

# Interfaces and boundaries of guidance for innovation in small Brazilian companies

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## Abstract

The study offers two important conclusions. The challenges for innovation can be perceived along three dimensions: design innovation, the implementation of innovation and functional area of innovation. And the data confirms that small Brazilian companies generally have difficulties to sell their innovations.

**Keywords:** innovation, small enterprises, patents.

## Introduction

Companies worldwide are looking to technological innovation as feasible for your market expansion (Burns and Stalker 1961, Nelson 1993) alternative. In Brazil, the change and technological innovation are more than one alternative, is a survival necessity. Technological innovation is not only important to the prosperity of private enterprises, is also one of the key factors contributors to economic growth. Brazil's economic growth and prosperity depend on how local businesses are effective in marketing new technologies and innovations, converting MSEs into viable enterprises with a sustainable competitive advantage. Thus, the role of science and technology in promoting economic growth has received increased attention from economists and policymakers in recent years in Brazil (Martins 2012).

Despite the importance of innovation for Brazilian MSEs, a thorough analysis of such initiatives in Brazil has not actually happened, so the need for a greater understanding of innovation among Brazilian MSEs. Thus, this study aims to identify the interfaces and boundaries of innovation orientation of Brazilian MSEs. This research is important for at least three reasons: First, Brazil is one of the economies with greater strength in emerging markets, and second, the research seeks to provide a comprehensive assessment of the propensity for innovation MSE Brazilian, such evaluation is expected to show the extent to which the MSEs sector encompasses innovation, and third, the Brazilian government needs to understand the dynamics of innovation MSEs in order to develop effective policies for the sector.

The structure of the article is as follows: the first section focuses on issues related to the provision of basic information about the innovation of MSEs and international comparative perspectives, the following section focuses on methodological issues and

describes the design of the research, in then discusses the study results and the final section summarizes the main concluding remarks.

### **Innovation in Brazilian MSEs**

Historically, there have been few incentives to encourage innovation in Brazil. The intellectual protection did not work well and the innovations were considered “social goods”. The task of innovation was centrally administered priority in specific industrial sectors. Innovation cycles in these specific sectors experienced political, social and economic crises, they did not try to modernize, improve or innovate. Attempts to innovate in the industry included the import of Western technology companies domestically and numerous research institutes were created to cover different industrial sectors. The actual throughput of these innovations in the economy was poor. The era of Brazilian economic transformation did little to improve the activities related to innovation. Fiscal constraints in Brazil put additional pressure on research institutions and universities with public funding, while the new private sector was concerned with the supply of basic goods and services for the local market (Cassiolato and Lastres 1999).

Most studies on innovation in Brazil in general, and of MSEs in particular, was carried out by public institutions, including SEBRAEs (Brazilian Service of Support for Micro and Small Enterprises), IBGE (Brazilian Institute of Geography and Statistics), MCT (Ministry of Science and Technology) and the INPI (National Institute of Industrial Property) or surveys worldwide by the World Intellectual Property Organization (WIPO) that have global data, including Brazil. The findings of these studies are relatively consistent. Firstly, investments in innovation in Brazil have been kept fixed. The statistical INPI investment in machinery, equipment, land and buildings is between 65 % and 85 % of all innovation expenditure declared in the last decade. Expenditures for research and development are less than 10 % of this amount (INPI 2013).

The value of these investments has declined in recent years. Private companies confirm that the vast majority of them do not have a department focused on research and development, knowledge transfer and innovation. Second, large firms seem to be responsible for the investment in innovation in Brazil. They have an advantage over smaller companies for about five times the production companies and 10 times in service companies. Moreover, large firms also introduce more products and services than smaller firms (Martins 2012).

This is in contrast with other Western countries, where innovations are predominantly generated by small firms, as shown by the reports of global data (WIPO 2013). Brazilian MSEs prefer to invest in fixed assets, perhaps believing that the purchase of new and modern equipment probably go help them solve the deficit of innovation. They are less inclined to adopt traditional methods of innovation, such as research and development, knowledge development, procurement of goods and so on.

