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## IGNIFICANT FACTORS IN THE TECHNOLOGICAL PROFILE OF INNOVATIVE COMPANIES IN THE RETURN OF CAPITAL IN TECHNOLOGICAL INNOVATION

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### ABSTRACT

Aim to analyze the significance of factors of technological profile in innovative companies that contribute to the return of capital in innovation (ROEI). The method used was design of experiments, by the structure of non-balanced factorial design. The field research was done with seventy companies. The main return of the capital applied in innovation, should support the open innovation system, and exclusively systematic studies of ideas for new products.

**Keywords:** Return of the capital employed in innovation, technological profile, open innovation, design of experiments.

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## 1 INTRODUCTION

To manage the vested resource in technological innovation and guarantee the return of the employed capital in innovation is a problem that deserves high attention from the managers and entrepreneurs in the process of business conception and formulation of corporate strategies.

One of the strategies of formulations for companies should be related to the technological profile of the companies, or especially, to the “technological footprint”. The “footprint” is related to the potential that the company had to manage and to access innovation, by their experience, resources, capacities and competencies (SANTOS; DOZ; WILLIANSON, 2004; TIDD, BESSANT; PAVITT, 2008; LOPES, 2011).

Furthermore, it is important to highlight that, besides many studies that has been published in the last decades about innovation, such as, Dosi (1991), Naddler and Tushman (1997), Freman (1984), Von Hippel (2005), Davila, Epstein and Shelton (2006), Christensen, Anthony and Roth (2007), Chesbrough (2003-2007), Tidd, Bessant and Pavitt (2008) and others, there are still difficulties in characterization of innovative processes. However, as the measurement of knowing particularities of generating and incorporating the technological innovation, more awareness of process domain is acquired, among them, the processes of innovation access are essential conditions for amplifying the base domain, and are critical for the development of competitive capacity in the companies.

One of the biggest difficulties of access and incorporation of innovation is the fact that innovation is not linear and it is characterized by discontinuous and irregular process, and it can create, in appropriated circumstance, a truly epidemic of innovation, but without any of the innovation imposed in the market. The utilization of innovation lies in the compatibility of standards of marketing. Nowadays, there is a dominant model (ANDERSON, TUSHMAN, 1990) that influences daily the behavior of the market.

Due the fact of innovation being non linear, characteristically dispersed and do not obey any evolutionary and predictable logic, the innovation provoke uncertain performance and return, since nothing can guarantee the favorable reaction of its introduction to the market. At same time, the innovation has a cumulative character in the majority of the cases, in special to the incremental innovative processes. These disparities almost antagonists in the evolutionary behavior of innovation have important implications about the speed and cost of their management, with a clear

reflex about launching time of their products and about the marketing performance of companies.

The main implication is a growing need to increase the ratio of innovation required by the companies to support their positions in the market. It is noticed, so, a need of the utilization of new mechanisms and strategies that would transmit inside the company, higher velocity of internal dissemination in their experiences of innovation. As a result, the companies can increase their ratio of innovation and can expand, in the same way, their technological domain (DOSI, 1991).

Despite the complexity of managing the technological innovation, because innovation can occur in many forms and places, the technological profile of the companies have to be considered as a strategy because the company needs to keep its technological profile according to the compatibilization of the desired innovation (LOPES, 2011).

In order to know their technological identity, such as, their footprint, the companies need to have and utilize their own instrument for accessing technological innovation. In this work, the instrument for accessing technological innovation consider the contribution of eighty variables of control (independent), that were adapted from the determined list by Tidd, Bessant and Pavitt (2008), known as the “innovative auditing”. The variables considered in this study are: supportive climate to novel ideas, systematic research of ideas for new products, open innovation, prompt control and budget for new projects of innovation, competitive intelligence.

In the other hand, the outcome variable (dependent), was adapted by Daviça, Epstein and Shelton (2006), in other words, the return of employed capital in technological innovation.

In other words, in order to obtain the return of the employed capital in technological innovation is necessary that the company has the control of a series of variety known in its own technological profile, such as, the existence of a supportive climate to novel ideas, open innovation, systematic research for ideas of new products, among others, that will allow the compatibilization of resources and capacities for the achievement of results (competency), such as, the return of the employed capital in technological innovation.

In this study, the objective is to show the significance of factors that influence the operation of systems of innovation focus on the return of capital in technological innovation, using design of experiment.

