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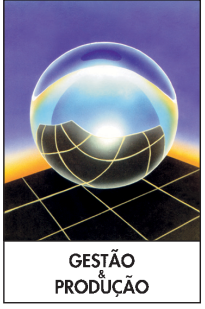

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Flexibility and orientation for two supply chains fashion industry markets: analysis and model for future research

Flexibilidade e orientação para mercados em duas cadeias de suprimentos da indústria da moda: análise e modelo para futuras pesquisas

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Abstract: This paper aimed to understand how flexibility can help large purchasing focal companies from fashion footwear industry to meet market demands, especially in international markets. We studied two supply chains of the fashion industry, one in Brazil, one in China using the multiple case studies method. We built a hierarchical structure describing the various levels of flexibility observed in supply chains. The following four constructs of flexibility were considered: operational flexibility, tactical, strategic and supply chain. We allocated a dichotomous dependent output variable, market orientation, which may be by value or price reduction. Twenty-four companies from both countries participated. The findings suggest that operational flexibility may be influenced by labor and equipment costs and by the level of applied technology, and that operational flexibility influences other levels. Results also suggest that chain flexibility can influence the entire supply chain competitivity. We present a model for further research on flexibility.

Keywords: Flexibility; Supply chain management; Competitivity; Competitive strategy.

Resumo: *O objetivo deste artigo foi entender como a flexibilidade pode auxiliar grandes empresas focais da indústria calçadista compradoras de materiais que serão usados em produtos de moda a atender a demandas de mercado, principalmente de mercados internacionais. Foram estudadas duas cadeias de suprimentos da indústria da moda, uma localizada no Brasil, outra na China. O método de pesquisa foi o estudo de caso múltiplo. Foi construída uma estrutura de construtos e dimensões que descreveu os vários níveis de flexibilidade que podem ser observados em cadeias de suprimento. Quatro construtos de flexibilidade foram considerados: flexibilidade operacional, tática, estratégica e de cadeia. Uma variável dicotômica dependente, de saída da estrutura, foi alocada: a orientação de mercado, que pode ser por diferenciação ou por redução de preço. Vinte e quatro empresas dos dois países participaram do estudo. Os achados sugerem que a flexibilidade operacional pode ser influenciada pelos custos de mão de obra e de equipamentos e pelo nível de tecnologia empregado e que a flexibilidade operacional influencia os demais níveis de flexibilidade. Também sugerem que flexibilidade de cadeia pode influenciar o tipo de competição. Um modelo para futuras pesquisas sobre flexibilidade foi apresentado.*

Palavras-chave: *Flexibilidade; Gestão da cadeia de suprimentos; Competitividade; Estratégia competitiva.*

1 Introduction

Suarez et al. (1996) defined flexibility in manufacturing as the ability to vary production parameters with little or no impact on product quality and manufacturing efficiency. Narasimhan & Das (1999) have defined flexibility as the ability of a productive system to rapidly change production parameters without considerable effort or exaggerated resource involvement. Initially, studies on manufacturing flexibility gave more importance to the internal and operational aspects of operations (Slack, 1983, 1987; Gerwin, 1987, 1993; Upton, 1995). Other studies have included external aspects associated with supply chain (SC) action (Fisher, 1997; Lambert et al., 1998; Croom et al., 2000; Jack & Raturi, 2002). Further research (Lau, 1996;

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De Toni & Tonchia, 2005; Krajewski et al., 2005) gave an strategic role to the flexibility in the context of the operation strategy, mainly in meeting customer demands (Fisher et al., 1994; Vickery et al., 1999; Olhager & West, 2002) and market-oriented practices (Hsu et al., 2006).

Specifically, regarding customer demands, competition factors and respective indicators have been proposed to evaluate the level of service provided by suppliers. These indicators have focused on five main dimensions: price; quality of delivery; quality of the product (Cavusgil & Yavas, 1987; Katsikeas & Al-Khalifa, 1993; Deng & Wortzel, 1995; Mummalaneni et al., 1996; Katsikeas & Leonidou, 1996; Lye & Hamilton, 2000); product packaging (Ghymn & Jacobs, 1993; Katsikeas & Leonidou, 1996; Piercy et al., 1997; Ghymn et al., 1999) and associated services, mainly payment terms (Katsikeas & Leonidou, 1996; Piercy et al., 1997; Lye & Hamilton, 2000). In particular, Hsu et al. (2006) proposed three constructs to assess the interest of focal companies by suppliers: quality of products and services; strategic positioning; and buyer-supplier relationship.

