number of key parameters (COPPER et al., 1997a). Visual charts, such as bubble diagrams or portfolio maps, are favored for displaying balance in new-product project portfolios. A number of dimensions may be considered for a bubble plot, such as (ROUSSEL et al., 1991): fit with business or corporate strategy; inventive merit and strategic importance to the business; durability of the competitive advantage; reward, based on financial expectations; competitive impact of technology; probability of success; R&D costs for completion; time to completion; and capital and marketing investment required to exploit.

In summary, effective portfolio management requires that three elements be in place and working in harmony with one another (COPPER et al., 1997b): the strategy of the business, a new product process with gates, and the portfolio review with its various models and tools.

2.1. New product development

KRISHNAN & ULRICH (2001) define new product development as the transformation of a market opportunity into a product available for sale. This is accomplished through a set of activities conducted in a logical way

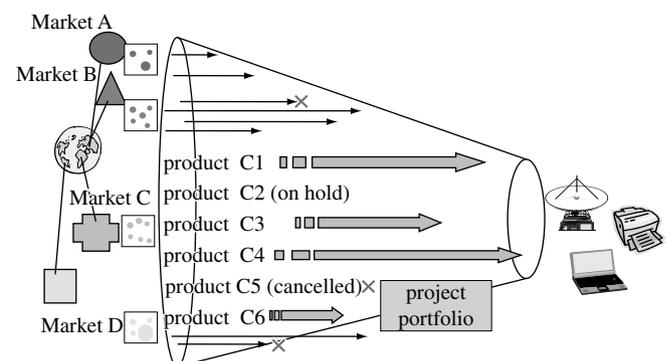


Figure 2. Project portfolio and product lines (adapted from ROZENFELD et al., 2006).

(ROZENFELD et al., 2006), sequentially or in parallel (DENKER et al., 2001).

The product development process presents several characteristics that differentiate it from other process, as follows (ROZENFELD et al., 2006): high degree of uncertainty and risks in the activities; difficult to change initial decisions; the basic activities follow an iterative cycle; the creation and handling of a high volume of information and multiple requirements to be considered. Due these characteristics, the development of products represents one of the most risky entrepreneurship of modern corporations (COOPER, 1993).

The development process of a new product usually follows the sequence of idea generation, investigation, design formulation, product production, after-production packaging and storing, and market launch. Several models for new product development have been created in the last decades. They contain rules, guidelines and procedures for managing product development (ENGWALL et al., 2005). Initially, a model described the process as a linear system, with discrete and sequential stages, while more recent studies consider that the development process evolves through stages, but with overlap and feedback loops (MCARTHY et al., 2006).

COOPER (1993) suggests four stages that comprise concept and development, product planning, product and process engineering and pilot production and ramp up. Best practices for product development should be supported by the implementation of the stage-gate approach (GRIFFIN,

1997). This approach breaks new product development into discrete and identifiable stages. Each stage is multifunctional and designed to gather information needed to progress the project to the next stage or decision point. The key stages are (COOPER, 1993): 1) preliminary investigation: a quick investigation and scoping of the project; 2) detailed investigation: a much more detailed investigation, including project definition and justification; 3) development: the actual design and development of the new product; 4) testing and validation: tests or trials in the marketplace, lab., and plant to verify and validate the proposed new product, and its marketing and production; and 5) full production and market launch: beginning of full production, marketing, and selling.

Many other publications also deal with the proposition of a new product development process. DUNCAN (1996) presents a process similarly to Cooper's. It consists of a set of four stages but includes a 'zero' stage called 'exploration'. This is relevant since much attention should be paid at the initial stages due to the complexity involved with product development which tends to increase as the time goes by (GRIFFIN, 1997). In order to consider initial stages, the reference model developed by ROZENFELD et al. (2006) not only includes 'pre-development' stages but also 'post-development' stages. Figure 3 shows the reference model proposed by ROZENFELD et al. (2006). As can be seen in the figure, this model expands product development life cycle. For instance, portfolio management, is depicted

