The challenge of integrating applied research and product development process: Cases study

José Luiz Moreira de Carvalho[a], José Carlos de Toledo[b]
[a]Federal University of Vale do São Francisco
[b]Federal University of São Carlos
e-mails: jose.carvalho@univasf.edu.br; toledo@dep.ufscar.br

Abstract: New products development has a growing strategic role within companies, and the technological development should be articulated with the product development process, which will have to incorporate the new technologies. An important question, from the theoretical and practical points of view, is integrating the research activities with new products development projects. The objective of this paper is discussing how to conciliate those activities, analyzing their nature differences and integration problems. Due to the exploratory character of this research, this paper discusses a question barely explored in the bibliography. Besides the theoretical discussion, this paper also presents the results of a field research in two large Brazilian companies, which are market leaders (petrochemical and home appliances). The field research results show that the use of already validated off-the shelf technologies and successive generations of new products are ways to facilitate such integration, furthermore, it is necessary to better explore that question within the context of more radical innovations and less frequent product changes. Deeper studies are necessary on the integrated planning of product development projects portfolio and applied research activities, as a mean to better integrate these processes, mainly in the case of more dynamic products or markets.

Keywords: integration, product development, research and development, home appliances, petrochemical industry.

1. Introduction

The development of new products has a growing strategic role within companies, specially in sectors which are technologically more dynamic and in those where the competition is more hostile. In view of this scenario, the improvement of existing products and the introduction of innovations become fundamental for a good competitive performance.

Companies tend to search for techniques which are alternative to those currently being used, trying to increase their profitability, and the technological change process results from their investment efforts in research and development activities and the subsequent inclusion of their results in new products, processes and organizational forms (HASENCLEVER; FERREIRA, 2002). R&D activities do not actually produce a physical product, an operational process or a new business. Rather, they produce only one product – the knowledge, the know-how which lies in the foundation of all those results (ROUSSEL et al., 1992).

The knowledge thus generated, specially in the applied research activities, has a practical application purpose on a new product and/or process. However, transferring that new knowledge to product development projects is not a simple task. Problems are likely to occur, like developments delays, lacks of synchrony and communication barriers (NOBELIUS, 2004).

The objective of this paper is to discuss the applied research activities and how to conciliate them with the new product development projects, by analyzing how these processes interact, their nature differences and their integration problems. Besides a theoretical discussion on this subject, this paper brings the results of a field research carried out in two large Brazilian companies, market leaders in their sectors, intended to assess how these difficulties are faced in practical ways.

2. The importance of functional integration in PDP

The development of a new product requires the precise evolution monitoring of the potential consumers' needs and the identification of market opportunities not taken advantage of by the rival companies, the combination of empowerment incorporated into the R&D teams with technical and scientific information externally sourced, the transformation of prototypes into good quality and low cost goods and the adaptation of the productive process and labor characteristics to the new product. Additionally, the marketing strategy and distribution channels should be

adequate and effective, after sale services should be created, when necessary, and monitoring the product under real utilization conditions by the users is often crucial, so as to ensure its gradual performance growth (PONDÉ, 2002).

Considering the various phases of the product development process, within a departmentalized company there will be sectors responsible to conduct specific stages. Being the interaction among company's areas even more necessary, specializations and work division impose predominant roles in the stages related to those areas' specific knowledge. The companies' internal organization can be a factor likely to boost or prevent the existence of some internal barriers. Thereby, according to Dougherty (*apud* BROWN; EISENHARDT, 1995), individuals working in different departments understand different aspects of product development and conceive them in different ways, thus leading to assorted interpretations of a given information.

Product development process (PDP), due to its nature, has a multidisciplinary and multifunctional character, which calls for the specialized technical knowledge, peculiar of the various areas. On account of the companies' usual division into various departments or functions, each one specialized in a specific process/area, a successful PDP requires a joint effort amongst the functions involved. And project's complexity is likely to grow whether its scope also includes research activities.