Thirdly, Brazilian firms predominantly rely on their own resources to finance innovation. Investments in innovation are funded from internally generated cash flow (representing approximately 80 % of total funding for innovation) and bank financing (about 15%). The roles of venture capital and public funding as contributing to the financing of innovation in enterprises are negligible (Ferreira *et al.* 2013).

Fourth, access to finance is seen as the most important issue hindering the development of innovation in Brazil. Specific points are related to lack of access to finance, high cost of borrowing and the high costs of implementing the innovation. Have the secondary reasons for not seeking innovation include high risk (Martins 2012).

Management efforts are fragmented innovation in Brazil. There are 1085 research units focusing on research and development. These include 313 research institutes and 200 research and development centers (including laboratories). There are 573 companies in the

public and private sectors who claim to have conducted research and development as part of their ongoing operations. The other participants include universities, providers of services to research institutes and other centers (INPI 2013).

The statistics of intellectual property in Brazil are divided into six categories: patents, trademarks, computer program, topography internal circuits, geographical indications and industrial designs (these relate to changes in the appearance of the product through the use of different resources, colors, textures, shapes and materials).

The statistics feature of the INPI disappointing trends on Brazilian innovation activities. The number of patents generated in Brazil more than doubled between 1998 and 2012, increasing from 14970 to 33780. However, the number of patents granted was 3455 in 1998 and 3137 in 2012, demonstrating fall within fourteen years later. The data also show that the majority of patents granted to residents are, respectively, the field and the technology industry of mechanical engineering, chemistry, and electrical engineering instruments. In contrast, the patents granted to non-residents are, respectively, chemistry, mechanical engineering, electrical engineering and instruments (INPI 2013).

International studies for the OECD on innovation in Brazil focused on aggregate macroeconomic data and are based on traditional models of inputs and outputs. Despite strong economic growth in Brazil in the last decade, the data shown in the previous section depict a disappointing picture and reflect years of neglect, lack of investment in innovation, limited access to capital, lack of legal infrastructure and lack of focus and public sector private. The conclusions drawn by these international reports are consistent and relate to the decrease in employment in knowledge-based sectors of the Brazilian economy, the limited number of innovative solutions deployed in enterprises, the lack of cooperation between research centers, universities and private sector and the limited number of new businesses developed based on new technologies. According to the OECD economic surveys, Brazilian expenditure on research and development as a proportion of GNP remain low (OECD 2013).

The OECD ranks Brazil as a country recovering, still well behind the European innovative leaders such as Finland, Denmark or Germany. Countries in this category are characterized by strong growth in entrepreneurship and has solid foundations in terms of its technical and scientific body and general infrastructure but are unable to convert these advantages into a set of implementable innovations. The OECD also points out that countries showed that category, mostly improvements with regard to their innovation (resulting in better scores for innovation) (OECD 2013). This may reflect the unrealized potential of Brazil in the area of innovation.

## **Method**

### **Data collection**

The survey was developed from the deductive method with a quantitative approach to use statistics with the primary data collected. The nature research is applied by wrapping a practical application of local interests of Brazilian MSEs as to the objectives the research is descriptive to describe a phenomenon that occurs with MSEs and procedures as it is a survey by using a questionnaire with a sample representative of the population as well as being a longitudinal study in which the collected data represent information for a long period of time (Alencar 2000, Rodrigues 2012, Triviños 1987, Vergara 2006).

Given that research on innovation in the MSE sector is still a developing field in Brazil, the aim of this study is not to put excessive focus on data and statistical models, the focus is predominantly on descriptive statistics data in key areas. The purpose was to gather information through interviews with companies in the MSE sector and subsequently testing them against a larger sample of the population. For the first phase of the research, the pre-test, twenty companies (ten micro and ten small businesses) agreed to participate in a one

hour interview. For reasons of practicality, personal interviews were conducted in December 2011, with Brazilian companies. The questionnaire used in the interviews was semistructured and aimed to discuss the innovation process employed by companies selected (with an emphasis on innovation in different areas of the organization). The interviews also served as the basis for a questionnaire developed for use in the final part of the study.

