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## MANAGING UNCERTAINTY IN PRODUCT INNOVATION USING MARKETING STRATEGIES

### GERENCIAMENTO DAS INCERTEZAS DE PRODUTOS DE INOVAÇÃO A PARTIR DAS ESTRATÉGIAS DE MARKETING

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#### ABSTRACT

Innovation is an important factor in increasing competitiveness of Brazilian enterprises. On the other hand, innovative projects are characterized by many technical and market uncertainties. This article proposes incorporating marketing strategies into risk management methods for the development of new products and technology projects, which we call the 4P's of innovation. To illustrate this concept, we apply this model to an IT project in order to determine its value and risks. The results indicate that the joint use of marketing and risk management tools proposed add value to the project and reduce the probability of the manager making bad decisions.

**Keywords:** Innovation, uncertainties, risk management, 4P's of innovation, projects of R&D and IT.

#### RESUMO

A inovação é um elemento importante para alavancar a competitividade das empresas brasileiras. Por outro lado, projetos inovadores tendem a ser caracterizados por inúmeras incertezas técnicas e de mercado. Este artigo propõe a fusão de estratégias de *marketing* com técnicas de gerenciamento de risco de projetos de desenvolvimento de novos produtos e novas tecnologias, aqui denominado de os 4P's da inovação. A fim de ilustrar esta proposta, este modelo é aplicado a um projeto de TI a fim de determinar o seu valor e risco. Os resultados indicam que o uso conjunto de ferramentas de *marketing* e de gerenciamento de risco proposto neste modelo agrega valor ao projeto e pode reduzir a probabilidade do gestor tomar decisões equivocadas.

**Palavras-chave:** Inovação, incertezas, gestão de risco, 4P's da inovação, projetos de P&D e TI.

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## 1. INTRODUCTION

Competitiveness is a key element for companies and it is associated with opportunity for growth, profitability and expansion into new areas (Jiménez *et al.*, 2011; Machuca *et al.*, 2011). In Brazil, in particular, progress in the development of new products and technologies helps increase the competitiveness of domestic companies, as the market attributes higher added value to products that are differentiated. Therefore, the competitiveness of Brazilian companies has a direct relationship with innovation and, therefore, with the quality of its management.

The increases in competitiveness through the development of innovative products, however, are associated with high risks and management challenges due to their importance to the economic and financial development of enterprises and the uncertainties surrounding the development stages and the launch of these products (Liao, 2001; Ozer, 2003). At times, firms may choose to abandon a product during the development stage due to the risks and the fact that they cannot determine beforehand the relationship between innovation and market return (Kash and Rycroft, 2000).

The board of the firm responsible for the management of project risks should seek more efficient techniques of risk management and measures to reduce risks, such as the firm's marketing plans. Marketing strategies are a useful tool for reducing uncertainties of innovative projects developed for specific audiences and new markets. Competitive priorities are directed at consumers with different demands for the same product, so without an alignment between the creative process and marketing, companies may operate in the short term in conflict with their long-term interests (Prajogo, 2007; Choudhari *et al.*, 2013). The synergy between these processes will increase the company's profit.

This study seeks to provide the separation of the development of a new product or a new technology of Brazilian companies in stages in order to map out marketing strategies consistent with the project and the development stage to minimize the uncertainties of these projects. A separation of the macro process into creative, production, performance and market processes according to the uncertainties in each stage was made. This division of the macro process in four steps resulted in the 4P's of innovation. Each stage includes a set of uncertainties for which a target plan is developed, considering different levels of intensity and marketing strategies.

This study contributes to the risk management literature of technological innovation projects and development of new products of Brazilian companies. Additionally, this article proposes an association between uncertainties in product innovation and marketing strategies that can be used to minimize the risk of managers making non optimal decisions. This paper proposes the 4P's of innovation, namely: Patent; PDP (Product Development Process), Product and Payoff.

This work is structured as follows. After this introduction, the next section shows the methodological aspects adopted in this research. Section three deals with the theoretical framework to guide the proposed theme and section four specifies the types of uncertainties surrounding innovation products and possible marketing strategies. Section five shows the relationship between risk management and a macro overview of the development process of a new product under the 4P's of innovation. The following section is an application of the proposed model. The conclusions, limitations and suggestions for further the research are presented in section seven.

## 2. METHODOLOGICAL ASPECTS

According to Gil (2002), the methodology can be understood as a set of methods that are used in the pursuit of knowledge and that can be presented in the form of research. Also, according to the author, research is a rational and systematic process that seeks to provide answers to proposed problems. Therefore, all research should outline the methodological procedures used for its realization.

Regarding the research adopted and based on the proposed objectives, this work is characterized as a theoretical essay. This work uses bibliographic research, understood as the act of seeking information about a particular subject, through a search in the national and international literature, in order to find what exists regarding consensus and controversy in its state of the art.

This work investigates marketing strategies that are available to the Brazilian companies and seeks a relationship between the activities of marketing and the reduction of risks in innovation projects, through the financial evaluation of the project. Therefore, the research used secondary data found in the literature of risks in innovation projects and the interaction between the development of new products and marketing. An application of the model was performed at the end of this work to a hypothetical firm in the information technology industry.

## 3. INNOVATION MANAGEMENT, RISKS IN NEW PRODUCTS AND MARKETING

### 3.1. Innovation management

As an important vector of productivity growth, profitability and competitiveness of firms, innovation has been an intense and recurrent theme in literature analysis (Maskell and Malmberg, 1999; Castellacci, 2008; Gibson and Naquin, 2011; Sener and Saridogan, 2011; Calmanovici, 2011; Simonceska, 2012). Innovations may be radical when they represent a break with current technological standards, or they can be incremental when they represent a continuous improvement in products and processes (Sainio, Ritala and Hurmelinna-Laukkanen, 2012; Oerlemans, Knoben and Pretorius, 2013).