Montgomery (2004) demonstrated that there are many applications for design of experiment in areas that there is no production or development of products, such as marketing and



services and operations of business in general. Nevertheless, the design of experiment is a method, still not very utilized for management, maybe because it is not very known method yet, since it is an excellent statistic tool for decision making. Holland and Cravens (1973); Starkey, Aughton and Brewin (1997); Ferrini and Scarpa (2007), Fontão (2008), Fontão and Lopes (2010) and Lopes (2011) utilized the design of experiment in studies in areas such as management, marketing, economy and open innovation.

To show the significance of factors that influence the return of capital in technological innovation, we intend to present one available and efficient tool of management to be used in decision process of access to technological innovation of interest. With this objective, the opinions of the managers were analyzed in the investigated companies, especially based on factors of technological identity, technological profile and also the known “footprint” of the companies. This paper covers an accurate literature revision about technological profile, and a discussion about methods of research, including design of experiment. In addition, we will analyze the main results, discussion and final considerations.

## 1. BACKGROUND

### 2.1. THE TECHNOLOGICAL PROFILE “FOOTPRINT” FOR ACCESSING INNOVATION

The processes of access to technological innovation are related to the group of experiences of innovation that one company has (SANTOS, DOZ, WILLIAMSON, 2004). Moreover, the technological access covers the group of internalized, socialized and unspoken knowledge that give to the company a level of “maturity” in the use of management of innovation (understanding and handling of innovation) and that allows the company to understand the nature of the processes of innovation, especially the ones that the company is interested in incorporate. The profile of understanding and handling the innovation is also defined by other authors (TIDD, BESSANT, PAVITT, 2008; DAVILA, EPSTEIN, SHELTON, 2006; SANTOS, DOZ, WILLIAMSON, 2004), like the technological footprint and the basic digital technology of one organization.

In practical terms, the main problem that one organization has to deal when building the technological domain, in the basic principles of open innovation, is the establishment of one system of evaluation specifically for the innovation to be incorporated. This evaluation or access to

innovation, allow the company to verify the degree of compatibilization of innovation to be incorporated to the technological footprint, so that to keep and reinforce the footprint, in the later processes of incorporation of innovation (LOPES, 2011).

In a simple logical thought and free of interferences, the higher the compatibilization of the technological footprint in the company, the higher the chances of the incorporated processes to be successful and the higher the chances of expanding the technological domain in order to achieve the corporative objectives (TIDD, BESSANT, PAVITT, 2008; SANTOS, DOZ, WILLIAMSON, 2004; LOPES, 2011).

According to Santos, Doz and Williamson (2006), the footprint is determined first by the identification of the places where the complementarities are required. Second, the more radical is the desired innovation, the higher is the footprint need. Third, the competitive strategy of the company affects the size and profile of the footprint (especially for disruptive innovations). Fourth, the historical background of one company is important to determine its footprint. The more intensive and variety is the historical background of the company, the more delimited is its footprint. Therefore, the use of internal experience of the company is better than adding external source that can disperse the focus of innovation efforts. Finally, the best footprint for innovation is the one that is built along the process.

To incremental innovation is necessary to understand the basic concepts of technological processes and the additional knowledge (this would define the optimal footprint). To radical and disruptive innovation, the footprint should change as the profile of innovation is determined (SANTOS; DOZ; WILLIAMSON, 2006).

To access technological innovation and to incorporate the new knowledge in the process of innovation of the organization, probably the company incurs additional cost, especially, if the access is related to the localization of the company. For example, if one manufacturer needs one specific technology, is he going to search for this new technology in all places in the world to access all new knowledge about this technology, or he will search for this technology only in some places? Is he going to use all the available resources or only the ones that are interested for him? (SANTOS; DOZ; WILLIAMSON, 2006).

Thus, each time that one organization adds one new source of knowledge; the company can increase its chance of development of a new product, and/or can actually increase its costs of innovation process. So, in theory, the decision of footprint needs to be objective and the companies



need to keep on searching for places with pools of knowledge, until achieve the benefits of diversity to overcome the growing costs of integration (SANTOS; DOZ; WILLIAMSON, 2006).

