

**International manufacturing networks: how changes at strategic level  
impact their design and management**

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**Abstract**

This paper focuses on the dynamic relationship between corporate strategy and international manufacturing networks. It argues that multinational companies will only be able to change its strategic positioning if the configuration of its international manufacturing networks provides organizational support for such change. The object of study are emerging country multinationals which, due to its late entry in international markets, provide a privileged field for the research. The study reveals that there is a co-evolution between strategy and network design. Additionally, it is proposed a systematic corporate strategic process for emerging country multinationals in order to define one or a set of missions that will guide the design and management of their international manufacturing networks.

**Keywords:** International Operations Management, International Manufacturing Networks, Internationalization strategy, Emerging Country Multinationals.

**1 – Introduction**

International Manufacturing Networks (IMN) is gradually being consolidated as a stream of research in International Operations Management (IOM). After the pioneering works of Ferdows (1997) and Shi and Gregory (1998), a number of authors have contributed to address a range of related issues. For example, Miltenburg (2009) developed a framework that links IMN to corporate global manufacturing strategy, in a multinational company; also, Feldmann et al. (2013) studied what happened to a company's IMN configuration when one plant (one node in the network) has its strategic role changed, that is, it upgrades to more complex roles. However, lack of research on the interaction between the strategic level and the IMN remains. This paper seeks to fill this gap, by addressing the problem of how a changing corporate strategy affects the IMN, over a period of time.

The object of the study are emerging country multinationals (EMNEs). The rise of EMNEs, in the last 20 years, has created a privileged field for empirical research on IOM in general and production networks in particular. The reason is that they are newcomers in global markets and, consequently, are still experimenting new forms of organization, in contrast with the more mature – and “rigid” – worldviews and organizational models adopted by developed country multinationals (DMNEs). Furthermore, EMNE's internationalization patterns usually are different from DMNEs, because they suffer stronger influence of institutional factors

(Sethi and Elango, 1999), grow in the shade of Global Production Networks (GPN) led by DMNEs, rely on production and operations as key competence (Fleury and Fleury, 2011) and finally have to develop new configurations for their internal value networks (Srai, 2013) better suited for their fast-paced expansion (Mathews, 2006).

The complexity and dynamism of IOM should be addressed with new analytical frameworks, drawn on streams of research based on both Operations Management (OM) and International Business (IB). For this research, the framework developed by Fleury et al. (2012) is adapted in order focus on the strategic and network levels mainly. Moreover, the analysis should take into consideration the principles of strategic fit (Galbraith, 2000), which advocate that companies have to get themselves aligned both externally (with the business environment) and internally (within the organization). More particularly, the fit should enable the contribution of Operations function to the execution of the overall strategy, through the reconciliation of market requirements with operations resources (Slack and Lewis, 2002).

As this is an exploratory, longitudinal research, two illustrative case studies of Brazilian multinationals are used. Both have sophisticated IMNs and are largely connected to GPNs in their respective industries. Based on the empirical findings, an evolutionary map for those EMNEs is drawn, describing the relationships between the positioning in a GPN, the generic internationalization strategy and the network configuration for each strategy, over a period of 20 years.

## 2 - Literature review

The literature review considers three research streams: international manufacturing networks, corporate strategy implementation and generic internationalization strategies of EMNEs.

### 2.1. International manufacturing networks

The research developed at the Institute for Manufacturing, University of Cambridge, has been setting the agenda for IMN studies, a concept introduced by Shi and Gregory (1998). These authors expanded Hayes and Wheelwright's (1984) Factory Manufacturing System towards International Manufacturing Networks considering geographic dispersion, coordination mechanisms (both horizontal and vertical) and factory's characteristics as key levers for the network. The combinations of these levers result in seven types of network configurations, which in turn create four types of network capabilities (Figure 1).

