INNOVATION IN EMERGING MARKETS: BRAZILIAN PRODUCTIVE SECTORS PRACTICING REVERSE INNOVATION?

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ABSTRACT

This paper proposes an analysis of current research on development and innovation (RD&I) activities in several sectors of the Brazilian economy. The main sources for the analysis are data extracted from the Brazilian National Survey (Pintec 2011). Based on this data, the most innovative sectors in terms of products and services for the global market were identified and analyzed. The analysis focuses on "reverse innovation", a concept describing an innovation process applied by a number of multinational companies that develop innovative products and services in emerging countries and then export this technology and know-how back to developed countries.

Our study presents different levels and kinds of innovation, including product and process innovations in domestic markets, organizational and marketing innovations within companies, and new products and processes designed for global markets. We discuss several variables, measuring their marginal contribution to each of the variables preceding the evolution of the explained variable in order to prioritize them. We then present a mapping of the positioning of the sectors in terms of their degree of innovation in the domestic market, and their applicability to global innovation. At this point they should be in a position to propose their domestic models to the global market. The results of this research will reflect the nature of the "reverse technology" applied in certain sectors of the Brazilian economy.

Key Words: Reverse innovation, Brazil, Research and Development, Industrial sectors, Globalization.

INTRODUCTION

An increasing number of multinationals are adopting a new strategic innovation model more commonly defined by some specialists as "reverse innovation". This new approach, developed in the wake of globalization, is ushering in a new era in economic development and intra-group relations.

The term "reverse innovation" covers the exploitation, adoption and commercialization of innovations developed by subsidiaries in emerging countries by international groups, who then apply them to maturing markets in emerging countries.

The innovation system in Brazil can be considered as a dynamic system in which it is imperative to improve efficiency in order to remain competitive.

The most recent study on innovation in Brazil (Pintec) was carried out by the Brazilian Institute of Geography and Statistics (IBGE) in 2009-2011. The main objective of the study, based on an overview of 65 sectors, was to provide information for the development of indicators applicable to innovation approaches.

In anothers terms, measuring the capacity of sectors of the brazilian economy to successfully implement reverse innovation movement applicable to products, services and processes. Our research focuses on 30 economic activities, particularly the extractive, processing, energy and service sectors.

The paper is organized into the followings sections: literature review, methodology, results and discussion.

LITERATURE REVIEW

Reverse innovation

Reverse innovation is a term applied when a company, usually a multinational, develops innovative products and services in emerging countries and exports the knowledge associated with them to developed countries.

Reverse innovation refers to innovations initially adopted in emerging countries and later taken up in developed countries (Sinha 2013). The concept of “reverse technology” emerged in the second half of the 20th century with Reddaway (1968). The term “reverse innovation” was introduced by Govindarajan, Professor at the Tuck School of Business (USA), and senior innovation consultant at General Electric (GE).

Most R&D carried out abroad focuses on technologies deriving from the matrix designed to boost sales or meet specific needs. As such, it is intimately linked to the concept of “tropicalization”. Dias and Salerno (2009) provide a succinct definition of tropicalization as the adaptation of derived products and services, platforms and existing models by a firm in an emerging country reacting to local conditions.

This notion is taken up and generalized by the concept of “reverse innovation”, or, in other words, innovation developed by foreign subsidiaries rather than by head office, but which is later absorbed by the latter (Hakanson and Nobel 2001). This innovation transfer tends to increase the influence of the subsidiary within the group. The approach requires the parent company to reappraise its schemas and dominant logic, carry out a thoroughgoing review of its approach to product development, and reorient its sales forces.

The objective of the tropicalization process suggested by the transfer of technology implies that if local subsidiaries do not want to become increasingly marginalized within the group, they need to become involved in the development of new models. In this regard, “reverse technology” can be seen as the ultimate stage of tropicalization.

Nevertheless, little academic research has been done in this area; instead, academics have focused on the internationalization of R&D carried out by the parent company. According to Criscuolo (2009) “reverse technology” is an approach defining how R&D carried out abroad by the subsidiaries of multinationals is developed in the “matrix” (which possess the resources required to coordination processes and relations with stakeholders).

R&D carried out by subsidiaries stimulates knowledge transfer within the group and enables firms to differentiate themselves from competitors. Knowledge transfer between a foreign subsidiary and its parent company is based on five factors: the value of the stock of knowledge of the subsidiary (high when it does not duplicate the rest of the network); motivations to diffuse that knowledge; motivations of other units to absorb it; the number and availability of channels of transmission; and the absorption capacity of other entities (Gupta et al. 2000).