Due the complexity, it is clear that the companies need to create models and strategies for alternatives of accessing and/or generating innovation, in such a way of sustaining their business effectively. Many authors, such as Von Hippel (1986), Prahalad and Hamel (1990), Hamel (2000), Bovet and Martha (2000) have been demonstrating the need of the companies to accelerate their process of innovation in their business. Chesbrough (2003;2007) is known to summarize different approaches about the concept of macro, and for known-how regarding mechanisms of management in processes that accelerate and diversifies the prospecting and incorporation of innovation, which is called the "open innovation" (LOPES, 2011).

Chesbrough (2003) proposes searching for innovation in external cognitive sources. Thus, the companies could increase their ratio of innovation when implemented and also have new technological combinations when developing new products or simply develop new products to the market.

Furthermore, Santos, Doz and Williamson (2004) argue with the managers for focus their mind in new global parameters of innovation. To prospect innovation, globally disperse, is becoming one rule and not one exception like in the past. In addition, more than prospecting, the companies need to access innovation, with their own experience and incorporating it slowly.

According to Lopes (2011), to access innovation of companies is necessary to know their technological profile, each company has their own and specific footprint, which depends on factors that can change along the time, such as resources, capacities, experiences and others. It is possible that the profile of the technological footprint changes with the redirection of the company. Technological access, basically, is a dynamic process that seeks for a balance between technological profile, resources, capacities and competencies of a company and their innovative characteristics in analyses.

The importance of technological access is based in the fact that innovation do not have adherence to values, culture, experience and socialized knowledge in one company, it can be rejected internally or can not be incorporated, minimizing the chances of its utilization and maximizing the risks of failure (LOPES, 2011).

To Tidd, Bessant and Pavitt (2008), the innovation depends in the good management, especially, when there are choices to be made about the sources of access. One deep analysis about the

technological innovation showed that, although there are technical difficulties and structural barriers to overcome the majority of the failures, the majority of the failures are related to inconsistency in the project management. The authors supports that innovation depends on two important elements: source of technical information and organizational competency. In this specific study, we will analyze the significant factors for the process of accessing specifically the capital return in technological innovation or organizational competency.

## 2. METHODS

The statistic inferential quantitative method, through design of experiment, was used. According to Tahara (2010), the design of experiment is one technique used to define factors, quantity and conditions to collect data during one experiment, with the objective of attending major statistic precision in the answers and less cost in the process. It is an important technique for decision making in management, since it can save money and time.

The selected method of design of experiment, in this study, was the non balanced factorial design, using two levels of control (high level (+) and low level (-)). Seventy treatments with 95% of confidence were executed.

### 3.1 POPULATION AND SAMPLE

In this study, the population was represented by five hundred companies with technological base in Brazil. To keep the confidentiality of company identity, the companies were codified in numbers.

The samples were conditioned to the quantity of obtained answers, resulting, in seventy. Each company represented one run or experimental treatment that combined two levels of control about independent variables, which are factors inherent to the technological profile of these companies.

In this research, the realization of a test to verify the population was not executed using normal distribution, once the statistic methods utilized here was robust enough regarding to normality deviations. Barros Neto, Scarminio and Bruns (2010) said that even though the population of interest is not distributed normally, the techniques of design of experiments can be used and continue to be valid.

This technical advantage came from one fundamental theorem of statistic, the theorem of central limit, that is described as follow: if the total fluctuation in one determined random variable is the result of the sum of fluctuations of many



independent variables of more or less equal importance, its distribution will tend to normal independently of the nature of the distributions of the variables singly (BARROS NETO; SCARMÍNIO; BRUNS, 2010).

### **3.2 SELECTION OF SUBJECTS OF RESEARCH AND PROFILE OF INFORMANTS**

This research has the basic objective of utilize the experience of people and companies regarding to management of innovation. This aim induces the search for social subject with maximum experience in the field of the research. Nevertheless, the logic, in this thought, is to choose a group of companies with technological base that present similar experiences.

Thus, the choice of the social subjects for this research was done based on the relevance of those subjects in the context of management in innovation, in their correspondent companies of technological base. This is necessary because these experts, in last sentence, are the people who have the experience in technological innovation inside their organizations. Only the social subject, with experience in management of innovation, presumably, has the necessary knowledge to answer with more precision for the questions presented in this survey.

### **3.3 DEPENDENT VARIABLE: SELECTION AND MEASUREMENT**

In this research, the return of employed capital in technological innovation will represent the dependent variable and its measurement correspond to the result of the treatment, namely, return of the capital in technological innovation.