The concept of innovation has evolved in recent years. While in the 1950s, innovation was considered a discrete development resulting from studies of individual researchers, nowadays innovation is designed as a troubleshooting process (Dosi, 1982), an interactive process involving relationships between firms and different actors (Kline and Rosenberg, 1986), a diverse learning process (Cohen and Levinthal, 1989), a process involving the exchange of codified and tacit knowledge (Patel and Pavit, 1997) and an interactive learning process and exchange of information where the interaction between the actors creates an innovation system or groups (clusters) of innovation (Edquist, 2005).

Despite the conceptual evolution, innovation management in organizations, however, is a complex process that has strong interdisciplinary characteristics and its practice permeates different emphasis and functional activities of an organization (McDermott and O'Connor, 2002; Baregheh, Rowley and Sambrook, 2009). On the other hand, understanding the innovation process is crucial to understand factors that facilitate or inhibit the development of innovations in organizations.

In general, the available models for managing innovation focus on the development of new products and research and development (R&D), which are considered a proxy for innovation (Tidd, Bessant and Pavitt, 2008). Cooper (1993) understands technological innovation as a process focused on developing new products. In his description of the model he recognized organizational factors such as cross-functionality required by each stage, the connection with market and decision-making levels. Brockhoff (1994) interprets R&D as an interface function between what technology management would be (focused on the acquisition of knowledge) and innovation management (focused on market), making a bridge between what is "gross" knowledge and how it could materialize a product innovation (Figure 1).

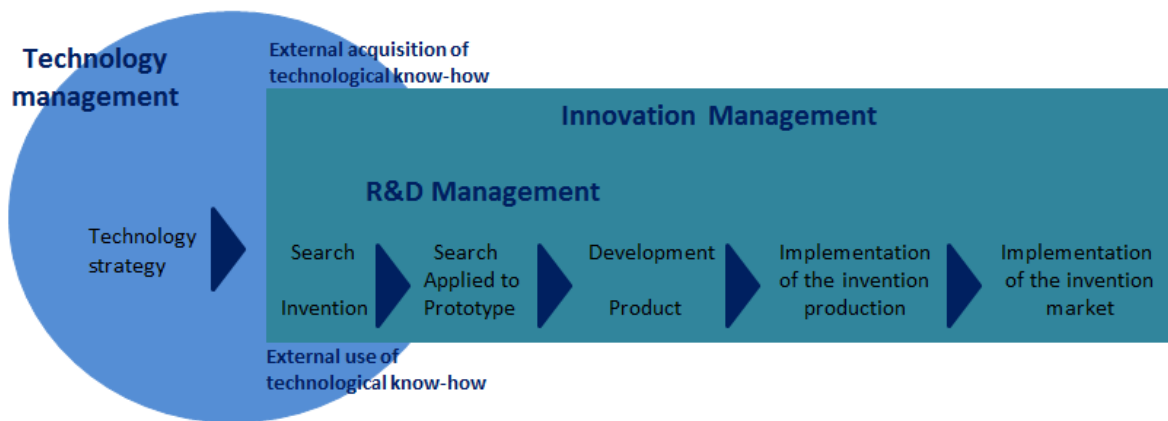


Figure 1 - Innovation Management.

Source: Adapted from Brockhoff (1994).

Note that innovation management ranges from a part of technology management to the entire product development process. For a manager to be successful, he should well understand the concepts and limits of each stage, but first he should be able to conceive a macro overview of the innovative process. If a firm operates at the tip of the process, for example, there is a risk that its beginning is not well structured and the uncertainties of the following steps are not well studied, which affect the achievement of expected results. Therefore, the need for an effective management of the development of a product or process is clear when the degree of uncertainties is higher.

### 3.2. Risks on the development of new products

On the strategic nature of product development, its formalization is done through processes of innovation management, involving the steps of planning, identification, analysis, responses, monitoring and control of risks in order to increase the likelihood of positive events and decrease the probability of adverse events to the project.

Many developments have become impossible due the high degree of uncertainty in the early stages of the product development, given the high number of resources that is immobilized. In these cases it is common for the product to be redesigned many times to adjust and correct problems and concepts that could have been assessed and dealt with in the earliest stages of the project, and not during production.

At the beginning of the project, it is important to have an overview of the product development cycle as well as the degree of uncertainties involved in each step, as shown in Figure 2, in order to make a good management of the risks.

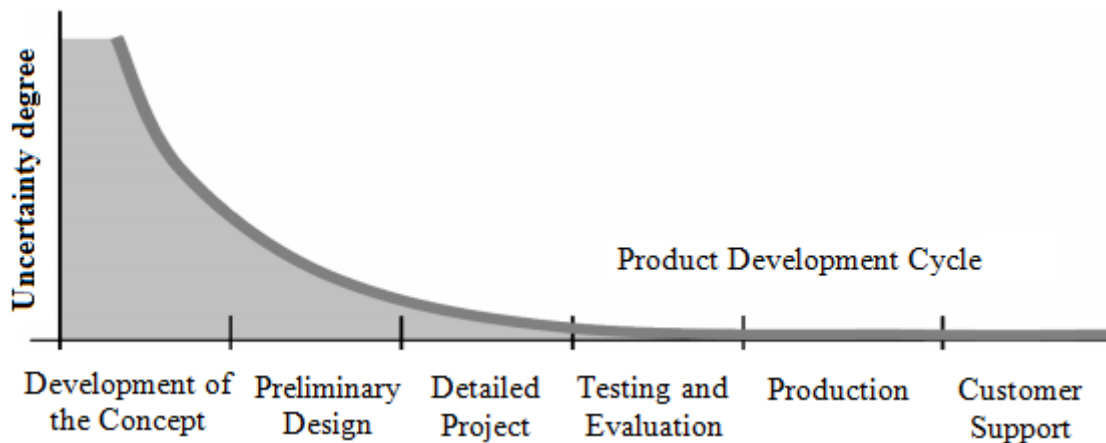


Figure 2 - Uncertainty Degree in Product Development Cycle

Source: Machado (2006).