In this article, we are interested in the so-called fashion industries, that is, focal companies and respective supply chains that provide materials for the manufacture of products that are influenced by some type of market or fashion trend (Macchion et al., 2015). In this type of industry, flexibility in manufacturing has been shown to be an essential competitive dimension (Purvis et al., 2014), especially in industries that are market-driven, as the changes in customer demand are sharper than in other industries (Abecassis-Moedas, 2006). Some reasons are the subjectivity and the impulse that characterize the purchase; the instability of the markets, due to the seasonality and the changes in the inspirations of the season; and the strong interdependence between supply chain links (Jin, 2004). This latter element is also observed in other supply chains.

As competition is not only between firms but also between supply chains (O'Marah, 2001), a research objective is to better understand how flexibility is used in supply chains that deliver raw materials to fashion products manufacturers, so to meet customer demands, especially in the footwear international market. The purpose of this article is to understand how flexibility can help large focal companies of the footwear industry that need to buy raw materials to meet market demands, mainly in international markets. The research question is: How supply chain companies with similar goals, but located in different countries, use flexibility to meet their clients´ demands in international markets? The specific objectives are: (i) to construct a structure of variables that can describe the concept of flexibility and relate it to customer service; (ii) to investigate the situation of these variables in two similar supply chains, but with different market orientation; and (iii) to conclude about which variables are most significant in the relationship between flexibility and market orientation. Two supply chains were studied, one in Brazil, the other in China. The research method was the multiple exploratory case study. According to Yin (2009), questions such as how can be answered by case studies. The continuity of previous research justifies the choice of the supply chains.

The rest of the article is organized in a review on flexibility and orientation of suppliers to market demands, research methodology, results, and discussion.

2 Review

One of the criteria of competition in production strategy is flexibility in manufacturing (Slack, 1993). As in other criteria, by trade-off, efforts focused on flexibility can have repercussions on the other competition criteria (Easton & Rothschild, 1987; Carlsson, 1989). Initially, efforts to add flexibility to manufacturing focused on the internal resources of focal companies. Further, companies added external sources of flexibility provided by partners and integrated by supply chain management (Croom et al., 2000; Jack & Raturi, 2002; Schmenner & Tatikonda, 2005). Supply chains that have become flexible have also become able to adapt more easily to supply disruptions and changes in demand without affecting the level of customer service (Stevenson & Spring, 2009).

Stevenson & Spring (2007) reviewed, integrated and synthesized the theme of flexibility, proposing four levels of flexibility in manufacturing: operational, tactical, strategic, and in the supply chain.

At the operational level, flexibility aims to produce as many items and lot sizes as possible in the same operation (Schmenner & Tatikonda, 2005), using mainly the technology and productive resources installed on the factory floor (Slack, 1983; Upton, 1995; Koste et al.; 2004). Citing references, Stevenson & Spring (2007) presented dimensions of operational flexibility: (i) flexibility of machinery, involving the diversity of operations that an equipment can perform without significant set-up; (ii) process flexibility, involving the variety of parts that can be produced without significant set-up; (iii) flexibility of operations, involving alternative processes for the production of the same part; (iv) flexibility of movement, involving the ability to move different parts in an installation; (v) labor flexibility, involving the number and diversity of tasks that the same operator can perform; (vi) route flexibility, involving the number of alternative paths that a part can follow through manufacturing until it is completed; and

(vii) output flexibility, involving the facility to make significant capacity adjustments to manufacturing in the short term, typically by substituting or adding machines and third party suppliers. In order to do so, the company can use two strategic elements, related to technology and productive resources: (i) level of automation, involving the level of advancement of installed technology; and (ii) policy of maintenance and redundancy of critical equipment, involving the time an installation can operate without maintenance intervention.

At the tactical level, the flexibility aims mainly to vary the capacity of the output of the manufacturer, according to dimensions (Stevenson & Spring, 2007). Citing Slack (1983), Gerwin (1987), Koste & Malhotra (1999), Narasimhan & Das (2000) and Vokurka & O'Leary-Kelly (2000), Stevenson & Spring (2007) synthesized the following tactical dimensions:(i) product flexibility, involving the ability to add, remove, or replace components to modify the product; (ii) volume flexibility, involving the ability to change the size of the manufacturing batch without influencing the unit cost; (iii) delivery flexibility, involving the ability to change transfer lot size, delivery date and route; and (iv) production flexibility, involving the variety of products (or mix) that can be produced in the same factory.