Within the aspects which should be understood to search for an effective integration, it is important to understand the effect of dividing activities among the various functions or departments. Departmentalization is a work division based on the differentiation amongst the different types of tasks to be executed. The homogeneity principle predominates, according to which functions should be assigned to organizational units based on the content homogeneity (CHIAVENATO, 2001).

The overall speed of the product development process, logically, depends on the speed of the individual stages and on their efficiency to transfer information amongst them. It is not sufficient to define project management organizational structures, nor is applying several technologies or having available sophisticated computerized systems. It is necessary to work on the learning and information transfer processes, as well as on motivation and, above all, it is necessary to attain the capacity to have people with different skills work together (CALABRESE, 1997). As shown on Chart 1, the diverse functions involved in PDP may furnish different inputs to the process.

The question of functional integration is, therefore, fundamental for a good PDP performance as regards efficiency, speed and quality. Integration is defined as the degree at which communication, collaboration and cooperative relationship take place (LEENDERS; WIERENGA, 2002). Different papers approach to integration between different processes (HART; SERVICE, 1993; NORTON et al., 1994; OLSON et al., 2001; SONG et al., 1996), with depth ranging from general to more specific. Thus, empiric studies showed that interdepartmental collaboration has a strong positive effect on performance (KAHN, 1996).

Chart 1. Inputs from the diverse PDP involved functions. Source: Based on Coombs et al. (1988); Clark and Wheelwright (1993) and Dias (1993).

Function	Inputs
R&D	Technical and scientific developments; new technologies; new product ideas; patents; competitors' products ; simulations; evaluations and prototype units testing
Marketing	Prices; market-shares; competitors' actions; changes in demand patterns; product concepts; product attributes; product scopes; sales and margins estimates.
Production	Costs estimates; product/process compatibility; demand regularity; production plans; process architecture; process simulation; suppliers validation; quality goals.
Supplies	Supply sources investigation; suppliers records; interaction with suppliers; packing and transport analysis.
Administration	Strategies; survival; growth; profit; future stability; diversification; political/social influences.

New products and/or processes are developed through projects which end up involving people from diverse functions and, depending on the company and product nature, may have different structure types. The following are identified as dominant PDP structures: functional (which reunites people according to knowledge area, tasks are carried out within each department, throughout time, and the responsibility for the project is sequentially transferred from one function to the next one); matricial (where each function nominates a person as a representative within the project team, which is lead by a project manager who is responsible for activities coordination) and the autonomous team (individuals are formally recruited from different functional areas and devote themselves exclusively to the project activities) (CLARK; WHEELWRIGHT, 1993).

As regards their duration, some structures are temporary (projects organized in autonomous or matricial structure) or permanent (keeping the division into functional areas or specific fields). Temporary structures allow a better functional integration and multi-disciplinarity, although from the organizational point of view, people's location in their respective departments remains unchanged. On the other hand, permanent structures do not concentrate on a unique and clearly defined objective, continually carrying

out tasks related to it and acquiring a deeper and more updated knowledge of a given discipline (KAY, 1998).

3. Integration between applied research and product development projects: some key questions

3.1. Participation of applied research in the product development process

R&D activities play an important strategic role in companies. For most companies, effective long term protection against new products competition lies on their capacity to foresee or at least face processes innovations, products and marketing techniques. Companies which will be first to introduce technological innovations into the market will also have competitive advantage due to the possibility to obtain patents protection (KON, 1994).

Regarding the range of R&D activities, these involve activities dealing with basic research, applied research and experimental development (KRUGLIANSKAS, apud CAMARGOS, 2000). Thus, basic research is the experimental or theoretical work primarily carried out to acquire new knowledge, without any particular application or use on sight. Applied research, on the other hand, is an original investigation, carried out to acquire new knowledge, primarily addressing a specific practical purpose (Frascati Manual (OECD, 2002); GAY; DIEHL, 1992). As regards experimental development, it involves to proof the technical/functional feasibility of new products, processes, systems and services, or even a substantial improvement of the existing ones, searched for through systematic efforts starting from technical/scientific and/or empiric knowledge already commanded by the company or externally obtained (HASENCLEVER; FERREIRA, 2002).