As can be seen in Figure 2, innovation projects require a long period of time for their development, testing and validation. Due this fact, these projects present great risks, especially regarding investment and financial return. As the activities of the research stage are carried out, the risks will decrease and can be evaluated more critically, which impacts on the next step.

In practical applications, an innovation project deals with the establishment and development of a product with improved performance characteristics. In this context, it is expected that this project presents numerous risk factors, as well as uncertainties involved in innovative products. These uncertainties range from the design of the product to market insertion, changing expectations regarding the viability of the new product and causing sometimes the abandonment of the product during the development stage (Pennings and Lint, 1997). In particular, these risks are associated with high costs for research and development and high failure rates (Carbonell, Escudero and Aleman, 2004).

There are many uncertainties involving new product development innovation projects. In general the technical uncertainty, which occurs during the development stage, has more impact on the final result of the product. The model advocated by Pugh (1991), for example, presents a focused approach to the development of technical uncertainties and focused on complex structured products. The development ranges through different levels of detail in the process: it begins with a general specifications; then it seeks concepts that best adhere to these specifications. Next it goes deep into the system design and finally it goes deep into the detailed design of subsystems and components. In the end, the results are reassembled into a complete product, which is compared with the initial target.

Some authors such as Weisz (2009) and Huchzermeier and Loch (2001), for example, made a more obvious analysis of these uncertainties. Weisz (2009) shows some examples of risks and uncertainties inherent to the technology developed in technological innovation projects, such that:

- The developed technology may become unfeasible during its implementation;



- The technology development work may follow different paths from those previously planned, requiring the adoption of different technical solutions than those initially planned for.
- The technology development time may be very long, making it impossible to enter the market.
- The possibility of not finding investors to assume risks with untested investments in technology and not yet in production.
- The technology may be viable in theory but unworkable in practice.

Huchzermeier and Loch (2001) identified five main sources of uncertainty in a technology development project, namely:

- The performance of the technology (performance) or the quality of technological development;
- The cost of development;
- Development time;
- The market required level; and
- How much it will pay for each level of technological performance achieved (market payoff).

From the definition of uncertainties inherent in the development of a new product and after treatment using a financial model, Huchzermeier and Loch (2001) concluded that more variability (uncertainty) can reduce the value of the project. In this article, however, it is noted that the increase of variability can be counterbalanced by investments in marketing in order to reduce uncertainty and increase product acceptance by the market.

### **3.3. The marketing plan**

The marketing plan is part of the business planning as it translates the method that the company will adopt to achieve its strategic objectives (Westwood, 2007). According to Kotler and Armstrong (1995), marketing is the management of the markets in order to achieve exchanges that meet people's needs and desires.

There are several types of marketing strategies. Peters (2015) highlights, for example, the importance of internal marketing to say that the quality of the services offered by a company is associated with the fact the leaders of organizations promote a pleasant environment for their employees. For Caetano and Rasquilha (2010) the people who make the product are a mirror of the organization in the eyes of foreign customers and are directly responsible for marketing.

However, the marketing mix formed by the 4Ps (Product, Price, Place and Promotion) is the best known strategic tool for companies not to lose competitiveness and pursue their goals monitoring customer needs (Borden, 1983; Klotler, 2000). Until now, the marketing mix has been one of the most used concepts in marketing due to its simplicity and the possibility of practical application.

These marketing strategies, however, are not limited to a product profile; they

can be used by all types of businesses. In particular, innovative companies have projects characterized by multiple sources of uncertainties that can be minimized with the use of marketing tools. According to Malvezzi and Zambalde (2013), due to increased competition, it is necessary that the innovative process has a holistic marketing orientation, which can be seen as the development, design and implementation of programs, processes and marketing activities, with recognition of their breadth, interdependencies and effects (Klotler and Keller, 2006).

Overall, innovation oriented research requires developing strategies to drive innovation to success. For Mohr *et al.* (2011), by adequately combining marketing tools with each type of innovation, one increases the chances of success of the product in the market. This notion of combining marketing with a given type of innovation is known as contingency theory of high-tech marketing.

The marketing plan of innovative companies should enter the early stages of research to maintain the effective cooperation of researchers with other functional units of an organization throughout the technology development process. The early connection with the market generates competitive intelligence, leading to decisions on market value, competitive position and marketing strategies (Bojesen-Trepka, 2009).

One should also consider that a market-oriented organization emphasizes the collection, dissemination and use of market intelligence based to decision-making (Kohli and Jaworski, 1990). Thus, according to Leonard-Barton (1995), for an organization based on technology, information coming from the market is of great importance since this input turns science into marketable products or services.

#### 4. UNCERTAINTY ABOUT PRODUCT AND MARKETING STRATEGIES

Given that Brazilian consumers have a growing range of product options and are able to specify their desirable characteristics, it is important that the firms analyze consumer preferences before developing a new product. The marketing plan is a resource available to businesses, which can contribute to the reduction of product development uncertainty levels if there is an interaction between the areas of innovation and marketing. Particularly, innovative companies that develop new products, technologies and R&D can make the use of marketing strategies to monitor the product from the beginning of the process, in order to attract customers and therefore reduce the risks of the project.