The sampling frame for the second phase of the study consisted of a population of 7.4 million Brazilian MSEs (IBGE 2013, RAIS 2013). For the sample to be statistically significant at a confidence level of 99% and a sampling error of 5%, the required sample is of 664 MEPS, however, 700 were interviewed MSEs using a probabilistic sampling. Her seven questionnaires were later disqualified due to inadequate responses four questionnaires were unusable because they are mid-sized companies. The questionnaires of respondents were therefore included in the study, yielding a high rate of effective response, making this one of the largest innovation studies of MSEs in Brazil.

To obtain the desired level of response, a semi-structured questionnaire was filed in Google Docs and link to your response by e-mail (please requesting disclosure) for all SEBRAES of Brazilian states, the respective departments of administration, industry, development, trade and finance these states, as well as those of the federal capital and also sent to departments of administration, economics and accounting of most federal and state universities in the country units.

The questionnaire was sent in January 2012, along with a cover letter and the information collected through July of the same year. The questionnaire consisted of three parts and had four pages. The first part of the questionnaire referring to four groups of innovation activities in the business that could be considered important to investigate the state of innovation in Brazilian MPE - these were considered innovation inputs.

### **Data analysis**

These four groups included 20 variables: Product or service innovations (introduction of new products or services, improvements to existing products or services), process innovations (education and training of workers, reengineering or benchmarking, production improvement, business programs quality management, information exchange, the use of advanced technologies), organizational innovations (decision making, cooperation systems with customers, suppliers, financial institutions, organizational structure, teamwork, decentralization, internal communication) and areas of functional innovations (marketing, supply chain management, financial management, accounting and human resource management).

In this part of the questionnaire a Likert five-point scale was used the questionnaire to assess the level of innovation activity in each category. The design of the questionnaire was based on literature review. Other parts of this section of the questionnaire were related to intellectual property management and financial statistics were concerning the acquisition of tangible assets as well as financial commitments to research and development. The second section of the questionnaire addressed the actual results of the innovation process and innovation outputs. This section was treated with predominantly financial indicators, such as annual sales growth, the percentage of sales generated from new products or services and the level of net profitability; elsewhere included measures of introduction of new products and the competitive situation of company. The third section of the questionnaire was concerned specifically with the demographics of companies. In this section questions were used to characterize the participants and their companies. The demographic profile included questions about the level of sales, number of employees, number of years in operation, the export activity of the company and the industry and the level of education of the owner.

## **Results and Discussion**

### **Interfaces and boundaries of Brazilian MSEs**

The collected data show significant deficiencies in the innovation orientation of Brazilian MSEs. Approximately 83.6% of the companies had less than four new products in the three years 2009-11, representing an average of about one new product per year. Innovation activities in other areas of the business were worse - 63% of respondents reported having income levels of up to US\$ 200,000. Low levels of innovation activity are reflected in the limited financial commitment in research and development - 67.9% of companies invested less than US\$ 40,000 in R&D in the period 2009-11, so that the level of sales generated from releases new products has been low. About 57% of firms generated less than 2% of its revenue from the launch of new products. Finally, 78.8% of respondents stated that they did not generate new patents, while 12.1% said up to two.

Demographic data show the financial advantages concerning Brazilian MSEs. Over 90% of all respondents stated that they were operating a profitable business on the net profit level and had experienced strong growth in sales (almost 50 % of respondents said their sales had grown annually between 10% and 20% in the period 2009-11. Around 33% of respondents said they had owned the business for less than four years and that most of the sample companies were microenterprises.

About the correlation matrix for some key parameters of innovation and demographic characteristics of the firms, a limited number of correlation values exceeded 0.5, indicating low multicollinearity between variables and a relationship between the variables of low to moderate. Overall, the data indicate that Brazilian MSEs have a propensity to innovate low to moderate. The interest in innovation is most visibly demonstrated by more mature companies: the correlation between the age of a company and investment in R&D is moderate ( $\rho = 0.490$ ). The correlations among the oldest companies are relatively consistent. Mature companies are most effective for the development of new products or services ( $\rho = 0.454$ ), deriving an increase in sales of such innovations ( $\rho = 0.519$ ).