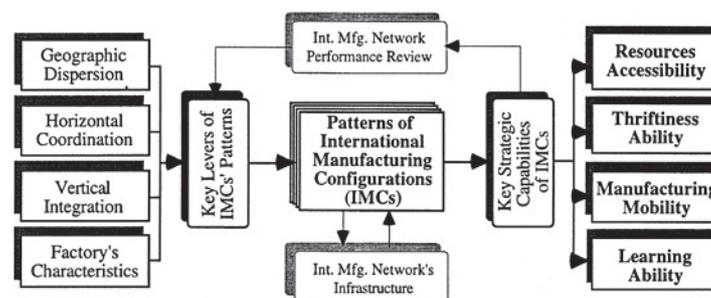


Figure 1 – Key capabilities derived from international manufacturing networks. Source: Shi and Gregory (1998).

Aiming at creating an integrative framework to describe and explain a multinational company's global manufacturing strategy, Miltenburg (2009) drew on Shi and Gregory's (1998). For Miltenburg (2009), the framework elements are manufacturing strategy's "objects" (generic international strategies, manufacturing networks, network manufacturing outputs, network levers, network capability, and factory types) which are related as in Figure 2. This framework extends Shi and Gregory's as it systematically seeks the relationship between the micro/operational level (factories), the meso/intermediate level (the manufacturing network) and the macro/strategic level (the company's manufacturing strategy). As Shi and Gregory (1998) propose that different configurations lead to different capabilities, Miltenburg (2009) adds that different configurations reflect different international manufacturing strategies.

Finally, Feldmann et al. (2013) drew on the previous frameworks to study changes in the international manufacturing network configuration when a subsidiary upgrades or downgrades its strategic role. Focusing on the relationship between the intermediate level (the network of subsidiaries) and the operational level (individual subsidiaries), the authors show that such shifts are likely to lead to systemic realignments within the company's IMN.

## 2.2. Generic internationalization strategies in EMNEs

As highlighted by authors like Peng, Wang and Jiang (2008), the internationalization of EMNEs is clearly influenced by the characteristics of the institutional environments where they were born. In addition, they usually grow as part of Global Production Networks (GPNs) led by developed country multinationals (DMNEs), what creates specific drivers and constraints for their international expansion. These two factors impact the formulation of strategies at firm level.

- *Country-of-origin effects*: derive from a combination of factor endowments, cultural traits, and policy options (Sethi and Elango, 1999). Three sets of elements: (1) both economic and physical resources and industrial capabilities, (2) cultural values and institutional norms, and (3) national government economic and industrial policies shape the propensity towards internationalization readiness and decisions. Resources and capabilities create drivers influencing firms' strategies. Among the BRIC countries, Brazil and Russia are rich in natural resources while China and India have large populations and few natural resources. That favors the development of nature-based companies in the former countries and assembling-type of industries in the latter. Values and norms are associated to the informal and formal institutions of a country. At the macro level, that reflects the business ecosystems where firms operate which can be more or less conducive to internationalization. At the micro level, organizational culture is heavily influenced by the nation's cultural environments. Depending on what types of values and norms prevail, organizations may lean towards entrepreneurship and risk-taking or conservatism and risk aversion. China and the India are considered nations which cultivate entrepreneurship while Brazil is said to be more conservative and risk-averse. Finally, governmental policies are clearly an important factor affecting emerging country firm's internationalization. For example, the international expansion of Chinese multinationals has been supported by the government through the 'Go Global' project, among other initiatives. Contrarily, both Brazilian and Indian institutions show conservative postures in regards to the importance of their firms moving abroad.

- *Global Production Networks*: usually emerging country firms engage in GPNs, what influences its propensity for internationalization and its entry strategy in international

markets. Fleury and Fleury (2007) proposed the Competence-based Positioning Framework to analyze the influence of the link to a GPN with regard to the firm's strategic positioning. The authors admit that, in GPNs, firms occupy one of six different positions depending on their core competences: (a) Manufacturers (key competence is Production and Operations Management); (b) Developers (R&D); (c) Integrators (Systems Engineering); (d) Service Providers (Service Operations Management); (e) Logistics Providers (Logistics) and (f) Technology Suppliers (providers of specialized knowledge for industry). Evidently, their argument assumes that every firm must master the whole set of organizational competences but there are core competences that provide strategic leverage to the firm.