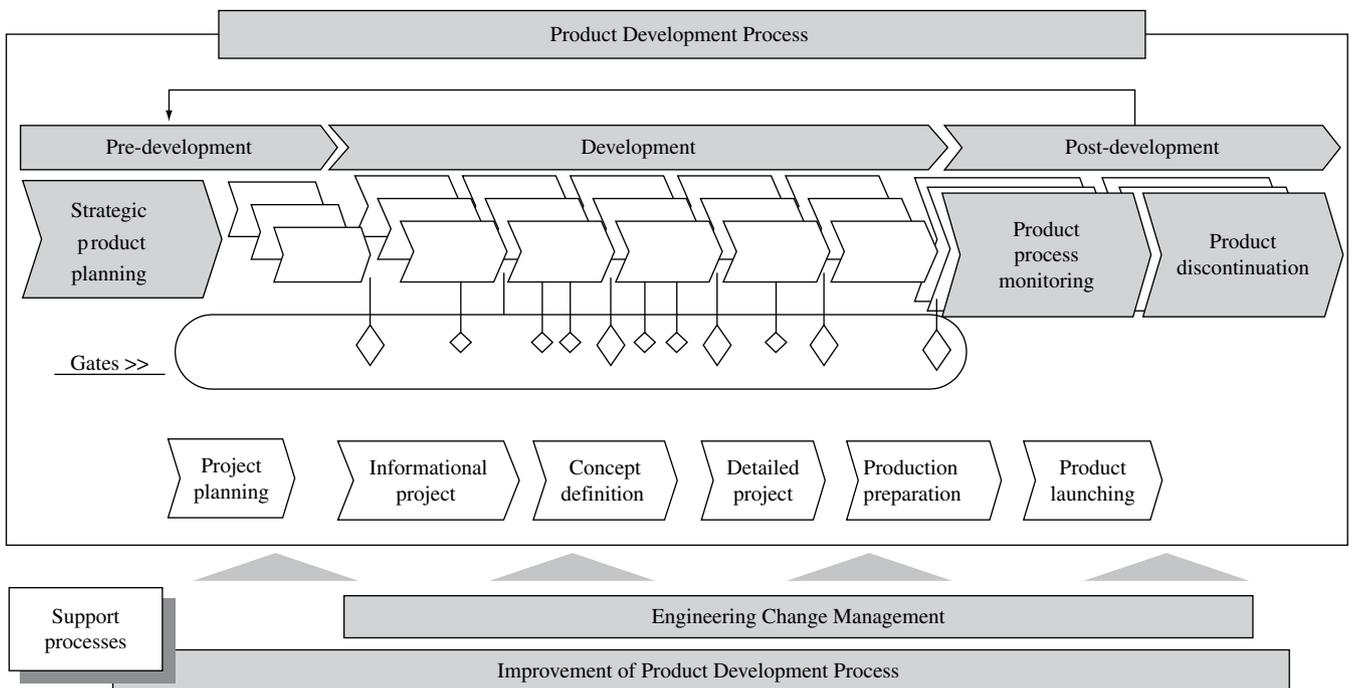


Figure 3. Reference model for developing new products (ROZENFELD et al., 2006).

at the initial stages (at the strategic product planning), then linked with development stages.

Having presented the theoretical background, the paper outlines the context of the automotive industry in Brazil. Afterwards, attention is firstly turned to the research design followed by the findings of the present study.

3. Automotive industry in the country

The automotive industry is one of the most prominent industrial sectors in Brazil. OEM (Original Equipment Manufacturers) installed assembly plants in Brazil in the end of 50's (Ford, GM, VW, and Mercedes-Benz). Fiat initiated its operations in 1976 and Honda is the first automotive plant installed after many years; the Japanese facility was inaugurated in October 1997. Then, there were other newcomers from which four of them started their operation prior to the end of 1998. Those included but were not limited to Audi/VW, Mercedes-Benz (cars; now Daimler Chrysler), Mitsubishi, PSA – Peugeot/Citroën, Renault, and Toyota (cars). More recently, other OEM have installed plants in the country, e.g. Nissan and Hyundai. As a consequence, the automotive sector in the country become more international and integrated to the global supply chain. It is now expected a US\$ 6 billion investment from OEM until 2011.

In this context, new product development and design activities assumed a more relevant role in this scenario through the introduction of a development strategy of a 'world platform'. In fact, the usual chosen strategy is to develop a world platform since it enables adaptations for the particularities of each market (HUMPHREY et al., 2001). This strategy raises the possibility of redirecting design activities to emerging economies resulting in positive effects in terms of attracting new investments and achieving more strategic importance to the operations in Brazil (SALERNO et al., 2002). As a consequence, a number of initiatives for introducing centers for new product development have been undertaken for the past 5-10 years (MIGUEL, 2006). This recent initiative opens up a series of opportunities for studying portfolio in new product development, the scope of the present article.