The dependent variable was measured, using the method of collecting data in the field, and through which sought to measure the return of the employed capital in innovation, according to the indicators listed by Davila, Epstein and Shelton (2006).

The obtained results, derivate from values attributed by the informants of each one of the business target in the survey and they were used

to measure the diverse answer of the experimental treatments.

The criteria of measurement of response came from the assumption that the companies have innovative profiles, and they present positive answers to the business targets listed by Davila, Epstein and Shelton (2006), in this particular case, the answer is a return of the employed capital in technological innovation. In other words, the dependent variable or the selected answer is represented by the answers regarding the attributed values by the informants.

### **3.4 INDEPENDENT VARIABLES: SELECTION, CATEGORIZATION, DETERMINATION OF CONTROL LEVELS AND MEASUREMENT**

To guarantee the selection of independent variables, which determine technological profiles of the companies, it was utilized the list of Tidd, Bessant and Pavitt (2008), which integrate essential factors to define the technological profile of the companies.

The independent variables were used to determine the technological profile of the studied companies, as preliminary critical conditions for decision making in the specific case of return of the capital in technological innovation. In the field research, each variable was measured by the respondents, following one qualitative/quantitative scale.

The independent variables were selected among eighty factors that affect the return of the employed capital in technological innovation. This group of factors defines the technological identity of the company, denominate in this research, simply as “footprint”.

Nevertheless, to guarantee the significance of these eighty factors with the variable answer, statistic procedures (test f) were done. Twenty factors were selected among the eighty original factors from the TBP list, with base on significance (test f) of independent variables with variable answer related to return of the employed capital in technological innovation. According to Table 01B – selection of top 20 factors to return of the employed capital in technological innovation.



Independent variables	Better combination of dependent continue variable: Return to the employed capital in technological innovation	
	F-value	p-value
23) Supportive climate to novel ideas	15,65337	0,000000
13) Systematic research about ideas for new products	15,01190	0,000000
69) Open innovation	10,86134	0,000000
10) Control of deadlines and budget for projects for innovation	9,43500	0,000001
20) Effective structure for decision making	9,07390	0,000001
22) Policy of support to innovation and new ideas	8,81644	0,000002
38) Difusion of knowledge inside the company	8,74772	0,000002
62) Involvement of innovation process	7,44452	0,000015
9) Processes for management of ideas for new products	7,35701	0,000017
6) Commitment to the top management	7,19827	0,000021
61) Reward of intra-entrepreneurship	7,05126	0,000026
18) Relationship among the departments	6,87700	0,000034
40) Measurement of innovation	6,81051	0,000038
64) Stimulus and experimentation	6,55005	0,000056
72) Distributed innovation	6,30974	0,000081
53) Selection of radical projects	6,18049	0,000098
2) Comunication in innovative strategy	6,14241	0,000104
48) Flexibility on development of products in small projects	6,03668	0,000341
39) Learning with other organizations	5,88865	0,000155
60) Incentive to new ideas	5,43598	0,000314

**Table 01B** – Selection of top 20 factors for the return of the employed capital in technological innovation.

The statistic calculations were elaborated about five independent variables, where four of these variables were: 23 (supportive climate), 13 (systematic research for ideas of new products), 69 (open innovation) and 10 (Control of deadlines and budget for projects for innovation). These variables were selected for being the most important variables related to the output (test f). Furthermore,

in this study was assumed that the variable 7 (competitive intelligence), has the objective of establishing that the return of employed capital in technological innovation. According to Figure 01A – independent variables (x) and dependent variables (y) are used in the alignment of variables or the delimited system for the return of the employed capital in innovation.

Independent variable (x)	Dependent variable
(23) Supportive climate to novel ideas	<b>Answer</b> = Return of the capital employed in technological innovation.
(13) Systematic research for ideas of new products	
(69) Open innovation	
(10) Control of deadlines and budget for projects for innovation	
(7) Competitive intelligence	

**Figure 01** – Delimited system for the return of the employed capital in technological innovation

The data were treated in a random way by the use of statistic techniques. After the alignment of variables, statistic calculation was done to measure the return of the employed capital in technological innovation.

The treatments were executed with six independent variables, showed in table 02. Two

levels were determined for each independent variables where the answers were divide like from 1 to 3 = low level (-) and from 4 to 6 = high level (+), based on the proposed model by Barros Neto, Scarmínio and Bruns (2010) and Montgomery (2008). The attribution of values was used after to



submit the independent variables to the impact of variable dependents.