Stevenson & Spring (2007) also presented strategic flexibility dimensions: (i) design flexibility, involving the speed with which the company can develop and introduce new products; (ii) expansion flexibility, involving the ease of increasing the long-term capacity of the productive system; and (iii) market flexibility, involving the company's ability to adapt to market changes.

Finally, researchers proposed and explored the concept of supply chain flexibility (Lau, 1994, 1996; Fawcett et al., 1996; Narasimhan & Das, 1999, 2000; Koste, 1999; Das, 2001; Olhager & West, 2002). Das & Abdel-Malek (2003) defined supply chain flexibility as the elasticity observed in the buyer-seller relationship under uncertain conditions of supply and demand. The notion of supply chain flexibility was amplified by Duclos et al. (2003), who proposed a conceptual model of six elements, later reduced to five by Lummus et al. (2003): operational system, logistics processes, supply network, organizational design, and information system flexibility. The concepts of non-manufacturing services, such as financing and technical assistance, and complexity and supply chain risk management have expanded the understanding of competition based on supply chain flexibility (Liao et al., 2010; Thun & Hoenig, 2011).

Based on references, Stevenson & Spring (2007) synthesized the level of supply chain flexibility to the following dimensions: (i) robustness, involving the variety of events to which the supply chain is able to react satisfactorily without changing the configuration; (ii) reconfiguration flexibility, involving the ease with which the supply chain can adapt by self-reorganization; (iii) relationship flexibility, involving the ability to establish new relationships in response to market variations; (iv) logistical flexibility, involving the ability to change sources of supply at acceptable costs; (v) learning flexibility, involving the ability to acquire and align knowledge and skills in response to market demands; and (vi) informational flexibility, involving the ability to align information systems.

Research correlated types of flexibility with business performance and market orientation. Narasimhan & Das (1999, 2000) correlated flexibility of supply and operational flexibility. Using regression analysis, the authors found a strong positive correlation between delivery management practices and manufacturing flexibility dimensions. Vickery et al. (1999), Jack & Raturi (2002), Martínez Sánchez & Pérez Pérez (2005) and Zhang et al. (2003) correlated volume flexibility and new products flexibility with business performance and customer satisfaction. The findings indicate that volume flexibility is strongly and positively correlated with indicators of overall strategic performance and market share growth. New products flexibility is strongly and positively correlated with high performance under conditions of uncertainty. They also indicate that high supply chain flexibility is correlated with higher profitability in seasonal industries and subject to supply and demand uncertainties, such as in fashion.

For this article, the relationship between flexibility and market orientation is more relevant. Waller et al. (2000) postulate that market orientation can influence supply chain relationships: the greater the market orientation, the greater the attractiveness that the supplier will trigger in customers. We conclude that flexibility may be required to make a component supply operation attractive in a supply chain. In general, the various types of flexibility are recognized as strategic for meeting customer demands and may be necessary for market-oriented operations (Fisher et al., 1994; Vickery et al., 1999; Olhager & West, 2002; Lau, 1996; De Toni & Tonchia, 2005; Krajewski et al., 2005).

This research used the theoretical framework of Hsu et al. (2006): for market orientation, the quality of the product, the level of punctuality, and the price that is practicable are influential. The first two can be associated with markets of higher added value or differentiation. Quality is associated with product attributes. Dependability is associated with agility in deliveries. The third attribute is associated with markets driven by price reduction and scale up.

2.1 Gaps identified in the review

The review revealed gaps that were explored in the research: (i) except Stevenson & Spring (2009) and Jack & Raturi (2002), little attention was paid to small and medium-sized enterprises (SMEs), despite their importance for flexibility in supplies; (ii) no research was found comparing flexibility in similar supply chains in different countries, especially with different market orientations; (iii) the literature, predominantly, assumes that the more flexible an operation, the more competitive this will be. This premise can and should be challenged empirically, especially when the focal company can act in more than one type of market and prioritize some levels or dimensions of flexibility, to the detriment of others; and (iv) another point still lacking in the research is the comparative relationship between customer demands, especially quality, punctuality and price, and levels and dimensions of flexibility prioritized by supply chain focal companies.