4. Research design

This work can be categorized as an empirical research. It is part of a major project on portfolio investigation in companies operating in Brazil. Preliminary findings related to this project can be found in MIGUEL (2006). The research has been carried out by analyzing current publications in this field and by getting empirical non-structured data from some company visits. Figure 4 illustrates the analytical process framework adopted as the methodological approach. It consists of identifying issues to be investigated, followed by what the literature have to say, next data is collected about each situation, and, finally, data analysis grounded to the

theory. Then, the cycle is closed but continuously restarted. This paper concerns the field data collection (Figure 4).

A case study approach was employed as research strategy to address the question on how is the current portfolio practice regarded new product development. Guidelines in the existing literature (YIN, 1994; VOSS et al., 2002) were followed to design and conduct the case. This unit of analysis was selected due its recent history of designing and producing trucks and bus chassis in the country. It can be considered as a revealing case study, as suggested by YIN (1994). In addition, the facility for data access was considered as well.

4.1. Company profile

The company is part of an international large automotive organization, producing trucks and cars. The truck group is the world's leading manufacturer of trucks, and boasts six strong independent and complementary vehicle brands. One of the brands (or business unit) is within the scope of the present study. 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 families of products. Typical company new product developments include platform and derivative projects.

During the past years the company has consolidated the implementation of a local technological center for developing new products. This enables the automaker to design and launch truck and bus platforms as well as components (engines, spindles, and components for a number of industrial applications). The technological center employs more than 500 people.

The product development process was created in its headquarters and is based on ten stages and gates. The development process is a framework similar to Cooper's 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 fulfillment list'. This document considers

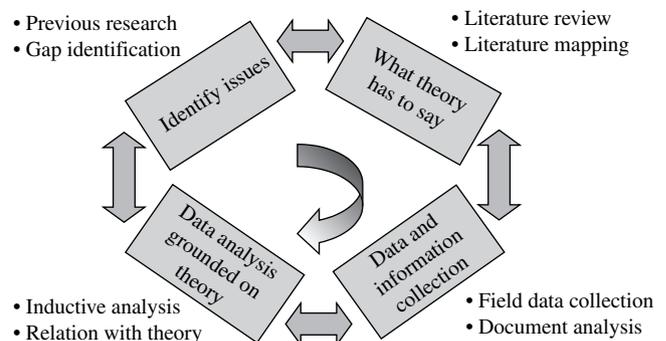


Figure 4. Research project cycle.

costs, quality and performance objectives including risk analysis.

4.2. Means for data collection and analysis

Data were provided by one of the authors who is deeply involved with portfolio analysis and new product development. Managers from other functional areas were also consulted (non-structured interviews), including people from marketing and financial departments. Other sources of evidence such as on-site visits and archival documents complemented data collection. All sources were then reviewed and analysed to identify and validate data. The emphasis on data analysis was in the process of exploration of data considering the existing theory (especially but not limited to: COOPER et al., 1997a; 1997b; 1998). Out of the analysis of data a case study was constructed and some conclusions could be drawn.

4.3. Theoretical reference for data collection and analysis

Firstly, general data for context purposes were obtained. These basically involved characterization of the portfolio and some of new product development activities. The main framework for data collection and analysis was the work conducted by COOPER et al. (1998). Some issues for analysis, suggested by the authors, were applied; those are (COOPER et al., 1998): portfolio results on six metrics; importance of portfolio management methodology; satisfaction with portfolio management methodology; portfolio management explicit and formality; and portfolio management methods.

5. Results and discussions

At the time frame of the study (between 2002 and 2005), the company had three large and 20 medium to small new product development projects. Two of large projects were active; those were strategically chosen to meet the needs of the national market. They have consumed 80% of new product development resources for three years. The other large one was an international project, which was on hold at that time. All medium and small projects were derivatives product developments within the categories of

product improvement and new product variants required by marketing. From those, 12 projects were active.

The large projects were new platforms based on a previous platform from the company headquarter. Off-road and on-road vehicles were developed in order to adapt them to local market and road conditions of South America. The level of complexity of those projects might be considered as moderate due to new technologies brought to Brazil and due to the challenge of a global development. As stated before, the medium and small projects were derivatives with adjustments in the existing products. Those were related to the new demands for noise emission and quality improvements.