As seen previously, uncertainties presented in innovative designs have been widely studied in the literature, therefore, now it is necessary a detailed study of how the assembly and association of these uncertainties may be used by the marketing sector in order to improve the management flexibility of the company's innovation manager and reduce the risk of miscarriage of high-risk innovative projects or the continuation of bad projects. In other words, there is a lack of studies on which stages of the project development marketing could act and the impact of this interaction in the project value.

In this sense, this section summarizes the definitions previously given in eight types of uncertainties and rearranges them in order to define marketing strategies that can be used by Brazilian companies. Next, this paper proposes a reclassification of uncertainties in four levels: (i) idea; (ii) Time, cost and market expectation; (iii) Product Performance; (iv) Market. This reclassification allows national companies to make marketing strategies in four areas: (i) Patent; (ii) Product Development Process - PDP;



(iii) Product; (iv) Payoff, which are called in this article of the 4P's of innovation. Figure 3 illustrates this arrangement.

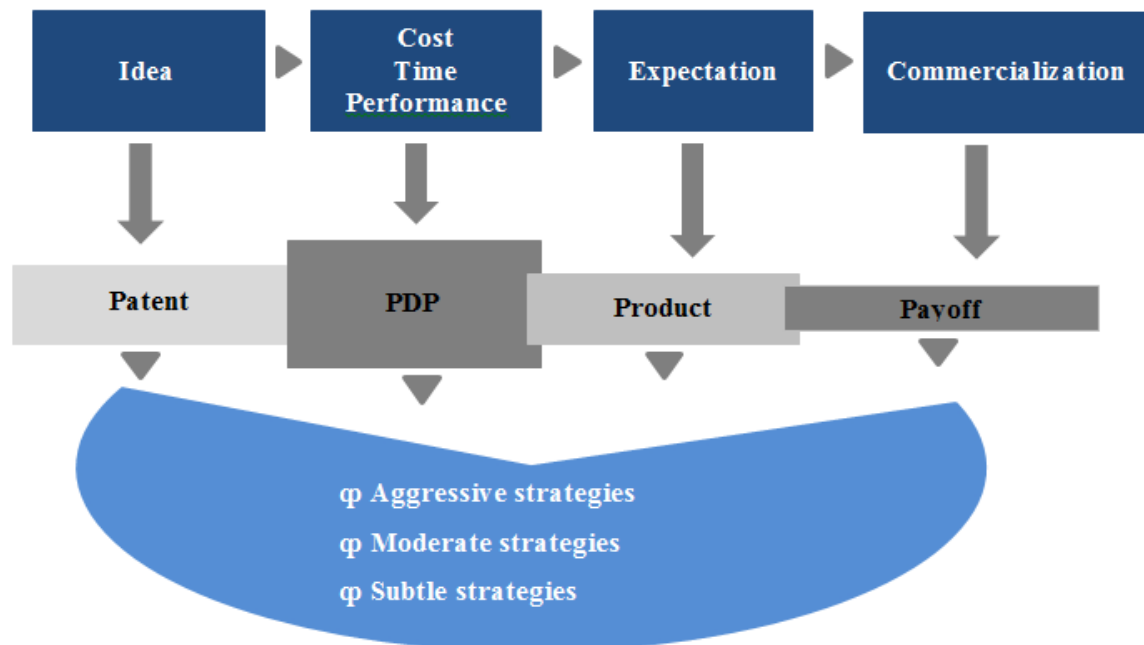


Figure 3 - The 4P's of uncertainties of innovation

For each one of the four groups of the 4P's of innovation, a marketing strategy (or a set of strategies) is designed to reduce the expectations associated with that group. Strategy is the production plans to achieve goals, serving as a guide for the marketing department to develop its activities. The marketing plan begins with its goal, i.e., it begins with the end result and with those who will contribute to it: the target audience. So, it lists the marketing tools. Then, it explains what the product and the company account for - why the offer has value and therefore why it should be purchased. Identity comes next, and marketing costs wrap everything.

A good marketing strategy should integrate the objectives, policies, and action sequences (tactics) into a coherent whole organization. The objective of a marketing strategy is to put the organization in a position to effectively fulfill its mission or business strategy. Once it is done, the company will launch its product, always seeking to develop strategies to attract new customers and retain those already attracted.

To define a marketing strategy, one should ask:

1. What is the marketing role to carry out the company's business strategy?
2. What campaigns and marketing projects should take to play its role?
3. Who will the targets of campaigns be? - Target Audience.

Marketing strategies can be at various levels, with some of them being more aggressive than others. The intensity of the strategy will depend on the level of uncertainty about the product and other factors such as company profile, the type of product developed, the disclosure of the product and how much should be invested in marketing. High investments in advertising campaigns and actions in social media are

often associated with large companies. However, with the need of expanding the market, small businesses also have given some attention to investments in marketing.

As shown in Figure 4, the higher the level of uncertainty about a particular new product development project, the more aggressively marketing should act in the market; otherwise, a more subtle marketing is advisable. Aggressive marketing encompasses a range of techniques to sell a particular product to the consumer using all possible arguments for them to purchase the product; it constantly attacks competitors and uses advertising that shocks consumers. In this case the company invests heavily in advertising to promote a product. A less shocking and expensive marketing, but also with a strong intention to convince the consumer of their needs for the product, is the moderate marketing. Subtle marketing takes place in a less comprehensive level, to promote products between individual and small groups. In general, its cost is lower than the previous marketing strategies.