3 The research

The research method is the exploratory multiple case study. Several cases have been studied to construct a first notion about the object: the relationship between the flexibility observed in supply chains and the market orientation that large focal companies give to their networks. The working method is: (i) construction of structure of variables to be investigated by focus groups with Chinese and Brazilian practitioners; (ii) selection of companies, in two supply chains of the fashion industry, one Chinese and one Brazilian, as units of analysis; (iii) construction of research protocol (control variables) and application in Chinese and Brazilian companies selected through interviews with managers and strategists, nonparticipant observations and documentary analysis; and (iii) information organization, comparative analysis, finding and discussion.

Case studies may contribute with new and diverse elements to the construction of grounded theories (Eisenhardt, 1989) and can help in proposing hypotheses that formalize regularities empirically observed (Dubois & Gadde, 2002). Such procedure was adopted in this research. Finally, hypotheses have been proposed to be verified in future surveys. Case studies are evaluated in terms of the validity and reliability of their observations. Validity is the confidence with which one can draw correct conclusions from observations. Reliability is the consistency and coherence between observations of multiple and different occurrences of a phenomenon, all made by the same research procedure. Validity refers to the ability of the selected method to achieve its objectives. Reliability refers to the assurance that another researcher may use the same procedure and arrive at similar observations (Kirk & Miller, 1986).

To guarantee validity and reliability of the findings, observations were triangulated. Triangulation can occur by employing more than one source, more than one researcher, more than one method, or more than one theory (Jick, 1979). In this research, identical research protocols were applied in China and Brazil. All the interviews were done by the same researchers, always more than one. More than one source and more than one researcher were used for similar observations. Another practice was the detailed description of the observations (Miles & Huberman, 1994). Transcriptions and translations of interview notes, analysis and synthesis of findings were made for later comparison. Finally, to ensure validity and reliability, the compiled and consolidated information was discussed with the research actors, who had a chance to correct eventual communication problems.

The research considered the theoretical gaps identified in the review, adopted the ambivalent posture proposed by Stevenson & Spring (2009) and focused on the SMEs that comprise two supply chains of materials for the fashion industry, one in China and another in Brazil. Focus on large companies was referred to the continuity of research. The conditions of competition in this industry differ in the two countries. In China, the competition focuses more on cost and volume of production; in Brazil, in innovation and quality.

Twenty-four suppliers to the fashion industry belonging to two supply chains were studied, one in China, the other in Brazil. The supply chains organize themselves in a similar way: a tier of many small suppliers of materials; a tier of large focal companies for the assembly of footwear and clothing; distribution network for large magazines; and local distribution network for small retailers. The research concentrated on the small suppliers of large focal shoe companies.

Brazilian and Chinese supply chains operate in similar markets. Currently, part of the orders originally destined for Brazil has been directed to China. An important difference between the supply chains is how small businesses make sales and deliveries to focal companies. In Brazil, sales teams typically serve buyers individually. In China, typically, buyers and sellers have organized shopping centers for industrial materials, which concentrate on a single location, specifying operations, definition, negotiation, purchase, delivery and eventual returns (Pereira et al., 2011).

For convenience and ease of access (Barratt et al., 2011), it was decided to study supply chains of the fashion footwear industry. Small and medium-sized enterprises (SMEs) were selected to provide various components used by large chain companies, producing clothing and shoes. The choice of component suppliers

was intended to give scope to the research and validity to the conclusions reached, as stipulated by Voss et al. (2002).

Selected suppliers provide materials to companies producing end products that fit the following profiles defined by Abecassis-Moedas (2006) for the fashion industry: (i) Traditional Manufacturing Companies (EMT): design and produce and sell for retail networks or proprietors of brands that subcontract production; (ii) Non-Industrialization Manufacturers (MSI): design, outsource production and sell to large retail chains and companies with recognized brands; and (iii) Trademark Holders (EDM): Design, outsource production and sell to department stores or in owned stores.

Four groups of suppliers were formed, depending on the type of material supplied (fabrics, metals, soles and non-metallic ornaments). Each group included six suppliers, three in China and three in Brazil, totaling twenty-four companies investigated. The selection of companies and the confirmation of their interest in participating in the survey took six months and were assisted by American and European import agents operating in both countries.