Most research on reverse innovation has been carried out by Vijay Govindarajan (2012). The author claims that this new strategic option, which is global in nature, has been adopted by an increasing number of companies operating in a wide range of sectors. Notable amongst these companies are General Electric, Pepsico, and Procter & Gamble, as well as firms operating in the telephone and automotive sectors.

To apply reverse innovation, firms need to study five characteristics in particular, namely product performance, infrastructure, sustainability, economic regulations, and the demands of the local market. Reverse innovation is, therefore, an approach to strategic positioning based on an optimal combination of local resources that are noticeably independent of the parent company.

Reverse innovation is a process whose roots are to be found in emerging countries. The process is based on a number of different characteristics and conditions. Firstly, innovation formalized by a subsidiary located in an emerging economy must satisfy the expectations of a segment of consumers with median incomes. Secondly, the innovations developed by such a subsidiary must emphasize the notion of convenience rather than sophistication in order to guarantee initial success in the local market. Thirdly, the subsidiary's personnel should be afforded a certain leeway to enable them to benefit from tacit interactions. The parent company must therefore encourage the spirit of entrepreneurship of its subsidiaries in order to increase the added value of the group as a whole.

This process encourages the creation of a network of local partners made up of internal and external stakeholders. The management and distribution of tasks amongst various stakeholders should promote the development of innovative products and services acceptable to the parent company, suitable to mature markets, and transferable to other companies within the group.

In order to develop fully, this phenomenon must benefit from a particular context and environment (Govindarajan 2012). Personnel in emerging countries should be given a certain amount of freedom; radical objectives must be defined (price reductions); subsidiaries in emerging countries must be able to access the resources of the group as a whole; the leader and the pilot should be selected with a view to avoiding all conflict; top management should take measures to ensure maximum impact; personnel should refocus on emerging markets; larger R&D budgets should be provided for emerging local markets; genuine expertise in emerging markets should be developed; and once the emergent product has been developed and rolled out in other markets and consumer fringes and integrated into other products, care should be taken to avoid cannibalization effects.

Based on commercial imperatives, the objective of reverse innovation is, after feasibility tests have been carried out, gradually to introduce mid-range models into traditional markets with a view to transforming them into the group's standard product. The challenge is not to boost development in emerging countries, but to transfer technology back to the original market.

Reverse innovation is not aimed at the bottom of the pyramid but, rather, at the middle (members of the middle classes and those with lower incomes).

The products developed are cheap, characterized by simplified technology and low design costs (Laperche and Lefebvre 2012). In brief, functionality rather than quality is the key word; the view is taken that it would be a waste of time to develop highly sophisticated systems that will never be entirely exploited by consumers.

For reverse technology to develop efficiently, the parent company must encourage the spirit of entrepreneurship of subsidiaries, thereby creating added value in the group as a whole (Borini 2012). The author notes that this process has a greater chance of success when subsidiaries have experience in the field and when their growth is organic.

The size and volume of the market, the presence of a technological network, and the entrepreneurial capacity of subsidiaries are of central importance in terms of organizing development projects in subsidiaries (Santini and Marx 2009).

Innovation blowback

Introduced by Brown in 2005, “blowback” is a term describing Western companies that carry out research, development and innovation in emerging countries. Brown studies radical innovation in Western firms, notably in regard to their Asian subsidiaries.

Western companies have access to a broad range of emerging markets. They have the capacity to develop innovative products and services in those countries and to use them to penetrate domestic markets. According to Brown (2005), delocalization to emerging markets accelerates the development of capacities at the global level, thereby helping companies to access rich networks of talent and learn how to manage them.

Frugal innovation

Similar in spirit to reverse innovation, frugal innovation, or “Jugaad” (a Hindu concept), is described in the current literature as the inventiveness of an organization (or a population) applying a certain degree of improvisation to produce innovations with few resources or with resources adapted to local conditions.

According to Huet et al. (2013), frugal innovation describes the kind of inventiveness of low income populations applied to simplifying or modifying products, services and business models in order to adapt to or meet needs that have not yet been satisfied.

The concept of Jugaad Innovation, analyzed by Radjou et al. (2012) in a large number of companies, most of them in India, is defined as follows:

Jugaad is a popular Hindu word that can be roughly translated as “an innovative, improvised solution born of ingeniousness and intelligence”. It is an audacious art that involves finding opportunities in the most unpromising circumstances and applying ingenious and improvised solutions in a simple way. Jugaad is doing more with less (Radjou et al. 2013).