Whether radical or incremental, applied research activities may play an important role in new product's development; hence, applied research and experimental development play different roles. Therefore, product development projects are a continuation of the innovation process starting from the research results (even in cases of products developed with the existing knowledge).

When research activities are part of PDP, problems are likely to occur, such as meeting deadlines, high development cost, tests insufficiency, lack of synchrony among development stages and communication barriers amongst the involved functions (NOBELIUS, 2004). Therefore, integrating those activities is not an easy matter; and it is necessary to understand their interaction modes and nature differences. The discussion of integration between applied research and product development projects also includes the identification of the interfaces amongst these processes.

Depending on how they are structured, an intersection may occur (if carried out by the same group) or else a simultaneity (if carried out in parallel by separate groups) between applied research and product development projects. In many project cases not including technology development (previous or simultaneous), applied research may not be included in their scope. The study on integration between applied research and product development projects applies when a project team, even a short duration one, interacts with the function or department responsible for the applied research, in a proactive or reactive way, as well as to a functional structure, when applied research is directly responsible for a project part.

Based on Dosi's definitions, in "demand-pull" theories, the market forces are pointed out as main determinants of technological changes (the recognition of a need arises the technological efforts to try to satisfy it) and in "technology-push" theories, technology is deemed as an autonomous or almost autonomous factor, at least at short term (DOSI, 1982). In view of this approach, the contribution of applied research to product development projects may acquire different forms, depending on the strand (demand-pull or technology-push). When technology-push prevails, applied research plays an active role, fundamental to process, boosting the launch of a new product development starting from a discovery or invention. If the prevailing strand is demand-pull, product development project launches the process and applied research owes the responsibility of making its realization possible, satisfying the need of a new technology, in a reactive way. In both cases, the exchange of two-way technical information takes place.

Several papers on innovation management (TIDD, BESSANT; PAVITT, 2001; DOSI, 1988) and functional integration (HART; SERVICE, 1993; NORTON et al., 1994; KAHN, 1996), do not consider applied research and product development project as different processes, rather take them as a whole. Those authors study the integration of the R&D function with others (Marketing, Production, etc), although that approach is more adequate to a project conducted with a functional structure and not with a project teal structure. A distinction between applied research and PDP is recognized in few papers (NOBELIUS, 2004; DREJER, 2000).

3.2. Nature differences between applied research and product development projects

Significant differences exist between the nature of applied research activities and product development projects, and even more amongst those and production related activities. Therefore, investigation and production activities are differentiated, due to their nature. As long as the researcher fleeds from what has been established, from repetition and routine, a given production can only take place when reaching a repeatability degree which allows continuous repetition. Inversely, the researcher stoplessly searches for

the new and, therefore, proceeds to the unknown. Once the result is reached and the reproducibility conditions become known, the researcher will address his motivations to other aspects or subjects (BRASIL, 1992).

The inventive activity has an intrinsically uncertain nature (DOSI, 1982), and innovation involves an uncertainty fundamental element which is not simply the lack of all the relevant information on the occurrence of known events, but also: 1) the existence of techno-economic problems whose solution procedures are unknown; and 2) the impossibility to accurately trace the consequence of actions (DOSI, 1988). Within the fundamental characteristics of R&D activities, the following outstand: 1) delay (a typical feature of this activity, which may increase costs); 2) uncertainty; and 3) high price (cost levels and allocation of related resources) (KAY, 1998).

In turn, product development projects strive to obtain production processes whose constancy and predictability is determined. Depending on a limited set of initial conditions, those results are expected to repeat anytime and anywhere.