3.1 Structure of variables and collection of information

In the first stage of the study, carried out in 2008, we discussed with practitioners who work in the industry and in representative entities, in two focus group sessions, mediated by researchers, one in China and another in Brazil, the relevant variables for the research. In China, practitioners from the Dongguan region participated; in Brazil, from Franca and Novo Hamburgo. The choice is justified by the similarity between the products of the two regions. Before the sessions, conceptual leveling meetings were held, coordinated by one of the researchers, in which the group discussed the various approaches to flexibility and the concept of market orientation. Six practitioners participated in each session. Two executives from focal companies who buy materials, two executives from traders, and two executives from business-class associations representing the industry.

The structure of flexibility was based on Stevenson & Spring (2007): operational, tactical, strategic, and supply chain. The market orientation was based on Hsu et al. (2006): quality, dependability, and price. The variables pointed out by Stevenson & Spring (2007) were presented to the specialists of the two supply chains. In both focus groups, the specialists chose some for the study. This stage occurred in 2009. The constructs and variables selected by the specialists and the techniques used in the investigation of the variables (interview with two managers of the companies, responsible for purchases and production; visits to manufacturing operations and shopping malls in Dongguan; and documentary analysis in enterprises) are presented in Chart 1.

In operational flexibility, the experts stated that three dimensions were sufficient: machinery, processes, and output. The others either were not significant in fashion product supply chains or were correlated and could be encompassed by the three dimensions. In tactical flexibility, the specialists indicated product, volume, and delivery, understanding that the production dimension was not significant in fashion supply chains and that the notion underlying the concept can be captured by volume flexibility. In strategic flexibility, the specialists indicated design and market. The first dimension includes the ability to change the

Chart 1. Structure of variables.

Construct	Dimension	Research tecnique*
Operational Flexibility	Machinery Flexibility	E/O
	Process Flexibility	E/O
	Output Flexibility	E
Tactical Flexibility	Product Flexibility	E/O
	Volume Flexibility	E
	Delivery Flexibility	E/O
Strategic Flexibility	Design Flexibility	E
	Market Flexibility	E/O
Supply Chain Flexibility	Robust Flexibility	E
	Relationship Flexibility	E/O
	Logistics Flexibility	E
Market Orientation	Quality	E/O
	Dependability	E/O
	Price	E/O/D

*E: Interview; O: Non-participant observation; D: Documental analysis. Source: by the authors.

design of the product. The second includes changing the delivery market. The experts understood that in fashion supply chains, the flexibility of expansion could be captured by market flexibility. Finally, in supply chain flexibility, the specialists indicated robustness, relationship, and logistics, understanding that, in fashion supply chains, the other dimensions are either not representative or can be captured by the other dimensions.

The analysis of findings sought regularities among the contexts investigated, followed by individual case analysis. Finally, the cases were compared and contrasted, triangulating the sources of evidence.

4 Results and discussion

Findings and discussion are presented construct to construct. Due to the number of interviews, the individual transcripts of the interviews were not used, but guiding threads of the interviewees' speeches were identified in the interpretation. In summary, the content of interviews, non-participant observations, and documentary analyzes was synthesized. At the end, the findings were synthesized and hypotheses were proposed for further research.

4.1 Operational flexibility

Chinese companies typically make use of simpler and cheaper equipment than the Brazilian. Capacity expansions occur by adding new machines, which can be purchased from new manufacturers, purchased from resellers and retrofitters, or leased for a fixed period from resellers. Chinese equipment is severely limited in terms of product changes (machinery flexibility) or processes (flexibility of operations): set-ups are often time-consuming and costly. In most observed Chinese companies, the typical way of increasing operational flexibility is to increase the variety and number of machines and workers, which has helped to create a parallel market for the purchase and leasing of industrial machinery. In the opinion of most of the interviewees, this practice does not significantly compromise the final price of the product due to the low cost of Chinese equipment and labor.

Brazil has a labor cost and labor costs of hiring and dispensing higher than the Chinese. Therefore, Brazilian companies invest more in automated equipment, fast set-up's, automation, flexible manufacture systems, and robotization to reduce the dependence of labor. Due to this, the increment of the operational flexibility in machinery and process occurs typically by aggregation of mechanical technology and automation. Unlike China, in Brazil the practice of retrofitting was observed: used machines in good condition are reformed with a substantial exchange of technology, mainly electronics. An example of this difference was observed in companies that inject soles for footwear. In Chinese companies, one operator operates a machine that injects the left sole, another operator operates another machine that injects the right sole. In all the Brazilian companies visited, a single operator operates from four to five machines that produce left and right soles pairs simultaneously. It was concluded that Brazilian companies seem to have more machinery and process flexibility.