The concept of frugal innovation aims “only” at developing products and services in emerging countries that are not intended for distribution in wider markets. Jugaad, on the other hand, involves the development by globalized innovation teams of market-oriented products in and for emerging countries. Such products are designed, from the outset, to be sold worldwide (Immelt et al. 2009).

According to Radjou et al. (2013), the motivations underpinning Jugaad can be broken down into six categories: a quest for opportunities in situations of adversity; doing more with less; thinking and acting in a flexible manner; focusing on simplicity; integrating marginalized and excluded segments of the population; and, finally, following your heart.

In reference to research carried out by Nunes and Breene (2011), Brem and Ivens define frugal innovation as the development of products and services specifically for a low income market segment, and reverse innovation as the development, in emerging countries, of new products that can be adapted to the needs of markets in developed countries.

Emerging economies are characterized by the same kind of unfavourable conditions as those that encourage Jugaad in India and, unsurprisingly, some people in those economies excel in the art of frugal improvisation in the face of complexity (Radjou et al. 2013).

Disruptive innovation and reverse innovation

According to Sinha (2013), the concept of disruptive innovation was introduced by Christensen & Bower (1996). This new managerial approach helps to identify fresh business opportunities, in that disruptive innovation makes it possible to create new markets and develop new value networks. The phenomenon perturbs already existing markets, prompting them to evolve towards more current technology.

Reverse innovation is potentially disruptive, particularly in markets in emerging countries. On the one hand, products originating in developing countries can be disruptive in terms of costs and prices in developed markets; on the other, new technological products can be disruptive in markets in emerging countries. Innovations developed within the sphere of reverse innovation can help firms to exploit opportunities generated by ruptures in new, emerging markets, as well as in radical design and/or low cost approaches in developed countries (Sinha 2013).

In the late 1990s, the Renault group developed a disruptive product that revolutionized the automotive industry. Manufactured in Romania under the Dacia marque, the vehicle was designed in France with help for a team of Romanian engineers and adapted to the needs and constraints of markets in emerging countries. The project can be seen as an intermediary stage on the road to the process of reverse innovation (Laperche and Lafebvre 2012).

The Logan was designed as a low cost vehicle for emerging markets. The initial idea was to develop a simple, robust and reliable car costing around 5,000 euros and aimed at emerging markets. Sales exceeded all expectations. Available in 59 countries, the Logan is now the company's best-selling model. Currently, one in every five Renaults is a Logan (Métais 2009).

In this perspective, the first disruptive innovation was the internationalization of vehicle design, while the second was the strategic disruption consisting in entering the market from below and upscaling the product by adding carefully targeted features immediately visible to the clientele. The third was the disruptive innovation of manufacturing a car costing 50% of an equivalent vehicle made in a low cost country. Lastly, the final disruptive innovation was the marketing approach developed for the Logan. Renault set up sales networks in countries in which the firm had previously had little presence or no presence at all (Midler et al. 2013).

Renault has applied the same internationalization strategy to other models, including the Sandero, another innovative low cost vehicle. Originally designed in Barcelona by European teams to meet Brazilian demand, and optimized in Brazil by local design teams, the Sandero has become Renault's most successful product in the South American country (Jullien et al. 2012).

Meanwhile, as many "Entry Level" products on the Brazilian automotive market are cheaper than they are in Europe, the Logan has been redesigned and upscaled. In effect, in Brazil, Renault has succeeded in "tropicalizing" the model by changing the wheels and adding new features to the dashboard (Jullien et al. 2012). In Brazil, the Logan and the Sandero now account for 69% of Renault's sales, which have increased by 78% (Métais et al. 2009).

The strategic challenge, considered as a frontier by Métais et al. (2009), is to convince consumers in mature markets to adopt "products from emerging markets".

Internationalization and globalization

Since Coase (1937), internationalization has been the subject of a good deal of research. A number of authors have demonstrated that, as well as improving corporate performance, this strategic approach also contributes to productivity. Globalization, which can be thought of as the final stage of internationalization, has forced companies to rationalize their value chains and adopt decentralized structures capable of meeting local demand more effectively. The most important consequences of this phenomenon are described by Sicoli (2012) as reducing costs and lead times, abolishing trade barriers, facilitating technology transfers, and boosting international trade. In order to guarantee a more accurate analysis of local needs, a network of local partners should be set up.

Internationalization, and more particularly globalization, makes it possible to locate growth opportunities and distribute risks in an optimal manner. On the other hand, it substantially increases coordination costs (Belaounia 2011). Consequently, in order to achieve economies of scale, already developed standards should be capitalized on, while local demands should be taken into account.

