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Decision making in the product portfolio: Methods adopted by Brazil's innovative companies

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Abstract

Product portfolio management is one of the leading contemporary trends in innovation strategy and R&D management. This paper aims to present and analyze methods that companies from the electronics and computer sectors adopt for decision making in their portfolios. A survey that collected information from 71 companies operating in Brazil was carried out, and it was noted that despite the financial methods, market research, and mapping being employed by some firms to base decision making on their product portfolios, most of them rely upon the informal decisions of senior management. In this way, the results of this survey indicate that, in addition to the formal methods, aspects of the influence and bargaining power of leaders must also be considered when analyzing and proposing management practices related to product portfolios.

Keywords: new product development; product portfolio management; decision making.

La toma de decisiones en portafolio de productos: Métodos adoptados por las empresas innovadoras de Brasil

Resumen

La gestión del portafolio de productos es una de las principales tendencias en estrategia de innovación y gestión de I+D. Este artículo tiene como objetivo presentar y analizar métodos que empresas de los sectores de productos electrónicos y de computadores adoptan para la toma de decisión de sus portafolios. Fue realizada una investigación tipo survey, la cual recolectó datos en 71 empresas que actúan en Brasil. Se notó que a pesar de que los métodos financieros, de investigación de mercado y de mapeamiento son empleados por parte de las empresas para la toma de decisión en portafolio de productos, la mayoría de ellas se basa en las decisiones informales y de la alta gerencia. De esta manera, los resultados de esta investigación indican que además de los métodos formales, los aspectos de influencia de líderes y de poder también deben ser considerados al analizar y proponer prácticas de gestión relacionadas al portafolio de productos.

Palabras clave: desarrollo de productos; gestión del portafolio de productos; la toma de decisiones.

1. Introduction

Decisions in managing a product portfolio have the following practical fundamental consequences for companies: definition of the set of product designs that enable the implementation of the business strategy, decisions on allocation of resources between the different projects, and the selection and prioritization of product designs. These decisions can be extended to and deployed in the development of technologies.

Given that it determines the current and future set of

products that a company uses to compete in the market, theme-portfolio management has attracted the attention of researchers and professionals. [1,2] highlight that product portfolio management (PPM) is a relevant activity because, apart from directing definitions on the projects of new products, decision making also raises implications for aligning technology-development needs, their potential employment in product designs, competitive advantages of the products to be launched, and which market segments are to be targeted with the product portfolio, among others.

Decision making related to the product portfolio is a

complex aspect and is involved in the planning stage of new products. The planning stage is a time for important decisions to be made regarding a company's future products, but this stage is still distant from the launch; it is important for defining key aspects of the final product [3] and, therefore, still presents many uncertainties [4]. Also, development decisions and resource allocation in product design are associated with subjective values and bargaining [5], which may compromise the optimization of choices related to the portfolio and the good performance of new product development (NPD).

Given both the strategic and complex nature of PPM, the literature on the subject reveals diverse methods that can assist companies in their management and decision-making activities in relation to the product portfolio [1,6]. Among these, we can highlight the financial method, scoring and ranking, the maps of products, checklists, and diagrams [7-10].

It is in the context of the previous paragraphs that this contribution is framed. This study seeks to present and discuss the main methods that companies operating in the electronic and computing sectors adopt for decision making regarding their product portfolio and to compare these results with those of earlier studies such as, for example, the one undertaken by [1]. To this end, a survey that collected data pertaining to 71 companies operating in Brazil was carried out. These two sectors were chosen because, according to the latest 'Survey of Innovation' conducted by the most important social-economic survey body of the Brazilian Federal Government, the Brazilian Institute of Geography and Statistics [11], these two sectors have shown the highest rates of innovation in recent times in Brazil. Further, in global terms, in the major industrialized nations, it is the electronic and computer sectors that usually present the more relevant indicators of innovation and of new product launches and their aggregated services.

