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Abstract. Agile supply chains or agile supply networks are those that adopt strategies for innovation and create customer/client needs before the customers/clients actually understand that they need such innovative products. Brazil is a developing country and belongs to the group of nations denominated BRICS, which, in addition to Brazil, involves Russia, India, China and South Africa. The purpose of this research was to study active companies in Brazil to verify the existence of agile companies in developing countries. First of all, this article applied the methodology to evaluated two companies considered agile in Brazil. Furthermore, this paper evaluated the scenario of the 100 largest companies in the country in the year 2012 (not included the two evaluated companies). The results show that among these companies, only one may be considered agile according to the methodology applied in this study.

Keywords: Agile Supply Chain; Supply Networks; Developing Countries; Brazil.

1 Introduction

Competition among companies increases as it moves out of the organizational context and includes the supply network. This kind of competition is no longer between individual firms, but rather between networks of companies [1], [2]. Thus, supply networks that are able to better manage their agents will be more successful in the market.

In fact, the condition that the value attributed to the product by the consumer in retail sales will be responsible for the profitability of the entire network is ever more evident because organizations that manage their network in an efficient and joint

manner have better results than organizations that are involved in a competitive battle within their own networks, with results searched by each firm separately [2], [3].

In this context, there have been diverse studies of networks, correlating the strategies applied in them to the fact of the products being innovative or functional [1], [2], [3], [4], [5], [6].

Functional products are those products that satisfy the basic needs of the consumer, that do not change much with the course of time, and that have stable and predictable demands with long life cycles. Innovative products are those products that, through innovation and technology, become popular at certain times and generate an additional attraction for the consumer to buy them. This increases the profit margins. Nevertheless, their demand is unpredictable, their life cycle is short (some months) and the companies live in innovation cycles [3], [4].

These products are bound up with four types of strategies: lean supply networks, which aim at efficiency of the network and reduction of its losses; flexibility, which involves the capacity of the network in being flexible in two or more actors of the network; responsiveness, related to the response capacity of the network in meeting a demand generated by the market; and, agility, which consists of anticipating the needs of the market through innovations. While the first two strategies are related to functional products, the latter two are related to innovative products (Figure 1) [4], [6].

		Demand Uncertainty	
		Low (Functional Products)	High (Innovative Products)
Supply Uncertainty	Low (Stable Process)	Grocery, basic apparel, food, oil and gas **Efficient or Lean Supply Chains**	Fashion apparel, computers, pop music **Responsive Supply Chains**
	High (Evolving Process)	Hydro-electric power, some food produce **Risk-Hedging or Flexible Supply Chains**	Telecom, high-end computers, semiconductors **Agile Supply Chains**

Fig. 1. Supply network strategies bound up with functional and innovative products (Source: Adapted from Lee 2002)

With the course of time, innovative products tend to become functional products and thus tend to move from an agile strategy to a lean strategy. Although organizations can participate in different types of networks and have different types of strategies according to their product portfolio, a trend is observed for these organizations of concentrate their products and efforts in one type of segment. In Table 1 are shown, based in references such [3], [4] and [6], characteristics of some aspects of products according to their classification on functional or innovative.

This paper seeks to address the relationship of agile companies with developing countries. In this paper, specifically, Brazil is under study, as an integrand w of a group of countries including also Russia, India, China and South Africa called BRICS, an economic term criated to designate the most promising developing countries on the international scene [7].

Table 1. Innovative products versus functional products

Item	Features	Functional Products	Innovative Products
1	Aspects of demand	Predictable	Unpredictable
2	Product life cycle	More than 2 years	Up to 2 years
3	Contribution margin	Up to 20%	More than 20%
4	Product variety	Low	High
5	Average margin of error in the forecast at the time production is committed	Up to 10%	More than 10%
6	Average stockout rate	Up to 2%	More than 2%
7	Average forced end-of-season markdown as percentage of full price	Up to 10%	More Than 10%
8	Lead time required for made-to-order products	3 weeks or more	Up to 2 weeks

2 Methodology

The purpose of this study is to show that agile companies have increasingly sought to sell their technologies in Brazil, but they see the Brazilian market only as a consumer market and not as a potential source of technological development. Brazilian consumption of technologies has increased due to the stability of the currency and the economy; nevertheless, these technologies arise from international conglomerates that do not invest in the country as a source of development. This research is of an exploratory nature and its purpose is to examine the proposed theme in the light of scientific knowledge [8]. Thus, this study was carried out as based on the following steps:

a) A study regarding the concepts of agile supply chains and their relationship to innovative producers;

b) A study of two multinational companies present in Brazil considered to be agile based on the methodology developed by Reis and Costa Neto [6] which involves identifying if the products are functional or innovative based on Table 1, and then classifying them according to the supply chains presented in Figure 1;

c) A survey of the 100 largest companies in Brazil and their classification from the point of view of innovative and functional products and of supply chain strategies, also based on the methodology developed by Reis and Costa Neto [6];
d) Discussion of the data collected based on the development of agile supply chains in Brazil.