A friction point is conciliating the uncertainty of the finding and the desire to adequate projects to a systematic administration. The R&D function, however, resists the pressure to yield measurable results in short term, because its results cannot often be viewed to be measured (MAGEE, 1992). In some situations, mismatch and frustration occur between the research and production sectors, often does the research sector generate technology which the production sector has no conditions to operationalize in engineering terms. Sometimes it is easier to the production area to adapt itself to a customized "technological package" purchased externally (BARRETO, 1992).

Technology creation is uncertain, hence, each planned technology may not be available exactly as foreseen (CLAUSING, 1994). Product concepts may guide the development of technology, but concept-guided technology development is only possible when the lead-time granted to technology is shorter than required by the product. When the lead-time granted to technology is longer, as often happens in the case of high technologies, the technology should be developed or in development stage when the product development work begins (CLARK; FUJIMOTO, 1991).

In a time-based competition scenario, considering the need for the technology to be mature to be utilized in the new products, the application of "off-the-shelf technologies" (previously developed and stored in the "technology bank") is a mandatory alternative, thus separating technology development do product development. In order to avoid mismatch between "stored technology" and new products requirements, the R&D function should anticipate concepts emerging from the products (CLARK; FUJIMOTO, 1991).

4. Applied research-PDP integration: cases study

Through a field research, the confrontation of theory and empirical reality was searched for, thus increasing the knowledge of applied research integration with product development. Due to confidentiality reasons, companies will be referred to as "A" and "B".

To achieve the intended objectives of this paper, the cases study methodology was chosen. This methodology aims at thoroughly analyzing the study object, describing a specific phenomenon which may be typical (similar to other cases) or exceptional. It is preferably utilized when attempting to explain the reason why certain phenomena occur and how does it happen, when the focus of interest is on current events and when there is not much possibility to control them (GODOY, 1995).

This paper has also an exploratory character. Exploratory studies are empirical research investigations whose objective is formulating questions or a problem with a triple purpose: 1) to develop hypotheses; 2) to increase the researcher's knowledge of an environment or fact to carry out a more precise research in the future; or 3) To modify and clarify concepts (MARCONI; LAKATOS, 2003).

An interview check list helped to gather characteristics of the companies, their operations and products, as well as to research how companies organize their applied research activities and product development and the strategies they resort to integrate them. Following are the cases of companies "A" and "B".

4.1. Company "A"

Company "A" operates in the "white line" home appliances sector, being leader in the Brazilian market of refrigerators, wash machines and freezers, having also an outstanding position in the cookers and microwaves ovens market. Its operations are divided into four factories, each one devoted to a specific product line (for example, the visited unit specializes in the production of clothes and dish washers). This sector can be classified as a durable goods one, being the final consumer its actual market. Research in company "A" was carried out while visiting one of its factories; during the visit two engineers were interviewed, one working in the R&D department and the other performing as project leader in product development.

In the home appliances sector, the renewal of the products line is a constant, due to the products tendency to closely resemble each other, thus causing the price-based consumers' choice. As long as the leader company's technicians and designers take between twelve and fifteen months to create a new model and launch it, the competition takes no more than four or five months thereafter to launch a similar product and reduce the innovation advantage of the former (CASTINHEIRA, 2005).

Although the interviewees considered the home appliances markets as mature and of average competition, company tries to compete by offering the market products differentiated from the existing ones. Hence, leadership in new products development is part of the company's competitive strategy because "it is important to be known as innovator, pioneer". Company "A" owns its process technologies having, according to the interviewees, the capacity to design its productive process. Despite this, company "A's" products and processes were considered technologically stable and the interviewees' opinion about the consumer (final, in this case) is that he prefers traditional products. In such case, although innovations can be introduced into the products, they cannot be changed in a very radical form without risking rejection by the consumer.