- *Generic strategies*: Ramamurti and Singh (2009), considering the influences of both country-of-origin effects and GPNs, observed that EMNEs are not a homogeneous group by any means and identified five generic internationalization strategies:

- Natural-resource vertical integrator – firms located in countries rich in natural resources and large demand for such inputs, which internationalize to achieve forward integration to downstream markets and/or backward integration upstream to secure natural resources;
- Local optimizer: firms located in countries populated by low-income consumers and underdeveloped 'hard' and 'soft' infrastructures which have the ability to reengineer imported products thus creating products suited for emerging markets;
- Low-cost partner: firms located in low-cost labor countries, where a large pool of skilled labor is available, which become global suppliers for GPNs and, simultaneously move up the value chain to increase value-adding and down the value chain to diversify supply locations;
- Global consolidator: firms located in large and rapidly growing home markets where customers are price sensitive, which achieve manufacturing excellence and move internationally to achieve global scale through the acquisition of poorly performing companies;
- Global first-mover: firms located in countries characterized by large and rapidly demand in a new industry where design, engineering and production are low-cost, which target the global market and internationalize to acquire key technologies or capabilities and customer access.

These generic strategies are the primary determinant of the mission statement for the network in the case of emerging country multinationals.

### 2.3. Analytical frameworks linking corporate strategy and IOM

There is a plethora of studies on operations strategy, but little on how changes in corporate strategy affect the production system (the IMN). In accordance with strategic fit principles, changes in strategy convey changes to the structure (Chandler, 1962; Galbraith, 2000). Usually, the most visible outcome of the strategic process for IOM is a set of strategic requirements (or missions) assigned to the IMN.

Once the corporate strategy is formulated, the mission for the IMN is then defined. This mission guides the dispersion of subsidiaries with specific roles (Ferdows, 1997), the governance and coordination mechanisms, as well as the establishment of flows (information, knowledge, materials, people, finance) among the subsidiaries. The IMN features result in a

configuration, which creates capabilities that potentially contribute to the accomplishment of the missions (Shi and Gregory, 1998). The design elements are described as follows:

- Mission: Shi and Gregory (1998) present an operational approach to network mission by admitting that it may be: (1) Efficiency-oriented, when it seeks economies of scale/scope, international operations synergies, the leveraging of expertise or precious resources on a global scale, and the sharing and reuse of existing solutions; (2) Innovation-oriented when it leads to customer intimacy, technology leadership, and market/technology-driven innovation, learning across disciplines or organizations; or (3) Flexibility-oriented when it relies on flexible work approaches, mobile engineering resources, reconfigurable network structures, and local responsiveness.
- Geographic dispersion: Dispersion is usually drawn by forces external to the company, especially new market opportunities. There is a full range of options for dispersion. Shi and Gregory (1998) classify as Domestic those in which all production is carried out in a single country serving both home and export markets. Regional approaches refers to factories and networks located in a particular geographical region, usually sharing similar cultural value systems. Multinational approaches, with trans-regional dispersion, involve factories located in several countries or free-trade zones.
- Governance/coordination: Co-ordination refers to the question of how to link or integrate the production and distribution facilities in order to achieve the firms' strategic objectives or its network mission (Meijboom and Vos, 1997:790). Governance refers to the mechanisms to direct and control the network, including authority structures, performance measurement and coordination mechanisms. There can be two generic orientations: multidomestic (weak coordination and more independent factories) and global (strong coordination and more interdependent factories, from either designed system structures or operations processes).
- Operations Processes: Referring to the flow of material, information and knowledge between members in the network to create valuable output to customers. For Shi and Gregory (1998) and Zhang and Gregory (2011), the processes control the operational mechanisms. They are structural elements regarded as the dynamic levers of the manufacturing network, in opposition to the static levers such as geographic dispersion, coordination and the factories.
- Configuration: It is the combination of the elements previously described: geographic dispersion, governance, operations processes and subsidiary roles representing the potential contribution to the accomplishment of the corporate strategy. For Shi and Gregory (1998) seven possible configurations for an IMN emerge: Regional Uncoordinated (MMC1), Home Exporting (GMC1), Regional Exporting (GMC2), Multidomestic (MMC2), Globalised (MMC3), Global-Integrated (GMC3) and Global-Coordinated (GMC4).
- Capabilities: The capabilities created by the IMN configuration are classified as Cost Efficiency, Customer Responsiveness, Resource Accessibility, Agility, Learning, Risk Management, and Manufacturing Mobility (Fleet and Shi, 2005; Srari and Gregory, 2008).
- Subsidiary role: Although this level is off-scope in the present study, it is noteworthy that each subsidiary has a strategic role within the intra-firm network. Ferdows' (1997) types of subsidiary roles (offshore, source, server, outpost, contributor, and lead) remain predominant in literature; each type demands distinct sets of competences. Rugman, Verbeke and Yuan's (2010) classify them as Production, Innovation, Marketing and Administrative competences.

