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## Factors Influencing New Products Success in Small Brazilian Medical and Hospital Equipment Firms

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**Abstract.** *A research line in new product development (NPD) management is identifying success factors, that is, best practices that contribute towards reducing the unsuccessful in launching new products. The objective of this paper is identify and analyze these factors that influence project development success of new products in the Brazilian High Technology Small Firms (HTSF) of the medical-hospital equipments sector. The data were obtained by a survey in 30 HTSFs, located in the State of São Paulo, Brazil. The application resulted in a sample of 49 new product projects: 30 were considered as successful and 19 were considered unsuccessful. Initially, the association of the 64 variables investigated was measured with the result of the project product (successful and unsuccessful) by means of the respective coefficients of contingency. It was also sought to reduce the individual variables by using the Analysis of Main Components. Considering the characteristics of market-target the pre-development activities stand out. The successful projects are those in which user requirements are well served and correctly interpreted concerning specifications. Moreover, market assessment was properly carried out and the clients wanted the new product. Therefore, these companies should carefully manage such factors in the development of new products.*

**Keywords.** New product development management, high technology small firms, success factors, small brazilian medical-hospital firms.

### 1. Introduction

In new product development (NPD) management many strategies, methodologies and tools are employed aiming at improving efficiency, quality, speed and innovation indicators. In this case, the most innovative companies seek to adopt strategies and structures that can combine operational efficiency and high innovation capacity in NPD in order to continually develop new products.

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A traditional research line in the area of NPD management is the discovery of success factors, that is, best practices (tactics, methods, tools and techniques) that when well executed contribute to increase the probabilities for success in new product development [5, 6, 9,10, 12 13, 16, 18]. Many of these factors are related to Concurrent Engineering principles.

Concurrent Engineering comprises two basic principles: early involvement of all enterprise functions that contribute to a successful product and parallelism in the NPD activities. This requires changes in the organizational structure, culture and new approaches to management and control, with a focus on human resource management [14].

The grounds for executing the present work lie in the extension of knowledge concerning NPD management in specific settings. In this case, it is the Brazilian High Technology Small Firms (HTSF) in the medical-hospital equipment sector. The HTSFs have aroused the attention of the academic community, governments and economic representatives on account of their role in regional development. Such companies stand out because of their technological density in creating products, which makes NPD very important for these companies' sustainability.

The HTSFs are companies that develop innovative products based on technologies found in less mature stages of development, which, on the one hand, involves much uncertainty concerning the path that these technologies will develop, but which, on the other hand, possess much potential to expand in the market. However, in the Brazilian reality, the HTSFs occupy a lower position in the innovation process by, usually, develop their technology and market by means of imitation and by occupying small market niches [7, 15].

The objective of this paper is identify and analyze the factors that influence project development success of new products in the Brazilian High Technology Small Firms (HTSF) of the medical-hospital equipments sector. The paper focused on the manufacturers of medical-hospital equipment because this sector stands out for its technological dynamics verified in Brazilian research concerning innovation.

## **2. Success Factors of New Product Development**

The vast literature in the NPD area produced a collection of factors associated to the success of new products. Classical studies [8, 18, 19] served as reference to carry out the present work. A new product's success depends on the configuration and dynamics of controllable variables (inherent to the company) and non-controlled variables (the company's insertion ambience). In this article, the following factors were investigated: innovation degree, market-target characteristics, product characteristics, technology sources, company skills, project leader competency, integration, NPD organization, the development proficiency activities and proficiency of other activities related to new product development. These factors are briefly discussed to follow.

Market guidelines have been indicated as a critical success factor of NPD [4,18]. This factor approaches aspects such as the capacity of a company to assess market potential for the new product, to understand the needs of the market-target and to interpret such information into NPD language.

Various authors [3, 17, 19] identify many product characteristics that propel them to success: low cost, high quality, superior performance and unique attributes. Also acknowledged is the need to integrate the strategy of product development to other business strategies. Technology sources can also contribute for the success or failure of a new project, since they demand acquisition, adaptation and management capacities from the technology-based companies [17].

Competency levels of the areas involved in NPD have been correlated to the success and failure of new products [3]. In this research, technical competency was defined as the competency and capacity to accurately execute activities, interfering directly in the quality of the tasks that make up product development.

The main organizational aspects of NPD mentioned in the literature include the organization methods of project development, the degree of integration among the functional areas, the structure of NDP and characteristics of key-individuals involved in executing the project [11]. However, the foremost factors that affect NPD performance are: project team, project leader, manager's role and the involvement of suppliers and clients during project execution of new products [2]. In regards to execution of NPD activities, it is recommend that attention be given to pre-development, especially, while conducting technical and market studies and feasibility analysis [5]. Similarly, the quality in the activities of generation and analysis of ideas, technical development and market presentation are very important [9].