Output flexibility is influenced by machine and process flexibility. Chinese companies are able to change personnel and switch machines faster than Brazilians can do retrofitting or capital investments, given the simplicity of the equipment. Therefore, Chinese companies seem to vary their output capacity faster: the Chinese output flexibility appears to be larger than the Brazilian one. At this point, the notion that the flexibility required by the markets is provided by the supply chain as a whole, not by isolated companies, has come to be understood: they have to increase the output flexibility.

For continuity, the construct suggests the research hypothesis H1: Supply chains that depend more on capital goods have less operational output flexibility than those that depend more on labor.

4.2 Tactical flexibility

The studied supply chains compete in the so-called fast fashion market that operates with low volume fashion products, high model variability, and reduced life cycle. In this market, it is essential that the supplier can modify products, quantities and delivery parameters to quickly meet new and uncertain customer demands.

As for product flexibility, because of the availability of more technology, the studied Brazilian companies seem to modify the products they can manufacture faster and more deeply. As for volume flexibility, for being able to hire and dispense workers at low-cost and use very cheap machines, Chinese companies seem to change the volume of deliveries more quickly. Finally, regarding the flexibility of deliveries, because they have more machines with fast set-up, Brazilian companies seem to respond better to changes in quantity, dates and delivery routes. Machines with fast set-up have more ability to vary lot sizes and production mix, allowing changes in quantities, dates, and better utilizing available routes.

Lower Chinese flexibility in product and delivery leads to cost reduction that is reflected in volume flexibility. In some offers from Brazilian suppliers, the price decrease in case of volume expansion is small (5% to 10%). On the other hand, the Chinese factory structure empowers companies to offer substantial

discounts for expanded volume. In some offers from Chinese suppliers, for orders ten times higher, the price may be up to 60% lower than that of equivalent Brazilian products.

For continuity, the construct suggests the research hypothesis H2: Supply chains with more flexibility of machinery and process have more tactical, delivery, and product flexibility.

4.3 Strategic flexibility

Brazilian companies seem to respond more quickly to design and market variations. Again, the main reason is the technology in the companies, which allows greater agility in product and production changes. In other words, because they can operate with smaller lot sizes and still keep cost low, companies can more quickly vary the design of their products and the markets they serve.

It has been observed that, typically, Brazilian companies have demanded, on average, up to thirty days to meet relevant changes in the design of their products without significant price change. Chinese companies, in turn, have demanded up to three months for the same service. The main reason for such a long time is not lack of ability to redesign components, but the excessive sizes of lots imposed on companies, which increases the size of the orders´ queue in the manufacturing. Since the main variation in demand that the market of the studied chains demands refers to design changes, market flexibility is also more observed in Brazilian companies than in Chinese firms.

For continuity, the construct suggests the research hypothesis H3: Supply chains that have more operational flexibility also have more strategic flexibility.

4.4 Supply chain flexibility

Chinese companies appear to have more supply chain flexibility. The Chinese companies were better evaluated in the three dimensions: robustness; relationship and logistics. The main reason observed was the low costs of labor and machinery, which allow self-reorganization actions of the chain much faster than those observed in Brazil. As a result, many suppliers specialized in the production of narrow slices of items. This broad and focused structure confers flexibility of hiring to the focal companies since they can always find at least one supplier specialized in the production of a given component. Robustness is guaranteed by the diversity of suppliers. The relationship is guaranteed by the mutual interest that the market awakens. Logistics is guaranteed by the possibility of hiring a new company if supply problems occur. If the demanded component does not yet exist, it has been observed that due to the ease of hiring labor and the acquisition or rental of machines, it is easier to start a new operation associated with a specific demand in China than in Brazil.

For continuity, the construct suggests the research hypothesis H4: Supply chains that operate at lower costs have more supply chain flexibility.

4.5 Market orientation

The evaluation of the market orientation according to price and quality was cross-checked: Brazilian manufacturers evaluated the Chinese and vice versa. The researchers presented to the respondents of one country materials, prices and described the market of the other country. Punctuality was assessed by interviews with suppliers in each country. The information collected from suppliers was triangulated with perceptions of customers of these companies. In order to do so, each company indicated five clients, who were contacted by telephone by the researchers. In these contacts, the researchers questioned buyers about suppliers' performance in terms of price, quality, and dependability. Customer information typically was consistent with supplier statements about price, punctuality, and quality.