Figure 2 shows the IOM framework (Fleury et al., 2012), upon which the fieldwork will be based.

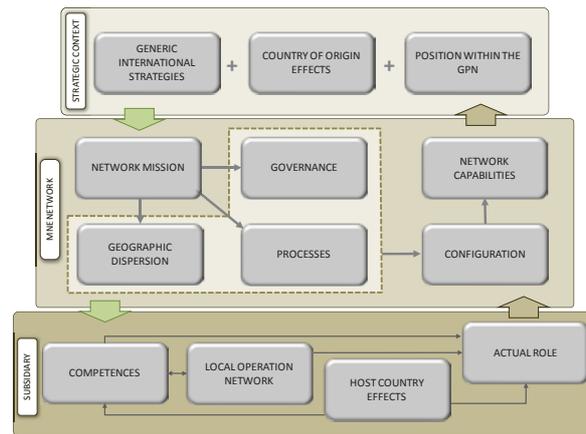


Figure 2 – Relationship between strategic context and the network of subsidiaries. Source: Fleury et al. (2012).

### 3 – Research Proposition

The literature review showed that there is a gap between the literature on IMN reconfiguration and corporate strategy, despite the contributions of Shi and Gregory (1998) and Miltenburg (2009). One of the hypotheses for that scarcity of research is that, in DMNEs, corporate strategies are more stable, with long-term perspective, what would require less frequent shifts in IOM. However, that is not the case for EMNEs: besides the turbulence in their home countries (Sull and Wong, 2005; Escobari and Sull, 2010), EMNEs are expected to systematically upgrade in GPNs, otherwise they will have their position menaced (Bartlett and Ghoshal, 2000). Moreover, it seems plausible to admit that, as infant multinationals, an EMNE will only be able to effectively change its strategy and move up the GPN if it succeeds in reconfiguring its IMN. Therefore, the proposition to be demonstrated is:

*There is a dynamic relationship between corporate strategy and international network configuration: multinationals will only be able to change strategic positioning if the international manufacturing configuration provides support for that shift.*

### 4 –Methodology and fieldwork

In order to better understand how changing an EMNE's position in a GPN affects its IMN, it is necessary to get empirical evidence over a considerable time span. Therefore case study was the chosen method for this research. Two Brazilian multinationals, Embraer and WEG, were analyzed over a period of 20 years, which is when they expanded their presence in global markets as for both sales and production. They were chosen due to the following reasons:

- They are successful industrial EMNEs, with subsidiaries located in developed regions (Europe and North America) as well as in other developing countries, such as China, which means they operate in diverse economic and institutional environments;
- They were founded as a result of public economic stimulus: Embraer emerged from a governmental project for technological development while WEG started business in the wake of the Imports Substitution Industrialization;
- Embraer was born a state-owned enterprise (SOE) and was privatized; while WEG has always been private;

- They are largely connected to GPNs from their respective industries; according to the CbPF (Fleury and Fleury, 2007), Embraer can now be categorized as an Integrator (of Complex Product Systems) while WEG is essentially a Manufacturer;
- The evolution of their strategies and operations is largely documented.

In order to capture potentially different types of changes, the approach focus on the evolution of their IMNs as a whole, avoiding particularization for one product or business unit. Historical data was gathered and analyzed for further discussion with company executives at both the headquarters and subsidiaries where they are embedded. Such an approach led to the identification of potential contingency factors concerning network design and relationships between the network and strategic context. Due to the nature of the topic, very little documentation was available in the company, thus making historical data and interviews material as the main source of information. Triangulation was possible through the access to some related company presentation material.