Internationalizing RD&I provides companies with fundamental advantages, including greater integration into the markets for which their products are designed, and the possibility of benefiting from technological competences developed outside the country in which the parent company is based. In effect, in some cases, the proximity of markets and the quest for new technologies are the *raisons d'être* of subsidiaries (Dias and Salerno 2009).

Major international groups are increasingly delocalizing their engineering or innovation departments. The percentage of R&D carried out in emerging countries is rising (Huet et al. 2013).

There are many reasons for localizing R&D in emerging countries. Amongst them are strengthening the economies of those countries; exploiting the scientific and technological potential associated with the lower cost of human resources; the globalization of intellectual property rights; the growth in demand in certain emerging countries, and the stagnation of markets in industrialized countries (Laperche and Lefebvre 2012).

In addition to cost-related objectives and conquering new markets, the internationalization of innovation reflects a desire to benefit from a process of global learning and to exploit knowledge generated in new, geographically distant markets (Jacquier-Roux et al. 2011).

According to Sinha (2013), referring to Govidarajan (2012), an analysis of the history of globalization based on the evolution of American multinationals reveals four distinct phases:

Phase 1 – Globalizing Market Presence, 1950-1960. This process was marked by an inter-dependence between different countries in the spheres of economics, politics and culture. Multinationals were able to achieve economies of scale in terms of innovation and focused on seeking new world markets for their products.

Phase 2 – Globalizing the Resource Base, 1970-1980. In order to maximize their efficiency, American multinationals delocalized many of their operations, including manufacturing and back office functions, to cheaper sites all over the world. These companies also established R&D units in locations abroad. However, innovation projects placed an overwhelming emphasis on the needs of industrialized countries. For example, Microsoft set up development centres in the USA, India and China.

Phase 3 – *Glocalization*, 1990-2005. This phase represents the start of the first part of the reverse innovation process. Multinationals began to focus on local development, using local resources to elaborate improved initiatives in terms of products and services and adapt them to these markets.

Phase 4 – Reverse innovation, 2005-? In this phase, which is the object of our study, products are developed "in the country, for the world." Multinationals initiate the reverse innovation process in emphasizing the local market. A decentralized approach to innovation originally developed to meet the needs of markets in poor countries is adapted for use throughout the world. The process of reverse innovation is not just limited to manufacturing, but can also be applied to other sectors, including design.

According to Govindarajan (2009), Phase 4 accounts for only half of the process of reverse innovation. Firms initially focus on developing products "in the country, for the country" by evaluating client needs in emerging markets, rather than contenting themselves with modifying existing products. Because firms develop products locally, they are in contact with the needs of local markets, while at the same time benefitting from the resources and technology of the parent company. Govindarajan adds a fifth phase, which he terms "bringing innovation home", or, in other words, a stage in which firms complete the process of recuperating innovations from emerging countries by adapting them and distributing them worldwide. This phase introduces the notion expressed in the slogan "in the country, for the world."

Sinha (2013) illustrates reverse innovation in reference to the example of the Grameen Bank, which provides banking facilities for poor men and women in India. The success of the "micro credit" concept has enabled this microfinance institution to establish a subsidiary in the United States – Grameen America – to serve Americans on low incomes.

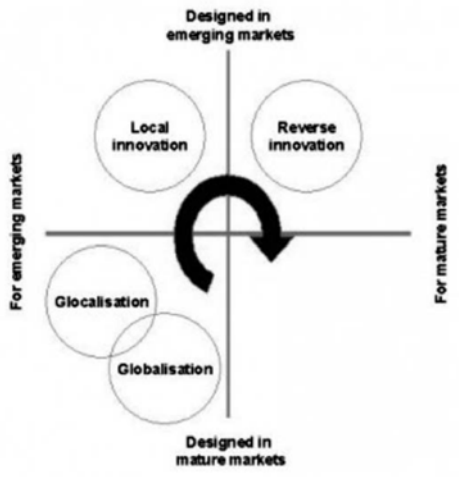

Figure 1: US – Grameen America – to serve poor people Source: Sinha (2013)

According to Dias and Salerno (2011), the literature on the internationalization of innovation in multinational companies describes two fundamental reasons for decentralizing R&D units.

The first is associated with the market: inserting subsidiaries into innovation networks close to local subsidiaries facilitates the analysis of local preferences and makes local markets easier to conquer.