Newly developed products may include the most significant changes as well as the most incremental ones or even just those linked to market positioning. In the case of company "A", since its products are final consumer oriented and meet assorted segments within that market, there are line extensions and changes in product appearance or form, technical performance improvement and parts or components changes. Design is an important aspect in that product type. There are also more significant changes in both products customization as well as products which are new to the corporation. On the other hand, there are no inventions or discoveries cases (the responsibility for those activities lies with the corporate "R&D", at the headquarters).

R&D activities within company "A" are carried out by own department, as long as new products development is organized based on projects whose structures are grounded on part-time functional teams ("light-weight" or "heavy-weight", according to the typology as defined by CLARK; WHEELWRIGHT (1993)). In Brazil, product development projects are centralized according to the type of technology or product being developed (in the factory that was visited, they develop washers related projects).

According to the interviewees, the sector responsible for applied research counts on its own staff, and product development and tests laboratories, budget and simulators. Besides the cited activities, this sector is responsible for: tests; technical information collection; patent related activities, safety and environmental conformance. Same as in production, research activities are centralized according to the type of technology or product. This scope does not include basic research without commercial purposes.

Finally, the research examined how the company conciliates applied research activities and product development projects. Within the projects context, situations are likely to occur where a new technology originates a new product (technology-push) or a market need demands the development of a new technology (demand-pull). In view of the constant products renewal and relatively incremental changes, the company manages to conciliate projects execution and necessary research activities through "off-the-shelf technologies" and product successive generations. In the first case, the use of "off-the-shelf technologies" reduces their application time in projects, with the advantage of being already thoroughly developed and tested, thus achieving the necessary maturity degree.

In the case of product generations, if a new technology not achieves the necessary maturity, it can be applied to the next product generation, without delaying the new product launch. Even so, the greatest degree of incremental changes does not imply too long development times. As previously mentioned, more radical innovations are carried out by the corporate R&D, at the headquarters, not being integrated to the product development activities.

4.2. Company "B"

Company "B" operates in the chemical/petrochemical sector, owning an assorted products line, ranging from the basic raw materials for the industry up to the most common use thermoplastics: polystyrene, polypropylene, PVC and PET. The activities of this company are distributed in different Brazilian regions. Considering its assorted products line, the company is leader in a great deal of them in the domestic market.

The petrochemical industry is essentially deemed as a "science-based" industry, strongly R&D intensive. Nevertheless, the crisis in the Brazilian petrochemical sector in the early 90s inhibited the demand for R&D investments in the private sector, due to the companies' restructuration need. As compared to the world leaders, Brazilian companies are perceived to invest very little in innovative capacity, around 1% of their revenue in the entire 90's decade. Thus, the low investments in innovative capacity jeopardize their development and generate a great competitive disadvantage as compared to their international competitors (MARTIN, 2001).

This case study focuses on the fabrication and development of a specific product: PVC resins, in which company "B" is also market leader. The vinyl polychloride is a thermoplastic resin applied in different industries, like pipes and pipe fittings, toys, shoes, wires and cables, doors and windows frames, ceiling linings, floor tiles and swimming pools. The research within this company was carried out in two stages; the first one involved visiting the pilot plant in one of its units, when a R&D engineer was also interviewed. The second stage, a visit to the administration office, also included interviewing an engineer assigned to the commercial area.

According to the R&D engineer interviewed, there is a department exclusively dedicated to those activities, which has its own engineers, operators team and a pilot plant.

According to the interviewee, the company is one of the few ones in its industrial pole whose applied research activities survived the post-privatization period.

The product development activities related to PVC resins have a typically functional structure, where the commercial, R&D and production departments play fundamental roles in the process. The role of the Commercial area is to initiate the process, detecting market needs or opportunities by working close to the clients. In that phase, R&D may participate in discussions with the clients about product specifications, supporting the commercial area. Once the requirements of the resin are defined, R&D takes over the responsibility for process continuation, developing the product initially in pilot scale (in this case, in its own pilot plant), thereafter the adaptation of the new product to industrial scale (the scale-up) will take place together with the Production sector. The commercial area is responsible for organizing joint tests with the customers.