Since this research explores the interaction between strategic level and the network level, extra care was taken to ensure that both levels were represented throughout the research process in order to ensure fit between data collection and the unit of analysis. Semi-structured questions were used during the sessions, with opportunities for clarification as well as collecting supplementary information between sessions. Most of the meetings had two researchers, one leading the discussion and the other taking notes and asking clarifying questions. Notes were compared after the meetings, and then shared with the executives for validation. Then, comparisons were made between the two EMNEs.

## 5 - The cases

### *5.1. EMBRAER: from local manufacturer to global first-mover in a hi-tech industry*

Embraer is the world's third largest commercial aircraft manufacturer, with more than 5,000 airplanes produced up to 2013 and 19,000 employees in eight countries besides Brazil: USA (full-fledged subsidiary), France (sales and client support), Portugal (two plants for maintenance facilities and components production), China (manufacturing plant and client support), UK (sales and client support), Singapore (logistics hub), Ireland (sales office), United Arab Emirates (sales office). Its business units include commercial aircraft, executive jets, and defense and security.

#### *1969-1994 – The local producer of a global product*

Embraer was born a State-Owned Enterprise, to produce airplanes that would contribute for the development of inner country regions, under the doctrine of national sovereignty. Since the development of its first airplane, the company negotiated with large DMNEs for the acquisition of engines and avionics. Simultaneously, it was involved in partnerships with mid-sized Italian and American manufacturers for the local production of airplanes under license, as well as supplied a large American manufacturer with structural components.

Embraer was then part of a large national project and, as such, it had the support of a research centre and a school that provided highly skilled engineers, and support from the government

as its client for both civilian and military products. In addition, Brazilian public banks created a financing scheme, to make feasible the global commercialization of Embraer's products.

Under those circumstances, Embraer's strategy was initially focused on domestic demands but, as airplanes are global products, exports started in the late 1970s. To make that strategy feasible, Embraer created a network of subsidiaries specialized in sales and after-sales.

Therefore, in the first stage of its history, Embraer was an isolated, vertically integrated aircraft manufacturer, assembling key modules imported from DMNEs, as well as selling small regional airplanes all over the world. According to Shi and Gregory (1998), Embraer's IMN configuration would then be categorized as Home Exporting Manufacturing (GMC1), because it had no transnational manufacturing operations, centralized manufacturing in home country and operated a global logistic system (for the acquisition of supplies).

#### *1994-2001 – From local producer to leader of a global production network*

At the time of its privatization, Embraer was in a delicate financial position. After privatization, the government gradually withdrew direct support, maintaining indirect influence through a "golden share" stake. Nevertheless, it remains Embraer's major client in the defense area, as it happens with other major global companies in the industry. For the turnaround, the acquiring private group gave Embraer a new strategic intent, with changes in its corporate mission, from technology-oriented to market-oriented, as well as new culture and organization.

The new product, the regional jet ERJ-145, was designed and manufactured under a radically new approach where Embraer created and led a network of four risk-sharing partners from Spain, Chile, Belgium and USA. These partners were, previously, common suppliers for Embraer.

In other words, the company reshaped its international network to be able to maintain its position in international markets. The new mission for its IMN was resource searching (from the partners) with tailored processes for the flow of information and knowledge among the risk-sharing partners, and standardized processes for the flow of parts and components that feed assembly lines.

For the most part of the second stage of its history, Embraer's IMN configuration remained a Home Exporting Manufacturing (GMC1), because it had no transnational manufacturing operations. For the most part, manufacturing and assembling was kept centralized in the home country but part of that became outsourced to risk-partners.

The ERJ-145 was extremely successful, despite the fierce rivalry with Bombardier of Canada, thus consolidating Embraer as a Global Integrator and leader of a global production network. That arrangement provided extraordinary competitive edge after the 9/11/2001. The flexibility of Embraer's global network allowed it to be the company that least suffered from the crisis that followed that tragedy: while its direct competitors succumbed one after the other, Embraer was able to manage its international operations to emerge as a new challenger in the aerospace industry.

### *2001- – A global player in the aerospace industry*

In the 2000s' Embraer gradually consolidated as a Global First Mover. Its previous experience with decentralized global manufacturing allowed the company to assemble a much more complex international network for the production of its new jet, involving 11 renowned DMNEs like GE and Mitsubishi. At the same time, this GPN made possible for Embraer to diversify its global strategy by entering a new business: executive jets.