Other correlations provide an interesting insight into the profiles of the respondents and their innovation activities face to face with his real business performance. For example, the correlation between the level of investment in R&D and introduction of new products or services ( $\rho = 0.312$ ) and the number of records of property rights ( $\rho = 0.328$ ) was relatively low. Investments in R&D were also poorly correlated with the generation of new sales of research activity ( $\rho = 0.120$ ), generating high sales levels ( $\rho = 0.146$ ).

The results indicate that Brazilian MSEs have challenges on two basic parameters of innovation: translating investments in R&D for the development of viable products or services on the market and market them successfully. The results confirms that investments in R&D do not translate into an improvement in profitability for MSEs ( $\rho = - 0.241$ ). This undoubtedly relates to the high costs required to support continuous innovation efforts. Although innovation costs can usually be recovered in the future, the data show that this may not be the case of MSEs in Brazil, these organizations seem unable to get pass the costs of innovation for consumers.

The connection between the commitment to R&D and introduction of new products or service introduction is low ( $\rho = 0.312$ ). There may be at least three explanations for this. Firstly, the relationship could suggest that these organizations rely on alternative methods to improve the supply of goods or services instead of traditional commitments to R&D within the company. For example, MSEs operating in the retail industry can rely on improvements in products or services developed by suppliers. Secondly, companies can focus on process innovation, upgrading its production facilities rather than actually inventing new products. Under such circumstances, the mere existence of a new machine can be susceptible to allowing the development of new products.

Thirdly, companies may be working with partners (universities, research centers, agencies, and others) on the development of products and services. From the point of view of intellectual property rights, registrations and inventions are weakly correlated with almost all variables ( $\rho < 0.300$ ), thus demonstrating the limited interest in developing and protecting intellectual property.

This undoubtedly stems from weak innovations and initiatives might be further aggravated by the weakness of intellectual property in Brazil (in case of hacking or similar practices). The prospects of business financing, capital requirements and needs, appear to be modestly correlated with the level of investment in R&D ( $\rho = 0.541$ ) and for achieving higher sales ( $\rho = 0.524$ ). This correlation is logical, since it is difficult to expect an important and significant commitment to R&D and innovation without funding.

### **Guidance for innovation**

The key factors of perceived innovation efforts is summarized in the results, which summarizes the average results of the respondents with regard to the importance attributed to different innovation initiatives. The highest ranked categories are discussed in this section. The most important innovation activity was found to improve existing products and services (mean = 3.96). MSEs confirmed that they must continuously improve their existing business proposals to remain competitive with other companies. This is a major determinant of market success and ultimately translates into strong financial performance.

The high rank of the implementation of quality management programs (such as ISO) reflects a growing popularity of these programs between companies (mean = 3.87). They realize the value of these programs from the point of view of external validation of their market offering, as well as confirmation of quality and safety of the product or service. The certificates are well regarded by many stakeholders of companies and are fundamental to distinguish it competitively local competitors. The introduction of new products or services related to the first point - i.e. the competitiveness of firms (mean = 3.71).

Issues relating to distribution and logistics are classified as the fourth most important category (mean = 3.69). These issues will no doubt highlight the difficulty of establishing a framework of effective distribution for the Brazilian market. The management of the supply chain is often regarded as one of the most expensive parts of the value chain in Brazil.

### **Structure innovation initiatives**

One of the principal factors extraction with varimax rotation was used to distinguish clusters of innovation initiatives developed by the interviewees. Using a load factor of 0.50 as the cutoff for inclusion within a factor, innovation initiatives developed by MSEs were separated into three factors (eigenvalues  $> 1$ ). Consequently, these factors were interpreted as: “design innovation” (explaining 25.4% of variance), the “implementation innovation” (explaining 17.5% of variance) and “feature innovation” associated with the diffusion of innovation in entire organization (explaining 13.8% of the variance). The twenty innovation initiatives used in the questionnaire provided a comprehensive framework for innovation to MSEs. The percentage of variance explained by three factors equals 56.7%. In addition, a Cronbach's alpha was computed to indicate the reliability of the construct, with values ranging from 0.74 to 0.87. This confirms the effectiveness of the innovation parameters chosen to define the environment for innovation in Brazilian MSEs.