### 3. Research Method

The Brazilian industry of medical-hospital equipment is composed of 374 companies [1]. Based on criteria such as size (small companies with less than 100 employees and mid-sized companies with more than 100 and less than 500 employees), operation segment (equipment manufacturers), geographical localization (the State of São Paulo) and their own active NPD, totalizing 52 companies (in the State of São Paulo) that fit in the desired profile. From this number, 30 companies agreed to participate in the research.

For data collection, a questionnaire composed of 64 closed-ended questions was applied. It was requested that the companies choose two development projects that resulted in new products, where one was considered a success and the other one considered unsuccessful. All the answers were supposed to be grounded on the history, facts and situations experienced at the time of the project execution. The application of such procedures resulted in a sample made up of 30 companies and 49 new product projects, out of which 30 were considered as successful and 19 unsuccessful.

In the data treatment stage, various statistical techniques were applied. For the responses related to projects of new products, first, the association of the variables investigated was measured against the results of the product project (success and non-success) by means of the respective contingency coefficients. Thus, it was sought to determine which variables, considered isolatedly, elucidated the new product's success or unsuccess. Also, the individual variables were reduced and summarized by using techniques of factorial analysis, more specifically the

Analysis of Main Components. From the statistical procedures, the interpretation of the results enabled to find a set of factors (practices) that affect the success of product development in these HTSFs.

#### 4. Analysis of Results

Each main component illustrated in Table 1 corresponds to a set of isolated variables (Table 2), which were reduced by applying the multivariate analysis technique, to facilitate data interpretation. The results in the Table 1 show the association coefficients and their respective significance levels (p-value) among ten main components (critical factors) and the result of the new product (success or not) for the companies. Table 2 shows the isolated variables considered significant for the companies investigated.

**Table 1: Association: Main Components and the Result of the New Product**

Main Components	Eigenvalue	% Variance Explained	Association Coefficient
Characteristics of Market Target	2,21	44,2	<b>0,630*</b>
NPD Proficiency <sup>1</sup>	2,94	48,3	<b>0,576*</b>
Integration	2,70	27,0	<b>0,534*</b>
Proficiency –other activities	2,89	48,3	<b>0,484*</b>
Degree of innovation	1,86	46,0	<b>0,436**</b>
Project Leader Competency	4,14	51,9	<b>0,408**</b>
Product characteristics	1,91	47,9	<b>0,327<sup>a</sup></b>
Company competency	2,46	49,0	<b>0,278**</b>
Organization	1,52	50,8	<b>0,208<sup>a</sup></b>
Technology sources	2,25	32,0	<b>0,730<sup>a</sup></b>

\*Significant at  $p \leq 0,001$  \*\*Significant at  $p \leq 0,05$  <sup>a</sup>Not significant at  $p \geq 0,1$

<sup>1</sup> Proficiency refers to thoroughness, completeness and competency in carrying out these activities

It was observed in Table 1 that there were three main components associated to the success of the new product: **characteristics of market target, proficiency of NPD activities and integration of areas involved in NPD**. The successful projects are those in which market assessment was well carried out and which had user requirements well interpreted concerning new product specifications

The first management implication of the research is to guide NPD to the market, that is, strategically align it to the needs of the client and the market. The consequence is that the companies need to develop competencies to constantly understand and assess consumer needs. From the data in Tables 1 and 2 it can be observed that placing a new product, based on superior performance compared to the competitors and the capacity to recognize and elucidate consumer needs, is important for these companies. Since marketing responsibility, in the companies studied, is basically done by personnel from the commercial areas, who maintain a close relationship with those responsible for product development, there is

transference of knowledge concerning market needs, thus enabling those responsible for NPD to generate new technical solutions for such needs.

The results corroborated in the Characteristics of Market Target reinforce the need for greater efficiency in NPD activities, especially in the activities related to pre-development (generating ideas, sorting ideas, concept formulation and feasibility analysis), since they were indicated as critical for success.

**Table 2: Association: Isolated Variables and New Product Result**

Variables	Contingency Coefficient *	p-value
<b>Innovation degree of product</b>		
Use of platform product.	0.464	0.009
<b>Characteristics of market target</b>		
Market potential carried out well	0.426	0.034
Consumer desire for product.	0.526	0.001
Interpretation of needs.	0.567	0.000
<b>Product Characteristics</b>		
Superior technical performance than competitors.	0.483	0.006
<b>Company Competency</b>		
Technical competency of Manufacture area.	0.424	0.030
<b>Project Leader Competency</b>		
Interpersonal skills necessary for the project	0.394	0.029
Management skills necessary for the project	0.487	0.004
Team participation in project decisions.	0.423	0.014
<b>Organizational characteristics - Integration</b>		
Administrative management involvement and support	0.414	0.039
Participation – generating and selecting ideas.	0.463	0.010
Participation – feasibility analysis.	0.442	0.018
<b>Proficiency of NPD activities</b>		
Generating and selecting ideas.	0.513	0.001
Feasibility analysis (technical and economical).	0.437	0.021
Technical development (product project).	0.458	0.005
Product/market tests.	0.404	0.049
Preparation of documents – homologate product.	0.486	0.042
<b>Proficiency - other activities</b>		
Determine goals product objectives.	0.414	0.038
Provide project documentation.	0.474	0.008
Comply to legal norms necessary for product.	0.388	0.043

\*Table 2 shows the individual variables considered significant for the companies investigated, which coefficients were over 0.38 (positive association of the practice with the result of the new product) and significant level below 5% ( $p < 0,05$ ).