Typically, suppliers in both countries have quality and reliability of delivery appropriate to their markets. As for price, it was observed that the values offered by the Chinese companies are much smaller than those of the Brazilian ones for high volumes (up to 60% lower). On the other hand, as demands for product differentiation increase, Brazilian prices are becoming more attractive to the focal companies that manufacture fashion goods. The research suggests that Chinese firms preferentially serve markets that demand lower prices, while Brazilians tend to prefer markets with higher added value or differentiation. Although different, delivery times in both countries are accepted by customers.

For continuity, the construct suggests the research hypothesis H5: Supply chains that have more output flexibility are easier to operate in markets that require price reduction; Supply chains that have more strategic flexibility are easier to operate in markets that require product differentiation.

4.6 Synthesis of findings and model for future research

Chart 2 summarizes the findings. Chart 3 separates the findings by supply chain.

Observing Chart 3 and using the research hypotheses H1 to H5, it is possible to propose a model that may be useful for further research.

Brazilian companies have added more technology, through the systematic practice of retrofitting, search

for fast set-up's and investments in automation and so-called flexible manufacturing systems, resulting in more flexibility of machinery and process. This increased operational flexibility increased product and delivery flexibility, mainly due to the possibility of reducing lot size and achieving a better leveling of production, taking better advantage of the delivery channels. This tactical flexibility seems to promote design and market flexibility, making it easier to change components and products, and more quickly reach new markets, sustaining the best performance at the strategic level. Greater strategic flexibility seems to be required to compete in markets driven by product differentiation or requiring greater added value for materials to the final product.

The low cost of labor and simple equipment seems to give more flexibility to Chinese companies. This greater flexibility of output seems to support the better performance in flexibility observed in the Chinese supply chain. The low costs seem to have enabled the creation of a large network of suppliers in the country, giving the Chinese chain more supply chain flexibility. The increased flexibility has attracted new international buyers, reinforcing the demand for

Chart 2. Synthesis of the findings.

Construct	Dimension	Findings
Operational Flexibility	Machinery Flexibility	Chinese companies increase flexibility by permanent exchange of workforce and machines, while Brazilian firms do so by exchange of technology. Brazilian companies have more machinery flexibility.
	Process Flexibility	Brazilian companies have more process flexibility due to greater use of technology.
	Output Flexibility	Chinese companies get more output flexibility by adding machines and personnel due to the low cost of machinery and labor.
Tactical Flexibility	Product Flexibility	Brazilian companies can vary their products faster and more deeply because they have more technology.
	Volume Flexibility	Chinese companies achieve significant cost reductions for high volumes.
	Delivery Flexibility	Brazilian companies are able to vary quantities, due dates, and delivery routes more quickly, by having more fast set-up machines.
Strategic Flexibility	Design Flexibility	Brazilian companies can vary the design of their products faster.
	Market Flexibility	Brazilian companies have more market flexibility.
Supply Chain Flexibility	Robustness Flexibility	Chinese companies are more robust because they have more focused chains.
	Relationship Flexibility	Chinese companies are able to perform more satisfactorily because they have more focused chains.
	Logistics Flexibility	Chinese companies have more effective and more logistics dedicated to the supply chain, due to the use of more specific and focused resources.
Market Orientation	Quality	Brazilian and Chinese companies have equally satisfactory performances, but only the Brazilian ones achieve some degree of differentiation.
	Dependability	Brazilian and Chinese companies perform equally well
	Price	Chinese companies have more ability to lower prices in large quantities by the existence of a wide range of low-cost suppliers.

Source: by the authors.

Chart 3. Findings according to the supply chain.

Supply chain	Flexibility				market orientation
	operational	tactical	strategic	supply chain	
Brazilian companies	Machinery and process	Product and delivery	Design and market		diferentiation
Chinese companies	Output	Volume		robustness relationship logistics	price

Source: by the authors.