Despite that typical functional structure, according to the R&D engineer there is a good interaction amongst functions during the process, without the "feuds" typical of that structure. The information technology tools are pointed out as important elements in that information exchange, because the departments involved are located in different regions (production, for example, takes place in three different regions).

The scope of the R&D activities involves the improvement of current products/processes, new products development/ processes, the search for technical solutions to meet clients' demands and, sometimes, the solution of problems in the productive process. The development of new products applications (resins, in this case) is carried out by the commercial area, aided by the R&D sector. Considering the main phases/stages of a typical PDP, there is greater participation of the R&D sector in ideas generation and new product conception; in product projects and process; in pilot scale production; in the production of pilot lots; in the validation of product/process and start of production in industrial scale.

Taking into account the product characteristics (thermoplastic raw material), specifications changes are not so frequent and the new products demands depend on the application type they are meant to satisfy (for example, PVC specifications for piping purposes differ from the PVC used in plastic bottles). Therefore, changes have a more incremental character and applied research is embedded in the project functional structure.

5. Results analysis

The importance of the integration of applied research activities with product development grows accordingly as increases the offensiveness of the company's technological strategy, changes become more significant (less incremental) and there is a growth of the frequency of new products launch.

The way company "A" competes in the market, the company needs to search for the technological leadership of its products, continuously developing new products ahead of the competitors. The products line renewal is constant, what implies the need of a more pro-active attitude for developing those products. New product projects in this company need to involve from changes requiring little or no associated research, line extensions, new product positioning or design changes, up to changes requiring medium or high importance applied research, such as performance improvement, new raw materials or components changes. The research importance in product development will thus depend on the particular characteristics of each project.

In the case of company "B", applied research is oriented to PVC raw-material and its applications, integrated with product development. Changes are related to PVC physical properties and technical specifications. Nevertheless, due to the fact of having a technological strategy performing permanent prospection and updating, following the leaders, and product maturity, product launches are less frequent than in company "A". Other characteristic of case "B" is a greater focus on research on production process (additives, catalyzers, etc.), on account of the chemical process.

In both cases, the applied research activities are carried out by own department, as long as the product development is different as regards utilized structures. In case "A", projects have "light-weight" or "heavy-weight" matricial structures (according to the typology as differentiated by CLARK; WHEELWRIGHT, 1993). Within that context, it is clear that applied research and product development project are different processes and there should be a good integration between them to obtain a successful project. Furthermore, that integration should also happen among other functions, such as Marketing and Production.

In case "B", applying a typically functional structure, applied research is a project stage. Despite that intrinsic integration, the question of development time and the company's product strategy limit new products and incremental changes of the existing ones. Consequently, that context does not favor more radical product innovations, at least in the case of PVC.

Despite the advantage of the typically functional structure, bringing into the project knowledge which is more specialized in technical key issues, the limitation of coordination and integration with other functions may be a disadvantage. Therefore, the process conducted by teams bears the advantage of greater personnel continuity and simplification of the information and knowledge transmission amongst the various process phases. On the other hand, in that configuration there is a more distinct

separation between the roles of applied research and project team.

In both cases, applied research may play an initiator role, by sooner developing the necessary technology, as well as project supplier, by meeting the demands for new knowledge/technologies related to the new product. In case "A", due to the company size and to its products nature, it is possible to work with products generations, by introducing later on modifications into them through derivative projects, what is more difficult in case "B" because of the greater product standardization.