The study initially presents a brief theoretical review of PPM. Following this, the research method employed is covered and, later, the empirical results obtained are presented and discussed. At the end, the final considerations are outlined.

2. Methods for Product Portfolio Management

It is the consensus of various publications [1,8,9] that PPM must essentially fulfill three basic goals: strategic alignment, balance, and maximized portfolio value. Previous researches have raised the issue of the difficulties faced by companies for the attainment of these goals [7,12]. Some studies mention that by determining with which products a company will compete, portfolio decisions are associated with the critical-planning moments of NPD, which has as its central feature a large amount of preliminary ideas coupled with high uncertainty of results [4,13].

[14,15] suggest that one of the main causes of failure in NPD occurs, mainly, as a result of imperfections in the planning activities of the product portfolio. According to these authors, many companies focus on individual projects and do not integrate them well with other projects or their

strategic planning. [1,16] point out that, on one hand, companies typically have many product designs, but, on the other, there is a limitation of time as well as financial and human resources.

Moreover, as indicated by [12], many companies find difficulty in prioritizing their projects for new products because they outlay intense energy in routine management problem solving and short-term pressures, while paying little attention to issues pertaining to the alignment between new product development with their respective strategies.

Studies such as [12,17] identified that those companies showing better performance in product portfolio are precisely those that adopt formal and systematic mechanisms to conduct these activities. Among these, we highlight the financial, checklist, scoring, maps, graphics, and diagrams [12].

The financial methods aim to maximize the value of the product portfolio. The following financial-assessment mechanisms are usually mentioned as suitable for the analysis of NPD: net-present value, internal rate of return, break-even point, payback, and real-options methods [2,9,14].

Scoring-based models suggest that product designs be ranked and prioritized according to the expected average of their performance and according to their respective degrees of alignment with the business strategy [18]. Scoring models require the prior establishment of the judgment criteria, to which, subsequently, notes are assigned. These same criteria can be analyzed by means of the checklist technique in order to observe whether the product design meets the market, technical, and performance criteria considered relevant by the company [19].

Papers such as those written by [14,20] have been drawing attention to the implementation of the "technology roadmap," as proposed initially by [21]. The use of these maps can be useful for planning the development of platform-type products, derivatives, and radically new products [22]. From visual methods, these maps indicate which products and technologies will possibly be developed over time. This technique facilitates the resource allocation, deadline planning, and assigning of functional responsibilities for the execution of the projects. The adoption of graphs and charts, such as bubbles and the BCG matrix, are also recommended as useful mechanisms for simultaneously analyzing, over the product's life cycle, the relationship of the product portfolio with the company's strategy and balance [17,23].

The implementation of the methods listed throughout this topic can be systematized with the aid of the evaluation phases [1]. The cross-functional team involved with decisions pertaining to the product portfolio can initially check at an early phase-evaluation stage whether the projects are to be maintained or discontinued. To do this through the above-mentioned financial, checklist, and scoring mechanisms, each project can be evaluated so that a list of the product designs that will be interrupted, "frozen," or remain under review for possible development can be obtained. In a second step, the maps and financial and scoring methods can be employed to compare and prioritize product designs approved for development.

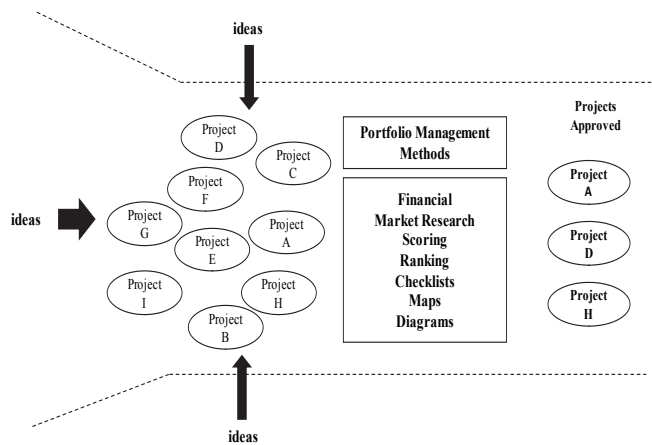


Figure 1. Structure for decision making in the project portfolio.
Source: Adapted from [24]