The existence of three factors confirms that MSEs address issues related to innovation according to common themes or considerations. These factors are also considered phases of innovation, as the factors that have captured the natural progression of businesses through the innovation process.

Factor 1, called design innovation, defines issues related to the initial considerations of innovation in the company. This activity is usually the first step in the innovation process. Companies initially improve an existing product or service offerings that can enhance the market position of the company. Alternatively, other companies buy the intellectual property, however, this can be expensive, especially for newly established companies that probably do not have sufficient financial resources. This indicates that companies tend initially to avoid the development of new products and services.

To improve the existing supply, the company should consider the most appropriate delivery method for improving the product or service - this can be done through the use of advanced technologies (new machinery and equipment for production), or by introducing of quality management programs (which are popular among some Brazilian companies). Innovation activities also require cooperation between different departments and teamwork. Such activities also require financial planning and analysis, hence the finance department should be involved early in the innovation process.

Factor 2, termed implementation of innovation involves a focus on operational issues in converting innovative concepts into implementable solutions, for example, the implementation of innovation for production companies tend to focus on more productive efforts. Any reformulation and implementation of new internal processes are performed based on internal evaluations as benchmarking and reengineering. There should also be additional training for contract employees are engaged with other human resources in the company, in addition, the relationship with the company's stakeholders (suppliers, customers) can also be refurbished .

Finally, companies should devote their efforts to internalize concepts of innovation throughout the company across functional departments, which is captured by Factor 3. The main activity here is to involve the entire organization in the innovation process, including management of supply, accounting and human resources chain. Internalize the consequences of this innovation potentially include changes in organizational structure and internal links found within the company. It is also important to note that when the organizational functions are well coordinated the company may be ready to implement new products or services and actively participate in internal R&D.

## **Conclusion**

This research demonstrated the interfaces and boundaries guidance for innovation among Brazilian MSEs, demonstrating that most of the companies had less than four new products in the three years 2009-11. Thus, low levels of innovation activity are reflected in the limited financial commitment in research and development, in which the level of sales generated from new product launches has been low.

Overall, the data indicate that Brazilian MSEs have a propensity to innovate low to moderate, so that the interest in innovation is demonstrated more clearly by more mature companies, reflecting the result that they are more effective for the development of new products or services.

Thus, there are two main conclusions that can be reached from this research. First, the study confirms that there is a specific challenge that MSEs face regarding their approach to innovation.

Factor analysis based on the entire sample reveals that there are different issues or problems that MSEs must face related to the design of innovation, implementation of innovation and functionality innovation.

In addition, the Brazilian government needs to understand the dynamics of innovation MSEs in order to develop effective policies for the sector. Accordingly, a program of specific government support for these organizations to established guidelines, clear and

unbureaucratic incentives can be effective in supporting innovation activities of these MSEs. Without him, the current force structure, they have serious challenges in terms of the propensity to innovation.

Secondly, the data confirm that Brazilian MSEs generally have critical difficulties in marketing their products/services. They are not able to translate its commitment to R&D in strong market offerings to consumers.

Thus, the results indicate that Brazilian MSEs have challenges on two basic parameters of innovation: translating investments in R&D for the development of viable products or services on the market and market them successfully.

As limitations, despite research provide a comprehensive assessment of the propensity for innovation MSE Brazilian, such evaluation has demonstrated the extent to which the MSEs sector encompasses innovation, discuss the theme Innovation in MSEs is quite complex. So obey the guidelines generated by the Oslo Manual (OECD 2005) that correspond to factors that should be observed for the collection and interpretation of data on technological innovation, is no easy task, considering that MSEs have specifics when it comes innovation, however, the horizon should be pursued, because as discussed previously in this section, there is a specific challenge for MSEs when the theme is innovation.