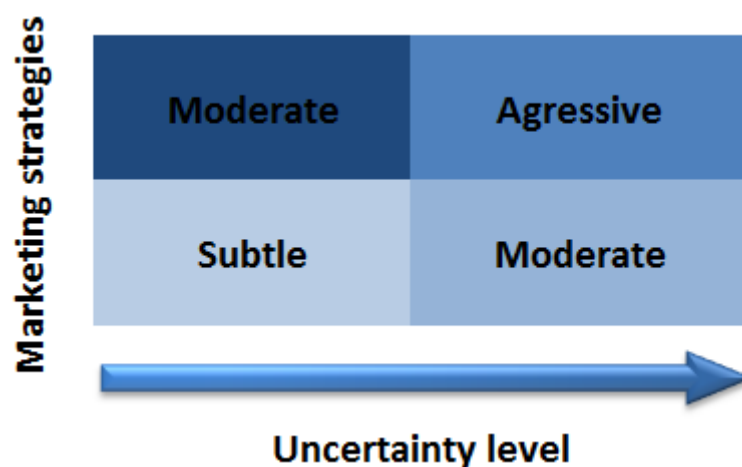


Figure 4 - Advertising intensity

After defining the strategies and intensity of advertising, managers define the means and processes intended to be used to implement the strategy. In this case, the tactical issues would be:

1. For each campaign and outlined project, how will they be executed?
2. What resources will be required to perform these campaigns and projects?
3. How and when is the target audience reached?

Among the definitions of strategies and tactics, there are several types of marketing that companies can practice. Direct marketing, for example, makes use of precise information of the target audience such as name, phone, address, to create direct messages to that consumer. Indirect marketing, on the other hand, is a more subtle way to advertise a brand or a company when consumers least expect it. In social marketing, companies support and sponsor major cultural events. One of the most recent developments is digital marketing, which has as its digital channels as its main operation. Content marketing model is aimed at generating content that is able to educate their consumers. Internal marketing, however, is a marketing strategy aimed for internal actions in companies.

## 5. RISK MANAGEMENT OF MACRO-AREAS

Risk management is an ongoing process that requires constant monitoring able to identify which areas have been successful and which need revisions and adjustments (Martins and Santos, 2005). Risk management in research and development projects is intense, because the fact the product is new indicates the existence of a degree of uncertainty characterized by the lack of information related to the idea for an invention. Thus, the inclusion of flexibility in the design aspects of a project is strategically important because it enables transforming conditions of uncertainty and risk into opportunities to be explored in the future.

Marketing helps companies increase the flexibility of options, particularly in the work of Brazilian companies, while reducing uncertainty about the sale of the product. Obtaining information reduces the uncertainty involved, particularly in the case where there is a choice among a number of alternatives. The company involved only with its operation experiences difficulties, since the relationship between the customer and the organization needs more space and flexibility to satisfy both. Thus, by properly combining the tools of marketing innovation, the chances of success in the Brazilian market are increased.

### 5.1. Patent

Holding a patent is important to show consumers that the company is innovative, as the number of patents granted to an organization may reflect its technological dynamism. In May 1997, Brazil Law 9.279 came into force, known as the Law of Patents, which then began to regulate the rights and obligations relating to intellectual property. Registration and investigation of patents in the country are carried out by the National Institute of Industrial Property (INPI), which generally grants 20-year patents, which is a very reasonable time period for patent holders to exploit their inventions and, consequently to have earnings.

Among the advantages of using patents are:

- a) Patents are the result of an intellectual property protection process, and indicators to measure the extent of technological change;
- b) Since patenting costs are high, inventions must be significant enough to justify the expenses involved;
- c) A patent is a tool to encourage the emergence of inventions, while offering a temporary monopoly for the inventor to have returns that compensate for their spending on the inventive process.

As a disadvantage, on the other hand, the patent application requires the holder to provide a clear description of the invention objectives, so to allow public access to the knowledge generated by innovative and repeatability of the patented invention by other experts in the field. By revealing its contents, a patent contributes to the advancement of knowledge, though this requirement can be seen as an innovative counterpart as others may know the patented object, they perfect it and outperform. Moreover, although Brazil has a patent protection law, breaking a patent, such as what occurred in 2007 with the anti-AIDS drug Efavirenz of Merck, reduces the patenting system robustness. Also, it is important to note that in Brazil the Industrial Property Law (LPI) excludes the protection of inventions and utility models of a series of actions, creations, ideas, intellectual activities, scientific discoveries, methods or inventions that cannot be processed.

Despite these disadvantages, the use of a patent law is a valuable asset and a competitive resource to organizations. In addition, the marketing of patents acts as a way to help consumers to understand more about the new products that a company is developing, as well as the direction that the company is aiming for the future. Moreover, the idea that start-up companies can make use of marketing test to identify, even without making major investments, if a customer will actually buy their product. The proper use of marketing reduces uncertainty in the consumption and in the risk of another firm to appropriate the idea for an invention, because according Mazzoleni and Nelson (1998) patent acts as an inducer of the investments required for the invention to be developed and marketed, and allows the patent holder to have an orderly control of the exploitation of the possibilities offered by the invention.

## 5.2. PDP - New Product Development Process

The new product development process should consist of a consistent planning. According to Kotler (2000), there are eight steps involved in the new product development process: idea generation, selection of ideas, concept development and testing, development of marketing strategy, analysis of the business, product development, market testing and commercialization. The goal of each stage is to determine whether the idea should be abandoned or whether to proceed to the next step.