3 Agile Supply Chain

Among the strategies of supply networks, one may perhaps be considered as standing out from the thus, which is the agile supply chains. This is due in large part to technological innovations, reduction of the product life cycle, variety of products and increase in international competition, together with a change in the supply and demand relationship and changes in consumer profile.

Agile supply networks can be considered an evolution of agile manufacturing, which is a structure within which each company can develop its own business strategies and products, being sustained by three pillars: organization, people and technology [9].

The English professor of the Cranfield School of Management, Martin Christopher, was one of the first to introduce the concept of agility in the supply chain [1], [10]. From this work followed a sequence of studies published in various periodicals which are recognized as basic for the conceptual foundation of the agile supply chain [10], [12], [13], [14].

The idea of agility in the context of supply chain management focuses on the context of the response to the market, being driven by demand and having shorter lead time as a characteristic based on information [1].

Agility Supply Chain (ASC) fits the capacity of a network and all its members for rapid alignment in responding to the dynamic and turbulent requirements of demand from the network. Its main focus is on the structure of the business environment, which should have an adequate level of agility to respond to changes, as well as to proactively anticipate these changes and find new emergent opportunities [12].

4. Results and Discussion

4.1 Diagnostic Products and Equipment Company

The diagnostic products company is a subsidiary of a multinational founded in the 19th Century. Present in Brazil for over 100 years, the German company is active in severed areas and product segments. The subsidiary is responsible for manufacture, sale and distribution of products and systems for laboratory diagnosis, which involves reagents for *in vitro* diagnosis and equipments. In Brazil it only carries out sales and distribution of products from manufacturing plants located abroad. Considering Table

1, some characteristics presented by the company indicate the condition of its products as innovative.

Production is made in lots, aiming to ensure quality control of the products and the stability of the active ingredients and its preservatives. Nevertheless, theses materials are produced based on forecasts of demand. Company products have a volatile demand depending on negotiations with distributors and sales to public agencies. Product life cycle is about 12 months. The contribution margin is from 58 to 60%.

Final price of products may vary for each customer through what the company calls "transfer price", which are specific tables for each customer adjusted annually. Product variety is of around 300 items. Average margin of error between the demand forecast and manufactured products was 65% and absolute error was around 35%. The stockout rate, when it occurs, is at a percentage from 2% to 4%; nevertheless, the company operates with safety stocks to reduce or eliminate this loss. End-of-season markdown of the product is from 30% to 40%; however, as the contribution margin is high, the initial earnings compensate for the reduction, and they pay for investments in technology.

The lead time up to delivery is 45 days. Although this characteristic is that of a functional product, it is fully justifiable through the global condition of the supply network and importation of the finished product, since the factory is not in Brazil but rather in the United States of America.

In regard to supply uncertainties and demand uncertainties that allow the classification of the company supply network strategy, the first one is considered high, due to the difficulty of supply sources and customs barriers, while the second one is high because the demand frequently changes, especially in the cases of government public bidding and orders from large customers.

Innovative products and demand uncertainties indicate that the company is in an agility stage, i.e., it may be considered as an agile supply chain through adopting agility measures and developing innovations.

4.2 Industrial Instrumentation and Technology Company

The technology company is focused on innovation as a competitive factor. Founded in 1976 in the USA at the peak of the information systems revolution, it has two factories, one in North America and the other in Europe, as well as an outsourcing and consolidation company in Asia.

It is currently active in 40 countries, including Brazil, where it has a business unit for distributing its equipment and solutions in the country, including technical support services. The company has 5280 employees, with 1529 of them working with innovation, in which it invests a fifth of its sales revenue.

The foreign market of the company represents 61% of its sales revenue. The main products sold by the company involve modular measurement and hardware control systems, software and integrated platforms, which are used by scientists and engineers in projects, tests and control of processes and products. Its products are sold in a market that currently amounts to around 13 billion dollars.

These systems are applicable to telephony, the automotive sector, the semiconductor, electronics and aeronautics industries, etc. The products are distributed worldwide from its stocks, generated according to estimated demand and orders.