As a suggestion, future research may focus their efforts on: larger interfaces between internal and external inter-relationships of the organization with innovation or the incidence of the shares of R&D in the functional areas itself. Still, future research could examine these methods as Brazilian MSEs can develop functional mechanisms can also translate to investments in R&D to sales and, thus, achieve greater competitiveness .

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## References

Alencar, E. 2000. *Introdução à metodologia de pesquisa*. UFLA, Lavras.

Burns, T., G. Stalker. 1961. *The management of innovation*. Tavistock, London. Available at [http://www.sagepub.com/upm-data/27412\\_8.pdf](http://www.sagepub.com/upm-data/27412_8.pdf) (accessed date July, 20 2013).

Cassiolato, J., H. Lastres. 1999. *Globalização e inovação localizada: experiências de sistemas locais no Mercosul*. IBICT/MCT, Brasília. Available at [http://amxinformatica.com.br/redesist/images/redesist\\_images/livros/Glob\\_Mercosul/Pre\\_Suma\\_Autor\\_es.pdf](http://amxinformatica.com.br/redesist/images/redesist_images/livros/Glob_Mercosul/Pre_Suma_Autor_es.pdf) (accessed date July 24, 2013).

Ferreira, D. *et al.* 2013. Índice Brasil de inovação: uma aplicação em nível estadual com foco no estado da BAHIA. *Revista Geintec - Gestão, Inovação e Tecnologias*, 3(1).

IBGE. 2013. *Pesquisa nacional por amostra de domicílios*. Instituto Brasileiro de Geografia e Estatística, São Paulo. Available at <http://www.ibge.gov.br> (accessed date July 21, 2013).

INPI. 2013. *Estatísticas*. Instituto Nacional da Propriedade Industrial, Brasília. Available at <http://www.inpi.gov.br/portal/artigo/estatisticas> (accessed date July 22, 2013).

- Martins, R. 2012. Os núcleos de inovação tecnológica como estratégia das políticas de inovação do MCT (2004-2010). *Latin American Journal of Business Management*, **3**(1).
- Nelson, R. 1993. *National systems of innovation: a comparative study*. Oxford University Press, Oxford.
- OECD. 2013. *Country profile statistical Brazil*. Organisation for Economic Co-operation and Development. Available at [http://www.oecd-ilibrary.org/economics/country-statistical-profile-brazil\\_csp-bra-table-en](http://www.oecd-ilibrary.org/economics/country-statistical-profile-brazil_csp-bra-table-en) (accessed date July 23, 2013).
- OECD. 2005. *Manual de Oslo: diretrizes para coleta e interpretação de dados sobre inovação*. Organisation for Economic Co-operation and Development, Paris. Available at [http://download.finep.gov.br/imprensa/manual\\_de\\_oslo.pdf](http://download.finep.gov.br/imprensa/manual_de_oslo.pdf) (accessed date July, 20 2013).
- RAIS. 2013. *Relação Anual de Informações Sociais do Ministério do Trabalho e Emprego*. São Paulo. Available at <http://www.mte.gov.br> (accessed date July 20, 2013).
- Rodrigues, T. K. A. 2012. *Caracterização de MPes brasileiras quanto ao conhecimento de ferramentas de gestão*. Universidade Federal de Lavras, Lavras.
- Triviños, A. 1987. *Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação*. Atlas, São Paulo.
- Vergara, S. C. 2006. *Projetos e relatórios de pesquisa em administração*. Atlas, São Paulo.
- WIPO. 2013. *Section A: patents, utility models and microorganisms*. World Intellectual Property Organization. Available at [http://www.wipo.int/export/sites/www/ipstats/en/wipi/pdf/941\\_2012\\_section\\_a.pdf](http://www.wipo.int/export/sites/www/ipstats/en/wipi/pdf/941_2012_section_a.pdf) (accessed date July 25, 2013).