Based on the proposed, the relationship between two different levels of each independent selected variable defines the technological identity regarding the return of the employed capital in technological innovation.

The response of the return of the employed capital in technological innovation was treated by non-balanced factorial design operating in two levels, with 70 treatments. Calculation of effects of factor, coefficients of variations, calculus of experimental errors were done, and also the t test and test of significance, as demonstrated in Table 02 – Calculus and statistic tests of selected factors of the return of the employed capital in technological innovation.

### 3.5 TREATMENT – THE RETURN OF THE EMPLOYED CAPITAL IN TECHNOLOGICAL INNOVATION

Factor	Effect estimate; Var.: 1) Return of the employed capital in innovation; R-sqr=0.56623; Adj:0.44574 – 5 factors in two levels; MS Residual = 2,690846, DV: 1) Return of the employed capital in innovation									
	Effect	Standard deviation	t(54)	p	-95,%	+95,%	Coef.	Standard deviation	-95,%	+95,%
average	6,31508	0,252379	25,0222	0,000000	5,80909	6,821065	6,315077	0,252379	5,80909	6,821065
(1)23)	1,19797	0,532174	2,25109	0,028472	0,13103	2,264916	0,598986	0,266087	0,06551	1,132458
(2)13)	1,28240	0,548624	2,33748	0,023151	0,18247	2,382323	0,641199	0,274312	0,09124	1,191161
(3)69)	0,89248	0,494849	1,80353	0,076884	-0,09964	1,884591	0,446239	0,247425	-0,04982	0,942296
(4)10)	0,85856	0,500120	1,71671	0,091764	-0,14412	1,861242	0,429281	0,250060	-0,07206	0,930621
(5)7)	0,82857	0,503706	1,64495	0,105789	-0,18130	1,838442	0,414287	0,251853	-0,09065	0,919221
1 int 2	-0,34664	0,542709	-0,63873	0,525700	-1,43471	0,741423	-0,173322	0,271354	-0,71735	0,370711
1 int 3	-1,24973	0,525904	-2,37635	0,021060	-2,30411	-0,195359	-0,624866	0,262952	-1,15205	-0,097679
1 int 4	-1,25135	0,551296	-2,26983	0,027234	-2,35663	-0,146066	-0,625674	0,275648	-1,17832	-0,073033
1 int 5	-0,27595	0,544095	-0,50718	0,614097	-1,36680	0,814893	-0,137976	0,272047	-0,68340	0,407446
2 int 3	0,14272	0,559718	0,25498	0,799708	-0,97945	1,264883	0,071358	0,279859	-0,48973	0,632442
2 int 4	-0,08863	0,588123	-0,15070	0,880773	-1,26775	1,090486	-0,044315	0,294062	-0,63387	0,545243
2 int 5	-0,43365	0,569168	-0,76190	0,449436	-1,57476	0,707466	-0,216824	0,284584	-0,78738	0,353733
3 int 4	0,78888	0,577186	1,36676	0,177364	-0,36831	1,946064	0,394438	0,288593	-0,18416	0,973032
3 int 5	-0,05679	0,531707	-0,10681	0,915333	-1,12280	1,009214	-0,028397	0,265853	-0,56140	0,504607
4 int 5	0,33107	0,547796	0,60436	0,548133	-0,76720	1,429332	0,165534	0,273898	-0,38360	0,714666

Table 02 – Calculus and statistic tests for selected factors of return of the employed capital in technological innovation.

After the statistic calculus and test of significance, the factor 23 (supportive climate for novel ideas) combined with factor 13 (systematic research for ideas of new products) were classified as significant. While the factor 23 (supportive climate for novel ideas) combined with factor 69

(open innovation) and combined with 10 (control of deadlines and budget for projects for innovation) showed significance of interactions in second order, as demonstrated in figure 02 – significance of factor for the return of the employed capital in technological innovation.