The need for integration consists of the second management implication of the research. The Integration in table 1 indicates a strong association with the result of the product. Throughout the analysis of practices related to integration (Table 2) adopted during the course of the new product projects, it was found that the involvement of functional areas is fundamental during the pre-development phase.

In recent years, the substitution of a sequential model to execute NPD activities for greater parallelism has been emphasized in the initial stages of the development cycle. The formation of multifunctional structures has been adopted by companies as an alternative to surpass barriers created by functional specialization. The values assessed do not indicate significant differences between the organization manner of the project team and the result of the product (table 1).

In spite of it being a common problem faced by many companies, the HTSFs investigated did not report difficulties concerning integration in their functional areas. According to the interviewees, integration occurs naturally and normally, since proximity among the individuals, as a result of the small number of employees, emphasizes the level of contact and facilitates communication and information exchange.

A strong influence of the Commercial area in relation to product development was noticed. Owing to closer contact with the client, the commercial area becomes more responsible for eventual needs, for suggesting new product ideas and even partially or fully approving a developing project.

The third management implication refers to the proficiency of NPD activities. Similarly to the analysis of individual variables (Table 2), when examining the results of the association level of the main components (Table 1), it can also be verified that pre-development and project activities are factors that should be carefully managed in NPD activities by such companies.

It is believed that correct guidance of development activities is capable of facilitating the deployment of desired characteristics by the consumer and the company's strategic view during the entire development cycle.

Finally, the project leader plays an essential role during the developing process of a new product, since he is directly responsible for the organization and direction of the development team. Besides leading the team, the leader must know how to negotiate with the administrative board in order to obtain the necessary resources for the project. In order to perform this role, the leader must have managing and relationships skills that will enable him to construct an environment of trust, coordination and control. The results in Tables 1 and 2 reinforce the importance of a leader that possesses technical and managerial competencies related to the activities of developing projects of a new product.

It was observed that three main components (skill levels of the company, technology sources and types of organizational structures applied to development projects) contributed very little or not at all for the success or failure of products developed by those companies. In regards to competency levels, two hypotheses can be raised as explanations of the results. The first one is a more complacent judgment by the responders, when they do not directly hold the functional areas accountable, due to ensuing problems and mistakes that took place during the unsuccessful projects. Another hypothesis suggests that the successful projects, as well as the unsuccessful ones, relied on appropriate endeavour and effort from the personnel of the departments involved. In this case, the failure can be explained by other reasons than lack of technical capacity.

## 5. Final Considerations

This paper analyzed practices adopted during the execution of development projects and their impact on the results of the new product, in a specific type of company. The limitation in this exploratory study is the fact that it was carried out with a small sample of Brazilian companies pertaining to only one sector of the technology-based companies.

The four management implication highlighted in this paper reinforce concurrent engineering principles, which enable the companies to continuously innovate. Concurrent engineering is defined as a systematic approach to parallel development of all product life-cycle activities, from initial conception through design, planning, production and disposal. It encourages right-first-time methods through cross-functional team working and consensus.

The increase involvement of the functional areas with NPD (integration) was observed, mainly in the pre-development activities. When the solutions appear in initial stages of the development, it becomes more evident the shortening of the time expended in some procedures, what it contributes to attenuate or even to eliminate errors in more advanced stages of development, favoring the anticipation in the launching of products in the market. For small firms, correct involvement of the functional areas in this stage can guarantee the rational use of resources employed in product development.

Notwithstanding, some results are not compatible with success factors in the literature about critical factors of success in NPD. Seeing that they are high technology firms, it was expected that the acquisition process and technological transference would be critical for such companies. However, this hypothesis was not verified with the results of the research. Another issue is related to the type of organizational arrangement in the development of a project and the success of a new product. It is perceived that cross-functional teams represent an important form of integration. However, the functional approach seems to be more common in the companies investigated. Nevertheless, the most natural behavior found in the small and mid-sized companies ends up compensating potential deficiencies of such organizational arrangement.

Especially in environments where the technological level is high, the improvement of the process of communication among the individuals and sectors, becomes a determinative factor for the success of the work. It was observed, therefore, the support of “project leader” for the success of the new product.

Market guidance, concern with efficiency and activity effectiveness of NPD, integration of know-how and leadership are key elements in any model of product development. NPD must combine technical elements that need to be planned and natural behaviors that bring diversity to the organizations. One can add to these elements a vision that adapts to contingencies as a way to promote new process configurations, structure and resources.

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