Once these steps are interconnected, the activity to develop products can be seen as a result of technical and scientific efforts that need to be managed with greater security, in order to seek to optimize factors such as speed, quality and cost (Clark and Wheelwright, 1992). Table 1, built on the work of Rozenfeld *et al.* (2006) and Carvalho and Toledo (2008), illustrates, in general, the activities that perform various functions throughout product development programs in Brazil and in the world.

Table 1 - General Activities Function Involved with PDP

Function	General activities
Marketing	Supply market information of PDP (throughout the stages of pre-development, development and post-development).
Engineering	Definitions of product design, process design and preparation for production.
R&D	Identification of new technologies, development and technology domain for the product design, process design and preparation for production.
Supplies	Interaction with suppliers, raw materials, supplies and components, location and supplier development.
Production	Preparation of the production prototype, pilot production, problem solving for the shift, from production on a commercial scale to actions to improve the process capability and product processing cost reductions.
Logistics	Definition of distribution channels and forms for storage, handling and transport of the product.
High administration	Strategic planning. strategic planning control results.

Source: Adapted from Rozenfeld *et al.* (2006) and Carvalho and Toledo (2008) works.

As noted by Rozenfeld *et al.* (2006) although each of these functions "see" the product development from their own perspective, their decisions and activities are complementary, are related and should be carried out jointly and in an integrated manner with the ultimate objective the development, production and distribution products that meet the company's goals. Thus, the combination of marketing with the product development process is seen as an important technique for spreading innovation and risk mitigation.

However, listening to excessively and uncritically to target audiences during the development stage can inhibit innovation, restricting them to the ideas that they themselves can view and express (Mohr *et al.*, 2011; Zhou, Ki and Tse, 2005). Therefore, both marketing managers as financial managers of the company should be in constant communication to avoid a lot of effort into products that consumers do not want and / or do not develop differentiated new products.

In general, the marketing process allows for consideration from strategic market decisions to operational ones, such as cost, development time and expected performance. Thus, it is therefore important to minimize the uncertainties inherent in the technical process of product development.

### **5.3. Product**

Customer satisfaction is an important element for the company to obtain a sales volume profitable in the long run (Kotler, 1972). The importance of integrated marketing to market expectations about new products is due to the fact that it decreases (or increases) the expectations of consumers for products already born with a great chance of success. An expected product means the minimum or basic conditions expected from a product, for example, that it works properly.

The company should be aware if your goals are aligned with consumers. It is important that the product quality is aligned with the expectation even by the consumer, since expectations are one of the reference frame members from which consumers evaluate their experiences (Oliver, 1997).

However, the company should not trace their goals only from the public's preferences, at the risk that the company cease to be innovative in the area. Voss and Voss (2000) understand that the market orientation can have a negative impact on the performance of the organization, possibly because of the lack of radical innovation, since it focuses almost exclusively on incremental innovation.

So the expected exceeding of consumers' expectations through innovative products and services ensures competitive advantages and enables companies occupying leading positions. The company's ability to serve customers and generate positive business results depends on its ability to manage innovation and new product development process taking into account their innovative profile.

### **5.4. Payoff**

The last stage of research and development process is the marketing of the product. The companies that plan to launch a new product on the market should decide the exact moment to enter it (Kotler, 2000). This process is not easy, but it is essential to the long-term success of a company. If the idea went through all the steps presented here so far, the company will structure the manufacturing, transportation and promotion of the product.

Only the ideas that possess viability will be the ones that could become products

offered by a company. For the idea to be able to be analyzed for its commercial viability, the company needs to identify (i) estimated sales which are essential to the opportunity identification process on the market and (ii) the projection of costs, according to the need for initial investments, and later with the unit costs of production of the product or services. The estimate of a reduced cost of sales estimate should generate a profit that is attractive for the company, and the estimates are made with quality, and business decision becomes quite simple.

Thus, marketing can help make the product of choice to be inserted in a more assertive market because while diffusing innovation in it there is a pre-acceptance of the product by the public, which reduces uncertainty to investors in the market payoff.

However, we need to take some care in time to trace the strategies in this stage. Even with the best product, price and advertising, if the audience is not well defined, the product may fail. Thus, it is important to make good market research. As for time for promotion, the product the company should also pay attention to the marketing that is coming to their customers; e-mail advertising, for example, can be received as email spam and customers do not see it. With fierce competition, companies need to have a marketing strategy that is concise, direct and persuasive.

## 6. MODEL APPLICATION

To illustrate the idea presented in this article, a study of possible marketing strategies is presented for a hypothetical Brazilian company of Information Technology (IT) that aims to develop a conversion technology of data transmitted in the system of digital TV.

Nowadays analog televisions have been replaced by digital technology, mainly due to the information evolution in recent years. Among advantages of digital TV are the preservation of signal quality and the encouraging of the development of national software, reducing the technological dependence of the country. The conversion from analog to digital occurs through equipment known as a set-top box coupled to the television. This equipment is a new technology that the company intends to develop.

### 6.1. Data

The data and parameters of the development process, construction costs and market returns of the product were estimated based on the current literature (Bolaño and Vieira, 2004; Birth and Baidya, 2006; Szapiro, 2011; Lui and Oliveira, 2015). It is estimated that the project cost will be around \$20 million, with an investment rate of \$4 million per year, generating an estimated cash flow of \$5 million, with a 3% growth trend. It is also considered a free interest rate of risk of 5% per annum and a risk premium of 7% per year.

Assuming that the company has the right to intellectual property of this invention, in accordance with the rules of the INPI, the company is entitled to patent protection for 20 years. Therefore, the project has an estimated time of 25 years; 5 related to the research and development of apparatus and 20 related to market, guaranteed by the patent.