The second is linked to technology: when a principal centre of development does not have control over a new technology available in another country, the parent company will set up R&D units in its subsidiaries in order to access that knowledge.

Emerging countries

It is clear that globalization is gradually establishing a stronghold in emerging countries. These countries have markets that demand attention and which can no longer be treated as if they were marginal. Sheth (2011) paints a warts-and-all picture of those markets, listing their characteristics as follows: heterogeneity, the central role of local institutions, the impact of competition from non-branded products, a chronic lack of resources, and inadequate infrastructure. On the other hand, positive indicators include competitive advantages, sustained growth, and expanding demand.

Laperche and Gilliane (2012) take this analysis further. According to these authors, the objective of firms that invest in R&D in emerging countries is to develop global products and platforms. But, their primary aims are to reduce costs, improve access to markets, be closer to scientific and technological resources, and benefit from production resources and government subsidies.

Stages in the historical development of the globalization of Research & Development according to Laperche and Lefebvre (2012)

Table 1: "The globalization of Research & Development in industrial corporations"

Up to 1980	Globalization of R&D either weak or non-existent	Exploitation of resources limited to strategy; concerns over intellectual property laws
1980-1990	Globalization of R&D principally focused on the Triad Zone	Resources increasingly exploited; harmonization of intellectual property laws; attractiveness policies and high added value investments; globalization of value chains and modular production
Since 1990	Globalization of R&D in emerging countries	Increase in the use of goods and resources; harmonization of intellectual property laws Reinforcement of emerging countries, potential in fields of science and technology; growing demand in emerging countries
Since 2000	Reverse innovation	Design in emerging countries; marketing in emerging countries and globally; growing demand in emerging countries

Source: adapted from Laperche and Lefebvre (2012)

METHODOLOGY

In order to position individual sectors with respect to one another, we opted for a descriptive multivariate method of analysis. Our first objective was to draw up a list of resemblances between sectors in regard to the variables considered. The second was to establish links between variables and understand relations between them in regard to the sectors concerned. Using SPSS software, we focused on generating a Principal Component Analysis enabling us to elaborate a graphic representation categorizing individual industrial sectors and comparing their differing approaches to innovation.

The data used in this article were extracted from the most recent study on innovation in Brazil (Pintec, 5th edition), carried out by the Brazilian Institute of Geography and Statistics (IBGE). The study, which focuses on 128,699 firms each with 10 or more employees, covers the period 2009-2011.

Out of this total, 45,950 firms have either developed a new product, or an improved process. This corresponds to an innovation rate of 35.7%.

We carried out two analyses.

The first consists in positioning all the sectors in the Brazilian economy.

Product and/or process innovation (Pa/oPI), uncompleted project (UP), organizational and/or marketing innovation (Oa/oMI), total number of firms (TNoF), new product for the firm (NPfF), new

product for the Brazilian market (NPBM), new process for the firm (NProcfF), new process for the Brazilian market (NProcBM), incremental innovation for an existing product in the Brazilian market (IInEPBM), innovation for the firm but not for Brazil (IFBNB), incremental innovation for the Brazilian market but already existing in the rest of the world (IIBM/ERW), product innovation for the firm but not for the rest of the world (PIfF/NRW), product innovation internal to the firm (PIintF), product innovation internal to the group (PIintG), product innovation in cooperation with other f

irms (PICoF), product acquisition (PA), process innovation within the firm (PIwF), process innovation internal to the group (ProcIIG), process innovation in cooperation with other firms (ProcICOF), acquisition process internal to the firm (AProcIF).

We purposely selected a wide range of variables in order to develop a clearer perception of groupings based on heterogeneous criteria. In applying these active variables, we were able to examine the points addressed in the literature review (strategic aspect and innovation).

The objective of the two analyses was to represent the way in which industrial and production sectors position themselves in regard to their innovation capacity in the Brazilian market and world markets. We represent our findings on two by two (factors) orthogonal axes on an optimal plane. This enables us to define strategic groups made up of different sectors with similar characteristics. Each axis, which could be described as Factor plus Explanation, is based on the relative influence of each active variable.

RESULTS

First Principal Component Analysis

In the initial phase of our study, we attempted to group together various general economic activities in Brazil according to the nine variables listed above.

The nine variables initially selected gave rise to a large number of often imperfect modelizations. The matrices of correlation led us to dispense, in an incremental manner, with those which were not relevant and to retain only those which enabled us to deliver a pertinent interpretation of products and services.