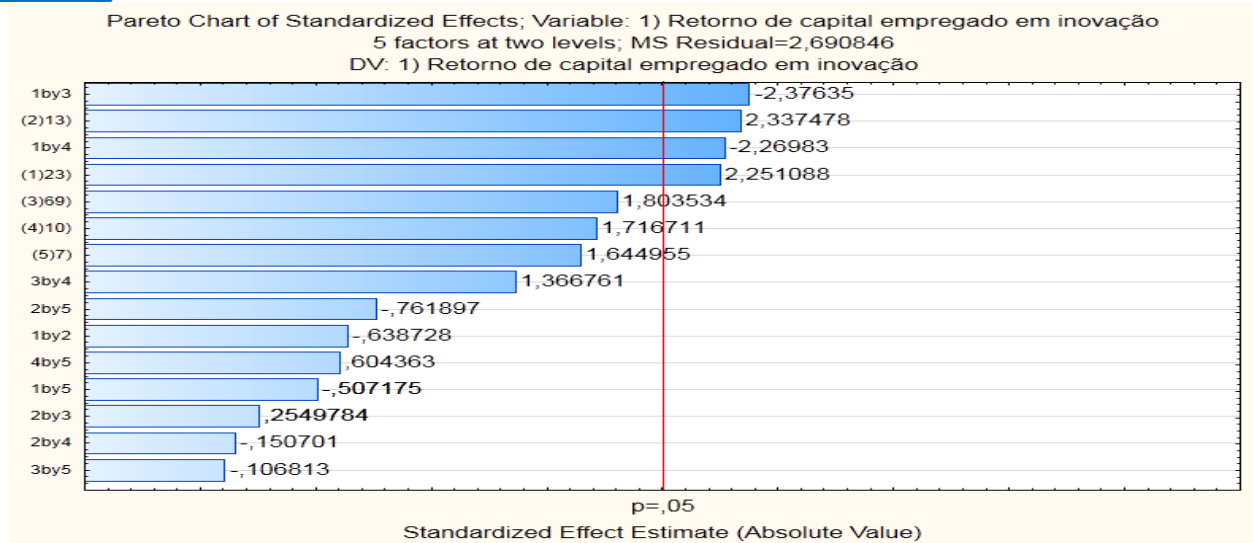


Figure 02 - significance of factor for the return of the employed capital in technological innovation

The results demonstrate that variable 23 (supportive climate for novel ideas) and 13 (systematic research for ideas of new products) are the most significant for the return of capital in innovation. This result confirm the ideas of many authors, such as, Chesbrough (2003); Trushman and O'Reilly (1996), Tidd, Bessant and Pavitt (2008), because, they demonstrated that companies need incentive for changing and it is important to create a supportive environment for the development of new ideas and new products.

Birkinshaw and Gibson (2004) showed that the companies that highlight management performance and social support can create a favorable environment and have higher chances of achieving their aims with employees better prepared and ready to reach the targets of the companies with high performance. The variable

open innovation, in this model, interacts with supportive climate for novel ideas, and in turn the supportive climate for novel ideas interacts with deadline control and budget of new projects of innovation.

To support the analyses of the obtained answers regarding to the interactions of second level of significance, response surface methodology was applied.

The interactions of the factors 23 (supportive climate for new ideas) and 69 (open innovation) are demonstrated in Figure 03 – Analyses of surface response between the interactions of 23 and 69 related to the return of capital in technological innovation. In Figure 03, the number 1 correspond to level (-) and the number 2 correspond to level (+) and the better adjusts are represented in the dark red.