### 6.2. Application

Following the plan, the company will begin to be able to enjoy the benefits of the project after the fifth year of investment, while the patent law lasts. The value of the



project can be calculated based on the Net Present Value (NPV), as shown in equation 1:

$$VPL = -I + \sum_{i=1}^T \frac{CF}{(1+\mu)^i} \quad (1)$$

Where  $I$  is investment,  $CF$  is cash flow and  $i$  ( $1, \dots, T$ ) is the number of product marketing periods in the market.  $\mu$  refers to the discount rate of the project, which is the sum of the risk-free interest rate with the risk premium. Considering the data presented above, the expected value of this project is approximately \$4.78 million.

However, this project involves many uncertainties that can lead to a project abandoned before its completion. As it is an investment project with sequential features in the first stage, it develops the product and the second boom in the market; it is assumed that there are technical uncertainties about the costs and development time. Also the cash flows can vary stochastically, making uncertain the payoff of the product. It is also the risk of competition developing a similar product in less time or the product is not well received by consumers.

To minimize the impact of these uncertainties on the value of the project, a marketing plan can be drawn up taking into account the characteristics of the invention and the target audience. For Malvezzi and Zambale (2013) the role of marketing activities is to convey to the market content carefully studied in order to positively influence the behavior of consumers. Furthermore, marketing dissemination means that the product development stage can also be thought of as a way to obtain public feedback, since the main function of the organization is no longer to produce and sell, but to satisfy customers, querying them before producing (Peters and Waterman, 2004).

To achieve the objectives set out in the marketing strategies, some key tools can be used, such as traditional advertising, trade shows, sales promotions (contests and incentives), public relations (events sponsorship), advertising (newspaper articles), internet, direct marketing (direct mail, telemarketing) and personal sales.

According to Szondi (2010), public relations include activities that the organization undertakes to build and maintain their reputation with customers. A form of public relations, for example, is sponsoring events. Advertising, in turn, refers to any positive coverage of the organization's products or activities in the news media and that can be done through interviews or events (Mohr *et al.*, 2011).

Television can be seen as a driver of advertising, since it offers a closer relationship with its audience, enabling the influence of the advertising discourse in viewers' habits and consumption values. Among the products offered by broadcasters, soap operas have option of choice because they reach a large audience, facilitating advertising in the form of merchandising. Advertising benefits from the TV audience and from the moment when viewers are in a state of relaxation, being conducive to advertising message absorption (Trindade, 2001).

The company that advertises its products should prove to its customers that it is reliable. Thus, the guarantees of the products are good marketing tools to acquire and retain consumers, since consumer confidence is one of the most powerful relationship marketing tools (Sallby, 1997). This trust is earned through the company's unique customer service where consumers have access to the requested information, product

warranty, service points, and suggestions, among others (Gonçalves and Filho, 1995).

Among the current marketing tools are Facebook and Whatsapp. Ferreira and Filho (2015) studied how technological convergence is affecting consumer behavior of social networks Facebook and Whatsapp. As result, the authors showed that the Whatsapp network is narrower and has a more intimate communication than the Facebook network. These networks represent a new loyalty tool and approach to consumers. Patent marketing for companies has also been something of prominence in recent years. According to Malvezzi and Zambale (2013) the dissemination of industrial protection (patent) is an incentive for innovation.

From these marketing tools a marketing plan was prepared for the project in question, as shown in Table 2. Note that the plan was structured by taking the overview of the project into account, i.e., the 4 P's strategies of innovation. In this case, for each of the 4P's it was designed three different types of advertising intensity: aggressive, moderate and subtle.

Table 2 - Development of marketing strategies for the television audience

Marketing plan	Strategy	Advertising		
		Aggressive	Moderate	Subtle
<b>Patent</b>	Disclose the discovery of a new technology and its importance and benefits / costs of the TV consumer society.	Magazines Journals Folder Flyers	Magazines Folder Flyers	Folder Flyers
<b>PDP</b>	Disseminate a new technology to the public highlighting the benefits as well as the time-to-market, product quality and its final cost.	Social events Congresses Books Articles Facebook WhatsApp Links E-mails Mail Merge	Congress Facebook WhatsApp E-mails Mail Merge	Facebook WhatsApp E-mails
<b>Product</b>	Show the functions of the new technology to consumers and emphasize its benefits and usefulness in the short and long term.	Advertising Movies Youtube Soap operas Newspapers	Advertising Youtube Newspapers	Advertising Youtube
<b>Payoff</b>	Draw consumers' attention to the product and promote sales in order to raise the company's revenue.	Promotions Discounts Awards Transport Guarantees	Promotions Discounts Awards	Promotions Discounts

The difference of more aggressive marketing to more subtle is the amount of vehicles that the company chooses to promote innovation. This was done due to the consumer public's premise that digital TV is composed of employed men and women between 18-60 years old. It is important to note, however, that different forms of advertising can be used for each level of intensity of the marketing. This choice is up to the managers of the company's marketing department and should be developed together with the technical team of the project, targeting a specific audience.

Marketing investment costs, for each advertising intensity level shown in Table 2, were based on typical market values. In the patent stage of the costs of publication of journals, magazines, brochures and pamphlets are, approximately and respectively, \$0.64, \$15, \$0.25, \$0.06 thousand of reais each. In the PDP stage advertising costs of books, scientific articles, social events, call center calls, participation in conferences, direct mail, Facebook, Whatsapp and sending of e-mails are respectively \$2.5, \$0.96, \$200, \$1, \$48, \$1 \$4, \$5, \$3 thousand of reais each. In the product stage, merchandising costs of films, novels, newspapers, videos on Youtube and television advertising are approximately \$800, \$1200, \$90, \$600, \$700 thousand of reais each. Finally, in the Payoff stage transport costs to the customer, warranty, stock, sales promotion and sales discounts are \$200, \$1000, \$10, \$850, \$930 thousand of reais each.