The influence of the variables is very much the same in regard to both products and services. The most significant coefficients are to be found in the two matrices presented below:

Table 2 : Products: Component Matrix after Rotation[a]

	Component	
	1	2
PIIntF	.940	.326
PI/RW	.184	.935
IIBM/ERW	.680	.666
PIfF/NRW	.212	.905
NPfF	.984	.113

	Component	
	1	2
Method of extraction: Principal Component Analysis. Method of rotation: Varimax with Kaiser normalization.		
a. The rotation converged in 3 iterations.		

Table 3 : Services: Component matrix after rotation[a]

	Component	
	1	2
PIintF	.867	-.120
I Ps/RW	.675	.692
IPSIcRDM	.752	.495
IPsRadicRW	-.184	.782
NPfF	.894	-.087
Method of extraction: Principal Component Analysis. Method of rotation : Varimax avec normalisation de Kaiser.		
a. The rotation converged in 3 iterations.		

The first axis (Factor 1), determined according to a combination of variables, can be described as "Intense R&D." Its construction is based, essentially, on a significant representativity of explicative variables, respectively "PIIntF"/"PIwF" and "NPfF"/ "NProcfF". It measures the efforts deployed in different sectors in terms of the internal mobilization of resources and the number of product and service innovations developed. It demonstrates the innovation capacity of the factors constituting the sector in question.

The second axis (Factor 2) is essentially based on the variables "PI/RW"/"I Ps/RW" and "PIfF/NRW"/"IPsRadicRW". In particular, it defines the capacity strongly impact markets. In this regard, we shall use the expression "Reverse Innovation Capacity". This propensity to truly envisage a transfer of innovation to various global markets determines the foundations of the construction of this second aspect.

By using these two aggregation axes, we were able to establish a representative mapping of the positioning of sectors that we interpreted in the following way.

The sectors in the first quadrant, which have a marked propensity to implement reverse innovation, but which develop their innovations in an insufficient manner, are referred to, generically, as "Exporters of Limited Innovations."

The second quadrant is composed of a group of sectors that place a strong emphasis on their capacity to adapt their innovations to global markets and that are predisposed to investing heavily in R&D. The sectors in question are referred to as “Exporters of Dynamic Innovations.”

The third quadrant is characterized by low intensity R&D and a focus on the domestic market. The group of sectors positioned in this configuration is referred to as “Innovators Limited to the Local Market.”

The last quadrant encompasses sectors closely involved in R&D, but which only apply their innovations to local markets.

These last are referred to as “Dynamic Innovators for the Local Market.”

Results and discussion

“Exporters of Limited Innovations”. This quadrant is made up of sectors that do not show a marked propensity to use resources to stimulate innovation. Nevertheless, perceptible innovations developed by various firms in these sectors demonstrate a real capacity to penetrate global markets. The quadrant includes processing sectors and sectors associated with heavy industry (cars, machines). Firms in these sectors need to make substantial efforts to impose themselves in their respective fields.

“Exporters of Dynamic Innovations.” This zone encompasses high-performance innovative sectors capable of imposing standards in global markets. Characterized by high added value, these sectors include: equipment, chemicals, IT, rubber and plastics. Brazil should capitalize on these sectors in order to develop the kind of competitive advantage that is difficult to imitate or to transfer.

“Innovators Limited to the Local Market.” In this part of the map, we observe a limited propensity for developing product innovations that have a weak impact on other markets. Storage and handling, extraction industries, and electricity can be considered the most emblematic sectors in this quadrant. They correspond to global standards and are not specifically adapted to local markets. In sum, these are sectors in which global references have already been defined, and in which little has been done to develop adaptations for local markets.

“Dynamic Innovators Focusing on the Local Market.” This last quadrant is made up of sectors that, in spite of substantial efforts to develop innovative products, have not succeeded in introducing those products to global markets. Their capacity to implement a reverse innovation process is, therefore, limited. Their influence is thus confined to the Brazilian market and they fail to generate standardization in world markets. Food Product Manufacturing, Furniture and Clothing are the most significant sectors in the quadrant. In fact, these three sectors focus on local demand and are adapted to the needs of the domestic market.