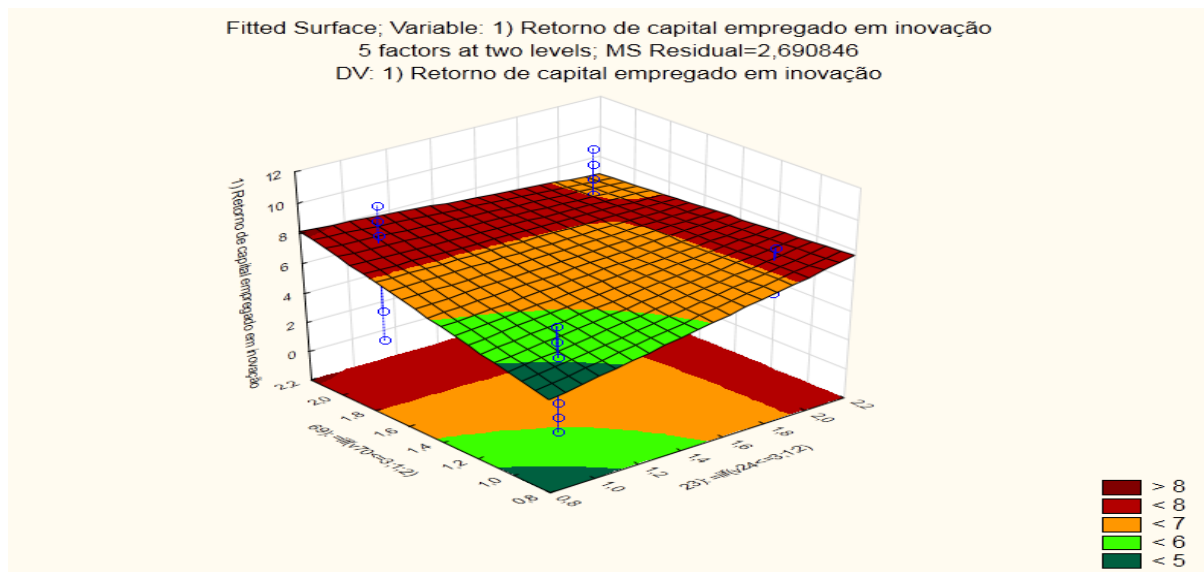


Figure 03 - Analyses of surface response between the interactions of 23 and 69 related to the return of capital in technological innovation.

The Figure 03 showed that the interaction between the variable 23 (supportive climate for novel ideas) and 69 (open innovation) is significant for the response of the return of the employed capital in technological innovation and the best combination of levels is the high level (+) for variable 69 and low level (-) for the variable 23.

This interaction showed that the use of open innovation gives positive return in the employed capital in innovation, and this result are in agreement with the studies of Cherbrough (2008). The companies that are open for novel ideas and are constantly looking for new knowledge externally can accelerate the gain of results that add value to their business and maximize the return of the capital employed in innovation.

Gibson and Skarzynski (2008) demonstrated that some of the major opportunities

in the companies can come from the competencies and actives of one company with other organizations to generate novel solutions. The authors highlight the strategies of researching new ideas and technologies that can be integrated to competences and actives in the organization, especially to improve the return of capital employed in technological innovation.

The results for the interaction of factor 23 (supportive climate for novel ideas) and 10 (control of deadlines and budget for projects for innovation) are presented in figure 04 – Analyses of surface response for the interactions 23 and 10 related to the return of capital employed in technological innovation. In Figure 04, the number 1 correspond to level (-) and the number 2 correspond to level (+) and the better adjusts are represented in the dark red.





innovation, is maximized when the process of access to technological innovation for the return of the capital employed in innovation is maintained in the high level (+) for the control of deadlines and budget for new projects of innovation and low level (-) for supportive climate to novel ideas.

Therefore, we can conclude that in the process of access of technological innovation, the best technological profile is maximized when the return of capital employed in technological innovation, is maintained in the high level (+) for the control of deadlines and budgets for new projects of innovation and giving maintenance for the systematic research of ideas for new products.