The development of the two large projects generated a necessity for collaborative development among 4 partners: the Brazilian company subsidiary, the company headquarter, a major supplier in Brazil, and a major supplier in Germany. The major challenges for this collaborative new product development were the intensive use of videoconferences, incorporation of new product development procedures from the headquarters (both from the OEM and the German supplier), and the extension of the decision process, i.e. more autonomy for the Brazilian subsidiary. Figure 5, extracted from the literature (SALERNO et al., 2002), illustrates the typical relationship among players for product development in the country. The above mentioned new product development projects at the studied company is well-compared with this relationship in this figure.

As identified in the literature, one of the needs for portfolio management is the definition of portfolio meetings. Table 1 shows some aspects of for portfolio gate review and design review gates.

5.1. Analysis of R&D product portfolio

As stated earlier, five issues were considered for analysis:

- Portfolio results on six metrics;
- Importance of portfolio management;
- Satisfaction with portfolio management method;
- Portfolio management explicit and formality; and
- Portfolio management methods (main portfolio methods employed and criteria used to rank projects against each other).

Table 1. Gate meetings.

	Portfolio meetings	Project meetings
Purpose	Review of 'active' and 'on hold' list of projects	Gate review of large projects strategically important and design review for medium and small ones
Frequency	'Status' meeting: monthly Major meetings: every four months (for the whole portfolio)	Large projects: 4 times a year Medium and small projects: gate meetings twice a month
Main Activities	Change in portfolio mainly considering marketing inputs about new market needs	Project follow up; go/kill decisions

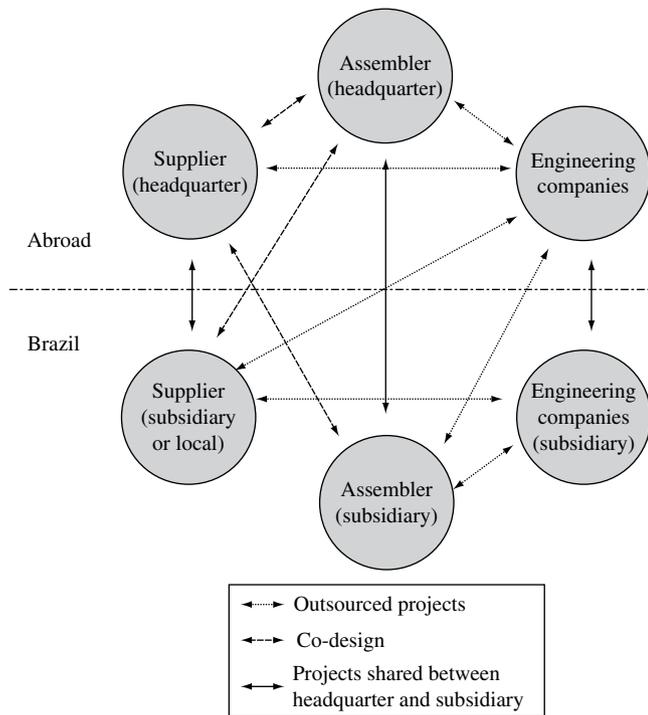


Figure 5. Relation among companies for product development (SALERNO et al., 2002).

Tables 2 to 5 shows the result for the first four issues followed by a discussion of their results. The remaining issue is also commented and discussed.

Table 2 shows the results for the first issue.

Project management of the investigated company is a maturity level similar to the top 20 companies established by COOPER et al. (1998). Such maturity is due to the company experience with portfolio management from the past 3 years, especially by the concern with strategic alignment and use of tools for monitoring portfolio, such as EVM (earned value management). One of the milestones was project ‘A’ (the name will not be cited due to confidentiality), a platform for South America market based on an previous headquarter major project. Relevant activities include communization of components among other projects, supplier involvement with new product development, portfolio internationalization (better alignment with the headquarter), and revision of the process of new product development. Nevertheless, there are still opportunities for improvement. For instance, a better balance should be achieved; especially for small projects (the vision is too centered in the short term). In addition, there is a necessity to find out a balanced and an ‘ideal’ number of projects in order to comply with project goals, time, quality, and costs.

Table 3 shows the results for the second issue.

As can be seen (as expected) people involved with new product development (‘technology management’) gave the highest score. The following two groups give some value to

Table 2. Portfolio results on six metrics (1 = poor; and 5 = excellent).

Metrics	Score
Projects are aligned with business objective	4
Portfolio contains very high value projects	4
Spending reflects the business strategy	4
Projects are done on time (no gridlock)	3
Portfolio has good balance of projects	3
Portfolio has right number of projects	2

Table 3. Portfolio management importance (1 = somewhat important; and 5 = critically important).