Table 4: Principal Component Analysis of products

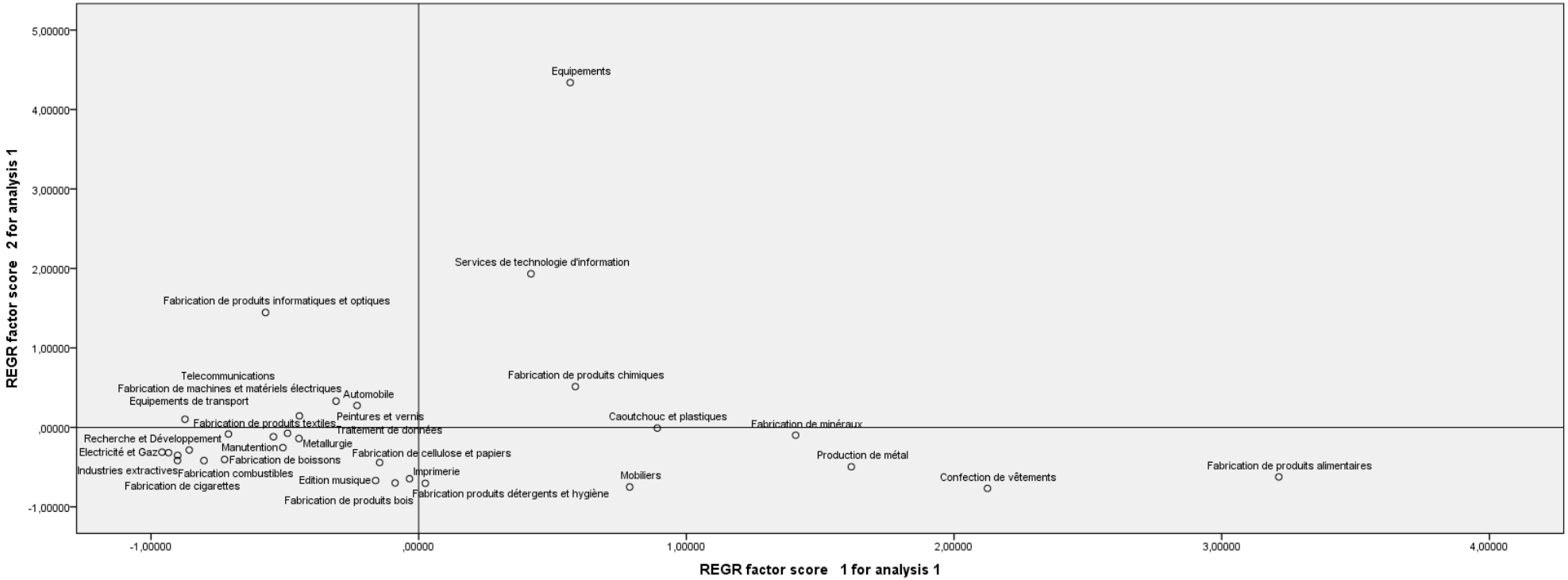

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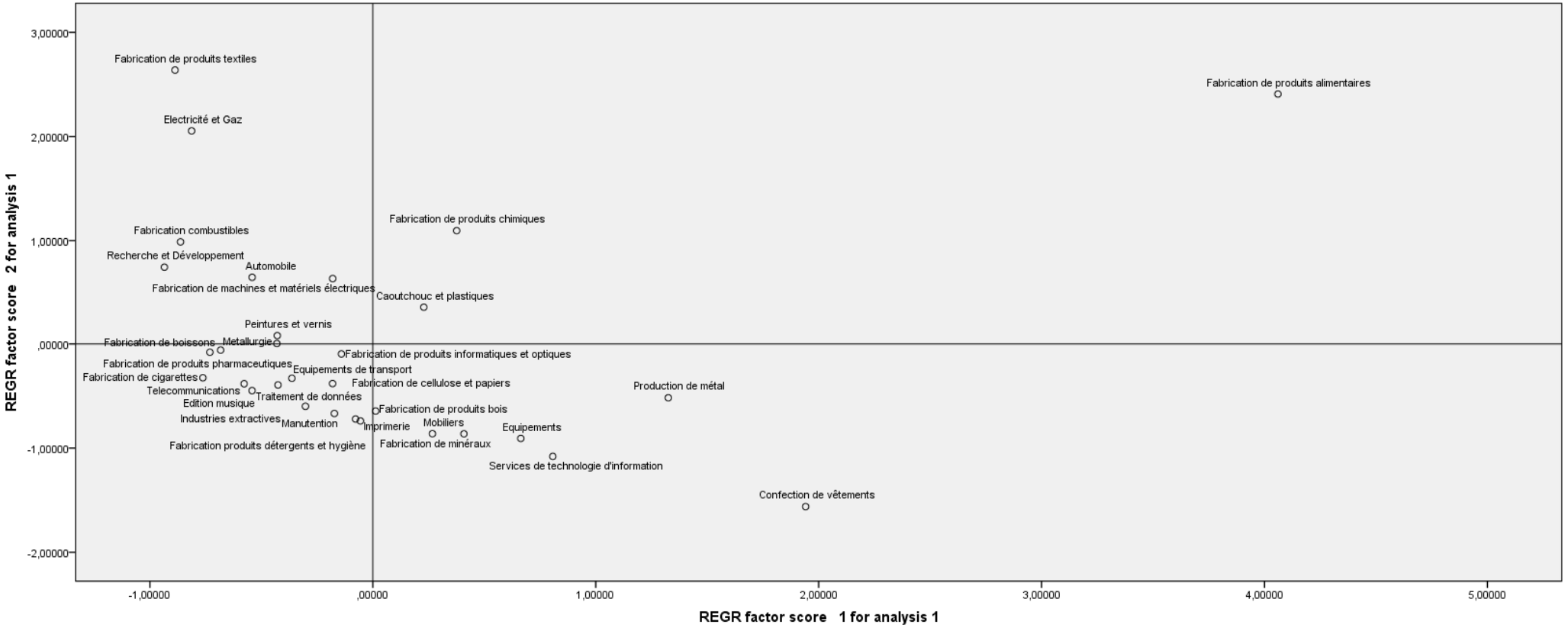
Table 5: Principal Component Analysis of services