Fig. 1 illustrates the systematic application of the formal methods that can be employed to evaluate the product portfolio. Note that in the figure, projects and product ideas are presented that originate internally (staff members and specialists from different departments, for example) and externally to the company (such as customers, suppliers, universities, consultants, etc). As Fig. 1 demonstrates, with the application of the methods mentioned throughout this theoretical review (financial, market research, scoring, checklists, and diagrams), only three of these project ideas remained after screening and selection, exactly those that have been effectively approved and that will be developed. In addition, the application of these methods can indicate which of these projects can be prioritized in the development stage.

The next topic presents the procedure employed in this study, after which the results are reported and discussed.

3. Research Method

To identify the population of companies in the sectors chosen, an investigation was made into the database of the Brazilian Association of the Electrical and Electronics Industry (*acronym in Portuguese*: ABINEE) and also into the companies registered with the National Institute of Metrology, Quality and Technology (INMETRO for its *acronym in Portuguese*). For the attainment of this paper's objectives, a survey-type research was carried out, this being considered the most appropriate for obtaining a descriptive overview of a given phenomenon, and as one of the most suitable methods when quantitative research is undertaken in the area of operations management [25]. A structured questionnaire was developed for the realization of the survey, aiming for, in particular, the identification of the main management methods that companies use for decision making in the product portfolio.

To define the size of the companies, criteria from both the Brazilian Service for Support to Micro and Small Companies (SEBRAE for its *acronym in Portuguese*) and the IBGE were adopted. According to these bodies, in industry, small

businesses are classified as having between 20 and 99 employees; medium-sized enterprises, between 100 and 499 employees; and large ones, over 500 employees.

To organize the sending of the questionnaires, a website was set up for the purpose of hosting the research instrument. Through the site it was possible to register the entire population of companies and send the link containing the questionnaire to each one of them. On receiving the link, the respondent was directed to the questionnaire hosted in the virtual research environment. The respondents comprised mostly directors, R&D managers, engineering managers, marketing managers, and supervisors, i.e. employees directly involved with decision making regarding product portfolios and implementation of NPD.

Seventy-one answered questionnaires were considered valid and therefore constitute the sample set for this research. A 14.4% rate of return was achieved, which, according to [26], can be considered an adequate sample in operations-management research. In relation to the number of observations, [27] suggest that the sample should be greater than 50 observations. For these reasons, the sample retrieved from 71 companies can be considered satisfactory for the fulfillment of the goals of this research.

The results were compiled and analyzed through descriptive statistics in order to highlight the most obvious results observed in practice of the application of the methods associated with the PPM. The decision making in product portfolio results were also compared considering the size of the companies. The next topic of the study presents and discusses the results obtained.

4. Presentation of Results and Discussion

In terms of sample composition, most of the companies belong to the electronic-industries segment (86%). Based on electronic and optical technologies, these companies develop products mainly for the areas of industrial automation, telecommunications, energy, automotive, and healthcare. The remainder of the sample (14%) is composed of companies from the computing sector, characterized foremost by software development.

As for their size, as Table 1 illustrates, the vast majority of these companies are small and medium companies, comprising approximately 85% of the gathered sample.

Table 2 presents the main method identified by companies for decision making in the product portfolio. It is possible to note that just over half of the enterprises base themselves on informal and intuitive decisions by senior management for this deliberation and, therefore, did not favor the application of any formal method. Next came financial means and market research in a much lower proportion than the other methods.

Table 1.
Distribution of companies by size.

| Size of the Companies | N. of the Companies | % |
|-----------------------|---------------------|------|
| Small | 31 | 43,7 |
| Medium-Sized | 29 | 40,8 |
| Large | 11 | 15,5 |

Source: Developed by the authors.