Areas	Score
Technology management	5
Senior management	3.5
Corporate executives	3.5
Marketing/sales management	3
Operations/production management	2

Table 4. Satisfaction with portfolio management methodology (1 = not satisfied; and 5 = very satisfied).

Characteristics	Score
Fits management style	4
Perceived as effective	4
Method truly used to make go/kill decisions	3.5
Perceived as efficient	4
Realistic method	4
User friendly	3
Understood by management	4
Method rated as excellent	3
Business recommended method	3.5

Table 5. Explicit and formality of portfolio management methodology (1 = not at all; and 5 = very much so).

Topic	Score
Have established a explicit method	4
Management buys into method	4
Clear rules and procedures	4
Treats all project as a portfolio	4
Consistently applied across all projects	3.5

portfolio management with the exceptions of marketing and production. Marketing believe that an excessive emphasis on scoring (strongly based on financial issues and product development capacity) might distort their expectations. Production practically does not have interest in portfolio management thus reflecting its score. The exception is when is necessary a large investment in the production line, as in the case of project ‘A’.

Table 4 shows the results for the third issue.

Although portfolio management methodology was introduced 3 years ago, it is worth mentioning that the current version of methodology is rather recent (six months old). The current version is not fully implemented since it is in phase-in. Therefore, some adjustments are necessary and should be incorporated to the decision process. The simpler previous version consisted of decisions taken by a group formed by top managers in periodical meetings. In the current version, a tool for prioritization was added to the decisions taken by the group. It uses a scoring system together with a financial method in order to compare all projects. Before implementing, the group of managers extensively discussed the scoring system and the financial method. Now they are well understood and accepted. This reflects the scores in Table 4, although some improvements (e.g. to be more 'user friendly') are needed.

Table 5 shows the results for the third issue.

As discussed earlier, the current portfolio management methodology is rather clear and well accepted by most managers. It is fair to say that marketing has a certain resistance and, for that reason, it has been chosen by the board of management to pull the process and report results once a month.

The last issue is related to portfolio methods. The most popular employed methods, in this order, are: financial; business strategy; and scoring models. The last one was recently suggested by project management team to the board of management in order to systematize the process and help to achieve a better portfolio balancing. The method currently used is, in fact, a mixture of all of them, as in the majority of companies identified by COOPER et al. (1998). The logic of the current method reflects the expectations of the present board of management. In addition, in the pilot runs, it has been observed an emphasis on financial aspects, followed by strategic issues and, finally, scoring.

Finally, criteria used to rank projects against each other were checked. These are:

- 1) commercialization capacity;
- 2) projects pay-off (contribution margins); and
- 3) strategic fit/leverage core competencies.

Market acceptance has a very important influence on project management decision taking. This criterion obviously presents a strong appealing and it is firmly defended by marketing. The second one is rather expected since this is a core subject when developing new products. Differently from Cooper's conclusions (COOPER et al., 1998), the Brazilian business unit does not rank strategic fit as commercial and financial criteria. This can be explained due the fact that strategic planning is centered in the company headquarters and the Brazilian business unit just plays an important but limited role in the long run planning. Although 'timing' and 'technological capability' were also

indicated, respectively, as fourth and fifth criteria, 'risk and probability of success', 'protectability', and 'synergy between projects' were not taken into account. At this point, the present investigation is not able to explain that, which will be an subject for future work.

6. Concluding remarks

Since this work is not fully completed, the conclusions of this work are limited. However, some initial concluding points can be raised. At a general level, portfolio management for new product development in the investigated company is in place. It is not evident from the results but the product development area in the Brazilian business unit is the major sponsor of the portfolio management methodology. It is the functional area that most value the methodology. There is, however, room for improvement, as the results shown.

One of the main challenges is to truly convince the commercial area that portfolio management is really important especially for long-term decisions. This area is very much oriented towards 'today' and, as a consequence, it does not value the portfolio management methodology.

Although there are some autonomy on portfolio management for new product development in the company, there is still a dependency from the company headquarter. It is fair to comment, once again, that portfolio management was introduced 3 years ago in the Brazilian business unit while it has worked for 6 years in the company headquarter. Therefore, more cycles of improvement are expected to occur.

Concerning criteria used to rank projects against each other, this investigation is not fully conclusive. Although the first three criteria can be reasonable explained, the remaining criteria are not. As stated earlier, these are subjects for further investigation.