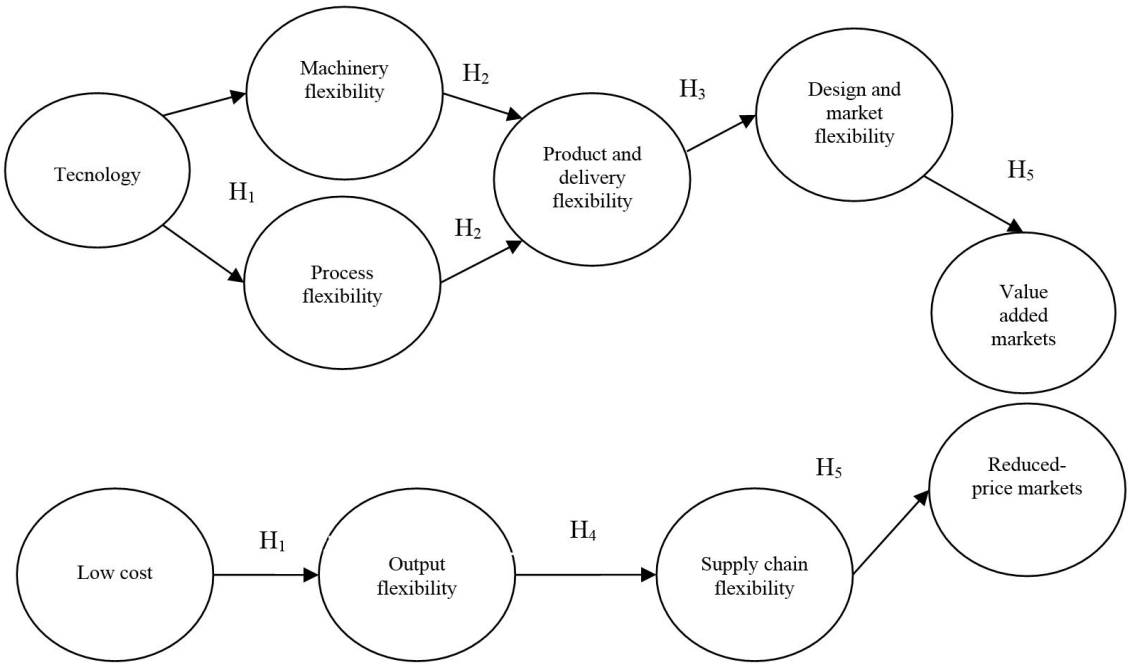

Figure 1. Path model for further research. Source: by the authors.

materials. Growing demand stimulated the opening of new businesses, reinforcing the increase in supply chain flexibility. Increased chain flexibility seems to be required to compete in price-driven markets.

Figure 1 summarizes the observed relationships and positions the research hypotheses in the form of a path model.

5 Final remarks

The purpose of this article was to understand how flexibility can help focus footwear companies that purchase fashion materials to meet market demands, especially in international markets. Two supply chains were studied, one located in Brazil, the other in China. Specific objectives were achieved by focus group sessions with practitioners; interviews with managers; non-participating visits and observations; and organization of findings and conclusions. The main conclusions were synthesized in Charts 2 and 3 and gave rise to the model represented in Figure 1.

The research has relevance for business as well as for scholars. Their results can provide support to practitioners and researchers about the levels and dimensions of flexibility that must be created in the direction their markets demand. The research had limitations. The case studies focused only on suppliers of materials for the fashion industry, located in Brazil and China. It is not prudent to generalize the findings to other chains or to other nations.

For further research, the path model of Figure 1 is helpful. The use of path models should consider initial theories that justify the rationalities underlying the relations (Jarvis et al., 2003), supported by empirical observations associated with previous theories (Mckelvey, 1999). Such procedures were adopted in this research, which reinforces and justifies the use of path models. The next research step will use the survey method as the main method. To this end, a questionnaire will be set up with groups of questions investigating the hypotheses deduced from the case studies. The questionnaire will be applied to an entire industry that works with fashion materials, through the business-class association, with about four thousand associated companies. To increase the reliability of the findings, more than one question may be required to verify each hypothesis. Usual multivariate statistical techniques will be used: factorial analysis; Crombach's alpha; correlation analysis; cluster analysis. The main analysis that will be done will be the verification of the force of the influences existing between the factors of the models. This verification will be done by structural equations modeling by the PLS (partial least squares) method. A comprehensive review of the PLS method is found in Rigdon et al. (2010). Another variant for continuity is to insert large companies into research, rather than being limited to SMEs.

To the best of our knowledge, this was one of the first case studies involving various levels and dimensions of flexibility, organized in structure, in supply chains of different countries that manufacture

similar products. The findings suggest that the level of operational flexibility is influenced by labor and equipment costs and the level of technology employed. They also suggest that operational flexibility can influence other levels of flexibility: tactical, strategic, and supply chain flexibility. The supply chain flexibility can influence the type of market orientation that the chain addresses. The various types of flexibility may be useful in competition for higher added value or for a final price reduction.

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