Table 2.
Main method adopted for decision making in the product portfolio.

| Main method for portfolio decision-making | Number of Companies | % |
|---|---------------------|------|
| Decision by senior management (i.e., no formal method associated) | 36 | 50,7 |
| Financial | 11 | 15,5 |
| Market Research | 11 | 15,5 |
| Product Maps | 5 | 7,0 |
| Technology Roadmap | 4 | 5,6 |
| Scoring | 2 | 2,8 |
| Checklist | 1 | 1,4 |
| Diagrams (such as BCG matrixes and GE bubble charts) | 1 | 1,4 |

Source: Developed by the authors.

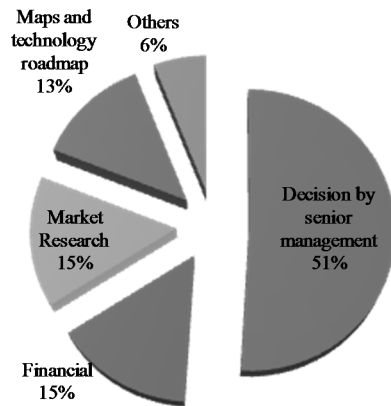


Figure 2.
Methods adopted for the decision making in product portfolio.
Source: Developed by the authors.

Fig. 2 shows the application of these results from the four most-cited mechanisms for decision making in the product portfolio. As the application of product maps and the technology roadmap are methods that have the same purpose of planning in product-portfolio management, they were grouped for joint analysis in this figure.

Through an analysis of Table 1 and Fig. 2, it becomes clear that applying formal methods is not a priority for decision making in product portfolio for the majority of the surveyed companies. This makes certain decisions of product innovation more dependent upon the perception and opinions of a company's top executives, their experiences, personal perspective, influence over managers, and bargaining power within the company. In addition to this perceived informality, this result also indicates which aspects of political influence and opinions of members of top management represent relevant mechanisms in these Brazilian companies for decision making on portfolios. These results converge with recent observations of [5,28] about the importance of considering political and

organizational aspects when analyzing and proposing PPM practices.

It can be noted, moreover, that there are differences between the results of this survey and those that [1,7] observed at different times in North American, Canadian, and Australian companies. These authors found that financial methods constitute the principal means that companies from those countries used for decision making in the product portfolio. It was noted, in the Brazilian case, that financial methods are adopted as a primary means for decision making by only 15% of the surveyed sample.

Information originating from market research and customer needs was indicated as the primary method for making decisions by 15% of companies. In addition to the basic importance of the role of market research to meet and capture customer needs to direct future product choices, another reason for this result is related to the market in which these companies operate. As many are active in the business-to-business area, most of their projects of new products are started only when effectively demanded by the customers.

The use of maps and the application of the technology roadmap as a primary means for decision making in the product portfolio by 13% of companies is a result that deserves attention. After all, it is only recently that studies in Brazil mention mapping methods as a way to manage the product portfolio [29]. On the other hand, it was noted that companies do not prioritize traditionally recommended methods for decision making in the portfolio, such as scoring, checklists, and diagrams, since only 6% of companies sampled mentioned the application of these methods; that is, four companies.

Table 3 presents the main method adopted for decision making in the product portfolio considering company size.

Considering the frequency of application of these methods in terms of company size, it is observed in Table 3 that only in large companies does the application of formal

Table 3.
Main method adopted for decision making in the product portfolio considering company size.

| Main method for portfolio decision-making | Large | Size of Companies Medium-Sized | Small |
|---|-------|-----------------------------------|--------|
| Decision by senior management (i.e., no formal method associated) | 27,2% | 55,2% | 58,06% |
| Financial | 36,4% | 13,8% | 9,68% |
| Market Research | - | 10,3% | 19,35% |
| Product Maps and Technology Roadmap | 18,2% | 10,3% | 12,90% |
| Scoring | 18,2% | 3,5% | - |
| Checklist | - | 3,5% | - |
| Diagrams (such as BCG matrixes and GE bubble charts) | - | 3,5% | - |

Source: Developed by the authors.

methods for decision making on product portfolios surpass the informal decisions of senior management. This result was already previously expected because usually the larger enterprises have consolidated departments and professionals trained and dedicated to deal specifically with management activities. In this regard, the adoption of financial methods, used by about 36% of these companies, stands out. This result, verified in large enterprises, converges with the results of international research on the subject [1,7].