One of the relevant concluding points is the identification that portfolio management methodology is essential to the future of the Brazilian business unit. Since this unit has autonomy for new product development (at certain extent), they have appreciated the usefulness of portfolio management. Portfolio practice is important not only to support managerial decisions but also to take better and faster decisions towards product development the markets under its responsibility. Keep the portfolio management methodology running can be considered as vital for its survival.

7. References

- DANILA, N. Strategic Evaluation and Selection of R&D Projects. **R&D Management**, v. 19, n. 1, p. 47-62, 1989.
- CLARK, K.B.; WHEELWRIGHT, S. C. **Managing New Product and Process Development**. New York: The Free Press, 1993.

- COOPER, R. **Winning at New Products – Accelerating the Process from Idea to Launch**. Cambridge, MA: Perseus Books, 1993.
- COOPER, R. G.; EDGETT, S. J.; KLEINSCHMIDT, E. J. Portfolio Management in New Product Devevelopment: Lessons from the Leaders – I. **Research Technology Management**, v. 40, n. 5, p. 43-52, 1997a.
- _____. Portfolio Management in New Product Devevelopment: Lessons from the Leaders – II. **Research Technology Management**, v. 40, n. 6, p. 16-27, 1997b.
- _____. Best Practice for Managing R&D Portfolio. **Research Technology Management**, v. 41, n. 4, p. 20-33, 1998.
- _____. New Problems, New Solutions: Making Portfolio Management more Effective. **Research Technology Management**. v. 43, n. 2, p. 18-33, 2000.
- DENKER, S.; STEWARD, D. V.; BROWNING, T. R. Planning Concurrency and Managing Iteration in Projects. **Project Management Journal**, v. 32, n. 3, p. 127-136, 2001.
- DOOLEY, L.; LUPTON, G.; O’SULLIVAN, D. Multiple Project Management: a Modern Competitive Necessity. **Journal of Manufacturing Technology Management**. v. 16, n. 5, p. 466-482, 2005.
- DUNCAN, W. R. A Guide to the Project Management Body of Knowledge. **Project Management Institute Publications**, Pennsylvania, 1996.
- ENGWALL, M.; KLING, R.; WERR, A. Models in Action: How Management Models Are Interpreted in New Product Development. **R&D Management**, v. 35, n. 4, p. 427-439, 2005.
- GRIFFIN, A. PDMA Research on New Product Development Practices: Updating Trends and Benchmarking Best Practices. **Journal of Product Innovation Management**, v. 14, n. 2, p. 429-458, 1997.
- HUMPHREY, J.; LECLER, Y.; SALERNO, M. S. **Global Strategies and Local Realities: the Auto Industry in Emerging Markets**. London: Macmillan, 2001.
- MCCARTHY, I. P. New Product Development as a Complex Adaptive System of Decisions. **Journal of Product and Innovation Management**, v. 23, p. 437-456, 2006.
- MIGUEL, P.A. C. The Potential of New Product Development in the Automotive Industry in Brazil: an Exploratory Study. **Product: Management & Development**, v. 4, n. 1, p. 35-43, 2006.
- ROZENFELD, H. et al. **Gestão do Desenvolvimento de Produtos – Uma Referência para a Melhoria do Processo**. São Paulo: Saraiva, 2006.
- ROUSSEL, P. K.; SAAD, K.; ERICKSON, T. **Third Generation R&D: Managing the Link to Corporate Strategy**. Boston, Massachusetts: Harvard Business School Press, 1991.
- SALERNO, M. S. et al. A Nova Configuração da Cadeia Automotiva Brasileira (“The New Configuration of Brazilian Automotive Supply Chain”). Relatório de Pesquisa, Departamento de Engenharia de Produção, USP, November. Available at: www.poli.usp.br/pro/cadeia-automotiva (in Portuguese), 2002.
- TATIKONDA, M. V. An Empirical Study of Platform and Derivative Product Development Projects. **Journal of Product Innovation Management**. v. 16, p. 3-16, 1999.
- VOSS, C.; TSIKRIKTSIS, N.; FROHLICH, M. Case Research in Operations Management. **International Journal of Operations and Productions Management**. v. 22, n. 2, p. 195-219, 2002.
- YIN, R. K. **Case Study Research – Design and Methods**. Applied Social Research Methods Series, v. 5, London: Sage Publications, 1994.