Table 3 shows the total of these costs for different advertising levels for 4P's innovation. Note that the cost of marketing investment varies depending on the intensity of advertising strategically adopted by the company. It is estimated for this project that the role of marketing in all stages of the project will leverage cash flow by 43% for more aggressive strategies, 25% for moderate ones and 14% for subtle strategies. These values were estimated from the experts in the field; however, market research could provide better accuracy of the impact of marketing on revenue.

Thus, from the increase in marketing costs, the expected value of the project was recalculated, considering the impact of these strategies on cash flow. This result is also shown in Table 3, together with the variation of the new results compared with the amounts found previously (\$4.78 millions). In all cases, the design value is calculated according to Equation 1 presented above.

Table 3: Marketing cost and impact on the project (\$ millions)

Advertising	4P's of innovation				Value	% $\Delta$ value
	Patent	PDP	Product	Payoff		
<b>Aggressive</b>	0.020	0.27	3.39	2.99	8.78	84
<b>Moderate</b>	0.020	0.06	1.39	1.79	7.72	61
<b>Subtle</b>	0.003	0.01	1.30	1.78	5.16	8

In another aspect, Table 4 shows the percentage of increase in costs, revenue and project value compared with the traditional expected value.

Table 4: Project result (\$ million)

	Cost	% $\Delta$ cost	Revenue	% $\Delta$ revenue	Value	% $\Delta$ value
Expected value - NPV	20.00		24.78		4.78	
Aggressive	26.66	33	35.44	43	8.78	84
Moderate	23.26	16	30.98	25	7.72	61
Subtle	23.09	15	28.25	14	5.16	8

A more aggressive marketing strategy represents a 33% increase in impact on costs and 43% in revenues, which resulted in a rise of 84% in the project value. A moderate strategy increases costs by 16% and revenue by 25%, which increases the value of the project by 61%. In turn, a subtle strategy increases the value of the project by 8% due to an increase in costs of 15% and revenue of 14%.

The development of a new software project involves many risks; in this case, more aggressive strategies or moderate sales have a more significant impact on the expected value of the project than on more subtle strategies of product promotion. More elaborate strategies, however, have higher costs, as shown in Table 5, which shows the relationship between the cost of marketing and the total project cost, the cost of marketing and the expected value of project cash flow.

Table 5: Marketing change in relation to cost and cash flow (CF)

Advertising	% marketing/cost	% marketing/CF
<b>Aggressive</b>	25	10
<b>Moderate</b>	14	6
<b>Subtle</b>	13	6

The ratio of marketing to cost is equivalent to the result of dividing the incremental cost of marketing strategies by the total cost of the project. On the other hand, the ratio of marketing to cash flow concerns the division of the incremental cost of marketing strategies by the sum of the estimated cash flows of the project.

Thus, the cost of the aggressive marketing strategy plan had a 25% weight on the

total cost of the project, but on the other hand, it increased by 10% the cash flow compared to the previous result. The weight of the cost of the moderate strategy in relation to the total cost of the project was 14%, with an increase of 6% in cash flow. The cost of subtle strategy was the smallest of the three, 13% compared to the total cost, but also generating a high cash flow by 6%.

Therefore, the strategic use of marketing plan in the 4P's of innovation, that is, in all four project development stages, had a positive impact on the project value. However, it is important to note that these strategies should be drawn by the marketing team in collaboration with the company's innovation team, otherwise the incremental costs of marketing can be greater than the benefits.

## 7. CONCLUSION

The development of new products and technologies is a driver of the long-term success of companies working with innovation projects. However, this process involves many technical and market uncertainties that need to be well managed to effectively lead to increased profitability. Therefore, it is important that managers have the ability to mobilize more sophisticated instruments, consistent with the goals they wish to achieve and the specific characteristics of the innovative process.

Innovation management can make use of marketing strategies to ensure the development of these projects in increasingly competitive and uncertain environments. To manage these risks in partnership with the marketing department, the company must seek information not only from customers but also from the company itself, with the research and development department. But first, the company needs to understand the macro overview of the project and only then trace the marketing strategies that effectively will lead to minimizing risks.

In this sense, this article is a division of the new product development process in four steps macros, called the 4P's of innovation, where the uncertainties associated with each stage and outlined strategies are listed in order to prevent these uncertainties. This article also presents an illustration of this model where an IT company is developing a new technology and marketing strategies that add value to the project.

One may observe that by appropriately combining the techniques of marketing to each group of the uncertainty of the 4P's of innovation, the chances of success are increased both in product development and in product launch. The involvement of marketing from the initial stage of the research allows the innovative process to be built together with industries and audiences. This connection with the market generates competitive intelligence, leading to decisions on market value, competitive position and marketing strategies.

As a limitation of this research, it can be noted that this work was built for the profile of Brazilian companies. However, this model can be extended to other countries' company structure. In addition, this study analyzed the different marketing intensity levels for the 4P's innovation for a hypothetical company for which more subtle strategies were a smaller set of the more aggressive and moderate strategies. Further work could apply this methodology to a real project, where market research could be done to better determine the type of strategy and advertising media that should be adopted by the firm.

Also, in this study we used the traditional method of project valuation; however,

other projects of pricing methods with many uncertainties, such as the real option method could have been used. Finally, it is suggested that in a future work a comparative analysis of the 4P's innovation is made for startups and small and large innovative companies, since the impact of the incremental cost of marketing can vary greatly between these companies.

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