Slightly more than half (55%) of midsize companies base themselves on the decisions of top management for decision making in the product portfolio. On the other hand, among small companies, this indicator rises to approximately 58%. Even among large companies, a significant portion also bases its product-portfolio decision making primarily on the decisions of their senior management (approximately 27%).

In a smaller proportion, the employment of market research methods and financial services are also used by small and medium-sized enterprises. Here it is interesting to note the high rate of implementation of maps and the technology roadmap method for product-portfolio planning in small businesses. Apart from the benefit that these methods provide for the visual planning of products and technologies, another explanation for this occurrence is that by being small technology-based companies, they have people who are in contact with undertakings of the same type but larger, or they have large customers such as multinationals at the forefront of their sectors that have organizationally-structured technology management, and they make use of these methods, disseminating this learning throughout the companies in the sample. In addition, risk-investment banks (venture capital), on being approached for financing by these companies, normally require technological maps to perform their credit ratings.

5. Conclusion

What stands out most in this study is the observation of the predominance of informal means for product-portfolio decision making, which are carried out, above all, according to the definitions of senior management. This mechanism was presented in this survey as the main approach in deliberations on product portfolios. In this manner, it is noted that issues such as the influence of leaders and the power and direct control of the company's top management are crucial for the deliberations on a product portfolio, which as a result defines the resource allocation in the design of the products that will be effectively developed.

These results demonstrate that, despite the rational and objective character normally associated with PPM, aspects of organizational culture, influence, and bargaining in companies must also be considered when portfolio-management practices are investigated and proposed. Even understanding that with limited application of formal methods, the likelihood of bad decisions increases with regard to which products must be developed, maintained, and discontinued [5,7]. The results obtained in this research indicate that managers must effectively concern themselves with also examining leadership aspects, informal groupings,

team culture, and functional integration in PPM.

With regard to the formalization of the PPM, this study contributes to the theme by briefly presenting a number of formal methods of management (such as financial, market research, maps, score and prioritization, diagrams, and checklists) that can be applied to the evaluation of product projects. The implementation of this set of methods is synthesized by Fig. 1, whereby they are compared with the application by the companies surveyed.

Because they are well disseminated and known both in academia and business, there was, on one hand, the prior expectation that financial methods would effectively be featured in the results of this paper. On the other hand, due to the novelty of the mapping mechanism in terms of research and publications in Brazil, the number of companies that use it as the main method for decision making in the product portfolio is somewhat surprising, and even more so, is the fact that small and mid-sized companies have adopted this mechanism. Future case studies could identify in greater detail the motivations and specific practices of mapping, which small high-tech companies have employed in PPM. Future research studies may investigate if and how the formal mechanisms can influence the generation of informal ways to improve decision making in PPM.

There was also the expectation that market research would prove to be more important in larger companies. This fact was not confirmed, as it was not cited by any of these companies as the main method for decision making in the product portfolio. However, about 20% of small businesses adopt results from market research and customer needs for this decision making. This indicates a possible trend whereby the concern for smaller companies—especially those that are technologically based on structured-marketing activities and market research—is to improve the performance of decision making on product portfolios, and consequently in NPD.

It should be noted that one of the main limitations of this paper was that the investigation limited itself to identifying only the main management method that companies use for decision making on product portfolios. However, no correlations were made between the application of these methods with the performance of a product portfolio and the NPD. Future studies could extend the results of this paper, in order to identify these correlations, and, also, to replicate this research in other sectors of the economy and to companies of different countries.

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