Company demand, although it has experienced a growth trend in recent years, as volatile, with constant variation from one quarter to the next, without establishment of a predictable sequence, being subject to diverse external and internal factors. Product life cycle has a mean duration of up to two years, due to being subject to an industry under great transformation, which is the information services and electronics industry.

The contribution margin of products is greater than 20%. Gross profit, which involves company income, deducting all costs and expenses, was around 77%. The made-to-order nature of the products for companies generates high variation of products per segment, although they have similar and modular foundations.

The volatile demand of the company results in a large number of products in obsolescence, as company strategy is concentrated on agility; in other words, it prefers to have loss of stocks instead of not being able to meet market needs, especially because the profitability rate is high. Causes of obsolescence are technological changes, demand, engineering, and emerging standards of the new industry and competitors.

Due to the need for rapid responses, the company has a low stockout rate of finished products because it generates stocks in large quantities to keep the market supplied. Another factor that leads to speed in service is that as the company clients are other companies and not the final consumer; so it only receives the payment from 30 to 90 days after installation of its equipments, leading the network to become agile in responding to markets. End-of-season markdown cannot be determined because the company understands that it depends on various situations, such as relationship to the market and customers. Analyzing the products of the organization as based on Table 1, it is possible to determine that the products are innovative.

The company has supply uncertainty, for it processes a broad number of components in several markets, such as Europe and Asia. Diverse resources used have limited supply sources, with few participating actors, which represents problems for demand in the business and for product quality and delivery. This represents a problem for manufacturing activities, which may generate additional costs.

The demand forecast is founded on sales estimates based on the economies in which it is active. As demand may vary due to many market conditions, constant review is needed. These demand uncertainties, associated with the supply uncertainty, make the company reorganizes itself in an agile manner to meet the needs of these markets, with time and technological development as fundamental factors.

4.3 Agile companies in Brazil

The two studies presented above clearly show the scenario of companies considered agile in relation to the country, i.e., it is a great potential market, but not a source of technological development. In a certain way, these organizations focus on their region of origin and those nearest the supply and labor sources, located in Asia.

Brazil, just as its Portuguese colonizers, has always been a technology purchasing country and not a technology developing one; this is not bound up by a lack of technical knowledge, but rather with the development model based on mineral exports and on the use of land for planting. Brazil is currently one of the main countries for diverse agricultural crops, with yield indexes envied by many countries in the world; nevertheless, the technology employed in its activities, whether in the field, in telecommunications or in industry have their origins of development in other countries.

A reflection of how complicated the situation is can be seen in the fact that high technology and innovation companies have not factories in the country, while the companies that manufacture or assemble products in the country are found in the other three points of network development, which are the efficient, the flexible and the responsive areas. Notice that this last type of network has advanced more in recent years due to the arrival of some technology companies and the development of domestic companies that deal with patents already established or not on the initial phase of innovation.

Analyzing the 100 largest companies in Brazil in the year 2012 [15], 42% of them are in the services area; most of the theirs are base industries that work with functional products in mature chains in which elimination of waste and the lean strategy are fundamental, such as mining and iron and steel plants.

The automobile industry corresponds to ten companies, in which nine are vehicle assemblers and one is a manufacturer. These companies are in a flexible stage and work with consolidated products with little embedded technology. Vehicles with the greatest degree of innovation are imported. However, from the point of view proposed by [2], [6], innovative products must attend to the characteristics proposed in Table 1 and, although the vehicles currently have innumerable innovations, they are pieces of equipment embedded in the vehicles, i.e., the electronic equipment is an innovative product, but the automobile is still a vehicle which assumes the condition of a functional product in a mature chain.

Thus, of the 100 largest companies in Brazil, only 5 work with more innovative products, but have products considered as functional in their portfolios. Of these organizations, only one is of Brazilian origin, directed to the cosmetics area and which has innovative products and is within the concept of an agile company according to the characteristics proposed by [3], [4] and [6].

In addition, although the country has a large oil company, with technologies for removing oil from deep waters, and a large airplane assembling company, the former works with a functional product, a commodity, and the second is in the same case as the automobile industries – the embedded electronics in the airplanes may be innovative, but the aircraft, in the context of its basic function, continues to be a functional product.

5 Conclusions

The conclusion of this study is that Brazil is still far from being a technology developer and, although with steady growth, this is a consequence of the high value given to agricultural commodities on the international market.

The country will only achieve sustainable growth if it is able to strengthen agile supply chains which can develop technology and innovation that continue having a very high added value compared to the cost of production.

The discussion in this paper addressed the fact that, although Brazil is considered to be a solid and emerging economy, it is not in the route of agility and of technological development. Its focus continues, as it has been for 500 years, in the use of its land for crop, livestock production and mineral extraction.

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