### REFERENCES

- ANDERSON, P.; TUSHMAN, M. L. Technological discontinuities and dominant designs: a cyclical model of technological design. *Administrative Science Quarterly*, v.35, n.4, p. 33, 1990. 604 p.
- BARROS NETO, B.; SCARMÍNIO, I. S.; BRUNS, R. Como fazer experimentos pesquisas e desenvolvimento na ciência e na indústria. Campinas: Unicamp, 2010. 401 P.
- BIRKINSHAW, J. GIBSON, C. Building ambidexterity into an organization. *MITSloan Management Review*, v.45, n.4, 2004.
- BOVET, D.; MARTHA, J. Rede de valor: aumento os lucros pelo uso da tecnologia da informação na cadeia de valor, v.45, n. 4, 2001.
- CHESBROUGH, H. W. The era of open innovation. *MITSloan Management Review*. Cambridge, v. 44, n. 3, p. 35-41, 2003.
- \_\_\_\_\_. Why companies should have open business models. *MITSloan Management Review*. Cambridge, v. 48, n. 2, p. 22-28, 2007.
- \_\_\_\_\_. As Novas regras de P&D. Série: Gestão Orientada para Resultados: Implementando a Inovação. Rio de Janeiro: Editora Campus, p. 57-62, 2007.
- \_\_\_\_\_. O Papel da Universidade no Modelo de Inovação Aberta. *Jornal da Unicamp, Universidade Estadual de Campinas*, p. 23-29 de junho de 2008.
- CHRISTENSEN, C. M.; ANTHONY, D. S.; ROTH, A. E. O futuro da inovação: usando teoria da inovação para prever mudanças no mercado. 1 ed., Rio de Janeiro: Editora Elsevier, 2007. 322 p.
- DAVILA, T.; ESPTEIN, M. J.; SHELTON, R. La Innovación que si Funciona: Cómo Gestionarla, Medirla y Obtener Beneficio Real de Ella. Editora Deusto, 2006. 324 p. DOSI, G. Una reconsideración de las condiciones y los modelos del desarrollo. Una perspectiva volucionista de la innovación, el comercio e el crecimiento. *Pensamiento ideroamericano*, n. 20, p. 167-191, 1991.
- FERRINI, S.; SCARPA, R. Designs with a Priori Information for Nonmarket Valuation with Choice Experiments: a Monte Carlo Study. *Journal of Environmental Economics and Management* 53 (2007): 342-363.
- FONTÃO, H. Planejamento de Experimentos: Aplicação de uma Ferramenta Lean Seis Sigma para Gestão Empresarial em Pequenos Supermercados Varejistas, (MsC. diss., Universidade de Taubaté, 2008), <http://www.ppga.com.br/mestrado/2008/fontao-henio.pdf>
- FONTÃO, H.; LOPES, M. E. Aplicação da Ferramenta Planejamento de Experimentos no Marketing de Relacionamento: um Estudo no Varejo. *Remark Revista Brasileira de Marketing*, v. 9, no. 3 (Setembro-Dezembro 2010): 137-160.
- FREEMAN, C. Long waves in the world economy. *International Library of Certifical Writings in Economics*. Aldershot, Elgar, 1984.
- GIBSON, R.; SKARZYNSKI, P. Inovação prioridade No. 1: caminho para transformação nas organizações. Rio de Janeiro: Editora Campus, 2008. 300, p.
- HAMEL, G. *Leading the Revolution*. Boston Harvard Business School Press, 2000.



- HOLLAND, C.; CRAVENS, D. Fractional Factorial Experimental Designs in Marketing Research, *Journal of Marketing Research* 6 (August 1973): 270.
- LOPES, M. E. Gestão da inovação aberta: modelo de acesso à inovação tecnológica. Tese de doutorado, Programa de Mestrado e Doutorado da Universidade Nove de Julho, 2011. <http://www.uninove.br>. 2011.
- MONTGOMERY, D. Introdução ao Controle Estatístico da Qualidade. Rio de Janeiro. Editora LTC, 2008.
- \_\_\_\_\_. *Design and Analysis of Experiments*. Wiley: Hardcover, 2004.
- NADLER, D. A.; TUSHIMAN, M. L. *Competing by design*. New York: Oxford University Press, 1997.
- PAVITT, K. Specialization and systems integration. In Hobday, M. (ed). *The Business of Systems Integration*. Oxford: Oxford University Press, 2003.
- PRAHALAD, C.; HAMEL, G. The core competence of the corporation. *Harvard Business Review*, may-june, 1990.
- SANTOS, J.; DOZ, Y.; WILLIAMSON, P. Is your Innovation Process Global?, *MITSloan Management Review*, Cambridge, v.45, n. 4, p. 31-37, 2004.
- \_\_\_\_\_. *O Desafio Metanacional: Como as Empresas Podem Vencer na Economia do Conhecimento*. Ied., Lisboa: Editora Monitor, 2006. 256 p.
- STARKEY, M.; AUGHTON, J.; BREWIN, R. Direct Marketing, Television Advertising, Process Controls, Design of Experiments, *The TQM Magazine* 6 (1997) 434.
- TAHARA, S. Planejamento de experimentos (DOE). Disponível em: [www.portaldeconhecimentos.org.br](http://www.portaldeconhecimentos.org.br), acesso em: 15 de out., 2010.
- TIDD, J.; BESSANT, J.; PAVITT, H. *Gestão da Inovação*. Porto Alegre, Editora Bookman, 2008. 600 p.
- TUSHMAN, M.; O'REILLY C. A. Evolution and revolution: mastering the dynamics of innovation and change, *California Management Review*, v.38 p. 8 – 30, 1996.
- VON HIPPEL, E. Lead users: an important source of novel product concepts. *Management Science*, 32, n.7, p. 791-805, 1986.
- \_\_\_\_\_. *Democratizing innovation*. Cambridge, MA: MIT Press, 2005.