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“Exporters of Limited Innovations”. In this first quadrant, which focuses on service innovations, we find sectors characterized by a pronounced capacity to develop innovative processes and procedures capable of penetrating global markets. However, R&D units do not succeed in markedly differentiating the country in which they operate. In spite of the fact that they do not place an emphasis on R&D, machinery, the automotive industry and electricity – all of which are to be found in this quadrant – are able to find an application for their products and services in world markets.

“Exporters of Dynamic Innovations”. Closely involved in the development of service innovation, and characterized by a pronounced capacity for reverse innovation, this group of sectors demonstrates the kind of competitive advantages that Brazil is capable of developing. Food Product Manufacturing, which is the most representative sector in this quadrant, reveals a capacity for differentiation in terms of original methods and processes that are perfectly transposable to and adoptable in markets in the rest of the world.

“Innovators Limited to the Local Market.” The sectors in this zone are characterized by their relative lack of capacity to export innovations in the field of products, procedures, production and management methods, as well as by their relative lack of investment. It is in these sectors that the giants on the world stage impose their standards (telecommunications, publishing, pharmaceuticals). Firms in these sectors apply small-scale, cosmetic innovations to the local, Brazilian market.

“Dynamic Innovators Focusing on the Local Market.” This last quadrant, focusing on service innovations, includes sectors that place a good deal of emphasis on procedural and production innovations. This approach does not find a favourable echo in other world markets, but can be adapted to sectors characterized by substantial labour requirements (clothing industry).

In grouping together the two maps of product and service innovations, it is important to note the Chemical Products Manufacturing sector. In both cases, this last demonstrates a substantial capacity for reverse innovation and a large investment in R&D. This sector is particularly effective in terms of creating added value and giving Brazil the opportunity to develop competitive advantages.

CONCLUSION

The main objective of this article was to measure the capacity of various sectors of the Brazilian economy to successfully implement reverse innovation processes applicable to both products and services.

In order to examine this propensity, several descriptive variables were selected, constituting a field of study that we represented into a two-dimensional graphic. The first axis (Factor 1) is defined as the dynamic of innovations applied in the sectors, the second (Factor 2) as the capacity to develop a reverse innovation process in all global markets. Different positioning quadrants emerged for the analysis of product and service innovations with characteristics formalized by the two preceding factors.

Although we were able to observe a number of trends, they did not enable us to elaborate interpretative models linked to reverse innovation and to the various sectors of the Brazilian economy. Nevertheless, one sector in particular retained our attention (Chemical Products Manufacturing), which is positioned in an identical manner in terms not only of product innovations, but also of innovations in services.

It appears that this kind of economic activity can genuinely lead to the development of methods for creating added value and competitive advantages, and introducing innovations in markets all over the world. A pertinent policy would be for firms to focus in particular on imposing their standards on all actors in the sector.

But this analysis is still too fragmentary. It would benefit from additional data, intrinsic and endogenous to the Chemical Product Manufacturing sector, the most innovative sector in terms of products, services. To the results already obtained should be added a study on the configuration of individual sectors (size of companies, joint-projects with stakeholders, purchases of patents and licenses, links with various actors in the Brazilian economy), on their modes of functioning and on the various stages that should be envisaged with a view to stimulating reverse innovation.

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