Company "A" also works with previously developed "off-the-shelf technologies", what may significantly shorten the new products development time. However, an "off-the-shelf technologies" difficulty is that the investment resources necessary to their development have to be made far in advance and there is no immediate return forecast. In smaller size companies or companies with less financial power, that situation may imply the application of immature technologies or the obligation to purchase technologies which are more mature, already developed and proven by third parties, due to the need of faster return of investment. In both situations, the ideal integration level between applied research and product development is not reached. In view of the time adequation need between applied research and project and the difficulties previously cited, it is necessary for the technology development to be ahead in time or concluded so that the project can, in due time, utilize its results. Due to the large size of company "A", investments in that type of technology are not a burden in the budget. However, "off-the-shelf technologies" are more frequent in central research units, where distance to the market is greater than in decentralized development units (GRIMPE, 2006).

The ways how the subject companies integrate applied research and product development projects are different, but in both case one can perceive the strategy to conduct changes of more incremental character. Other strategy, in case "A", is utilizing successive products generations (incorporating in the next generation the technologies which were not thoroughly developed). Therefore, a key element of product innovation involves applying a perspective of product platform or family when planning and implementing product development projects (CORMICAN; O'SULLIVAN, 2004).

In both research cases, there is not an integrated planning of the portfolio of product development projects and applied research activities. Product portfolio management, thus, relates to company's resources allocation and to optimal investments mix (between risk and return, between long versus short duration projects). In that process, new projects are evaluated, selected and assigned priorities; projects may be accelerated, extinct or even have priorities changed; and resources are allocated and reallocated for the running projects (COOPER et al., 1988). Projects selection is a process complicated by many factors, like uncertainty, interrelations amongst projects, changes throughout time and success factors are difficult to measure (COLDRICK et al., 2005).

Technological competition depends, primarily, on the competences value of applied research and project teams, on the adequation of technology to company's core business and time advantage over the competition (JOLLY, 2003). Beyond the questions on projects selection previously cited, it is necessary to answer what means will be chosen to achieve those development goals (in-house R&D, acquisition, inter-companies alliances, etc.). The integration of product developments and technology implies the integration of time horizon, determining, among other questions, when should the company commit itself to technology development, and when should this development be ready to minimize product development time (DREJER, 2000).

Finally, even accepted as important, it should be emphasized that this question is little explored, whether in terms of innovation management (TIDD et al., 2001), R&D management (ROUSSEL et al., 1992), PDP management (CLARK; WHEELWRIGHT, 1993; CLAUSING, 1994; ROZENFELD et al., 2006), product project (BAXTER, 1998); or even projects management handbook PMBOK (PMI, 2000). Consequently, plenty of academic work has focused on research or development methods, or has concentrated on R&D as a whole. The critical link between applied research and product development has deserved little priority (NOBELIUS, 2004). Therefore, the study of integration between applied research and product development project is a relevant issue, although scarcely explored.

6. Conclusion

New products development is deemed as a key to companies' growth, although the high costs and risks involved make this process complex. Not only can new products development failures and delays cause financial damages but also jeopardize companies' image. Thus, according to Silva (2003), among "world class" companies, quality and productivity equilibrium leads to competition through innovation, oppose to the speed at which copies are launched, thus reducing the innovative company's monopoly period, turning its advantage more ephemeral.

The importance of integration as a research theme is increasing and one of the key problems encountered by the companies' is how to integrate product development and technologies development (DREJER, 2000). Most innovations begin with Marketing, go through a Conception phase and arrive at Development (CANTISANI, 2006), although even in those cases, research activities can be

integrated with project (in a demand-pull strand). The role of applied research is still more relevant if the project initiative sprouts from it (technology -push).

Through this research, it was intended to see how in practice two large Brazilian companies conciliate applied research activities and new products development projects. The results of the field research show that the use of "off-the-shelf technologies" and successive product generations are ways to facilitate that integration, but it is still necessary to better explore that question within contexts of more radical innovations and less frequent changes. A deeper study is necessary on integrated planning of the product development projects portfolio and applied research activities, as a way to better integrate these processes, specially in the case of more dynamic products or markets.

On account of all the previous findings, the study of integration between applied research and product development project is a relevant question, although little explored. Within this research the attempt was, through a theoretical discussion and cases study, to further proceed in the study of this question.

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