Embraer's IMN was gradually expanded. When it began to act as the leader of a network of risk-sharing partners, its position changed significantly: by "deverticalizing" production and strengthening its interface with suppliers, partners and markets, either airlines and their leasing companies or individual customers for executive jets. There is clearly a global-integrated manufacturing configuration (GMC3), according to Shi and Gregory (1998). But it has a regional orientation in what concerns sales and maintenance. This configuration is meant to lead to capabilities of resources accessibility and learning ability, to satisfy the main mission of market presence.

In sum, as a global first-mover in its internationalization strategy (Ramamurti and Singh, 2009), the reasons for going abroad are to acquire global customers and scale as well as to acquire key missing technologies and capabilities. It occupies a unique leading position in its GPN, as a complex systems integrator, although secondarily it is also a manufacturer and service operator (providing maintenance for the airlines). Companies such as Embraer, in high technology, fast-moving global industries are likely to develop innovative management models for their network-based organizations. Doz, Santos and Williamson (2001) classify Embraer as a metanational: an advanced multinational that "was born in the wrong place".

### *5.2. WEG: from low cost supplier to global consolidator of industrial equipment*

WEG is one of the world's leading manufacturers of electric motors. Its global presence embraces subsidiaries in nine countries besides Brazil: Argentina, Mexico (3 plants), USA, India, South Africa (2), Portugal, Austria, Germany and China (4). Commercial offices are located in 28 other countries. WEG sells to over 135 countries and has 1,250 authorized repair shops covering all continents. Employment is over 28,000, 20% working abroad, in five business units: Electric Motors, Energy, Transmission and Distribution, Automation, and Coatings.

### *1969-1990 – WEG's foundation in the wake of the Imports Substitution Industrialization*

WEG was founded in 1961 by three entrepreneurs, with the mission to produce domestically universal electric motors cheaper than those imported. WEG's first 20 years were a moment when imports substitution economic model was at its peak, and thus the company received support from the government to start business, as well as financial support especially for R&D purposes.

Located in Southern Brazil, the prevalent European culture led WEG to develop a strong organizational culture and embrace a participative management system, where decisions are made by committees. The structure is highly vertically integrated, from foundry and coating and assembling to sales and distribution.

Since the beginning, WEG has had a global mindset. Modest exports to neighboring countries started in the 1970s, in order to sell excess production, but during the 1980s exports became priority. The Exportation Department was created with the mission to open new markets, and to export even when returns were negative. The main objective was to learn how to serve sophisticated foreign markets and thus reshape the company's strategies. The R&D department was also created at that time.

Therefore, in the first stage of its history, WEG was an isolated, vertically integrated electric motor manufacturer for domestic markets, but with increasing exports, first to modest markets and then to more demanding markets. The limits of exporting through foreign distributors soon became evident, and WEG started to establish commercial branches, the first one in the USA. the Exportation Department was renamed International Department. The role of the commercial branches was to approach large clients while distributors would keep their role as suppliers to retailers. According to Shi and Gregory (1998), WEG's IMN configuration would then be categorized as Home Exporting Manufacturing (GMC1), because it had no international manufacturing operations, centralized manufacturing in home country and operated a global logistic system (for the acquisition of supplies and distribution of products).

#### *1990-2003 – From home-exporter to low-cost partner*

In the early 1990s, with the end of the Cold War and the new wave of globalization, WEG was ready to expand exports to a wide range of segments of electric motors, from universal to make-to-order products. One industry to which WEG has long been connected to is the hydraulic pumps GPN, where WEG maintains preferential relationships with pump producers. It was then categorized as a low-cost partner (Ramamurti and Singh, 2009).

The mission of its IMN was largely related to be present in preferential markets, but it became clear that it had to change its mission to dynamic responses, seeking closer relationship with its clients. The corporate supply chains are dispersed in many countries to access to the most optimized resources, markets and strategic capabilities according to the corporate strategic intentions. WEG used to distribute supply chains vertically and centralise each stage of process to reduce the duplication of manufacturing facilities. This configuration is meant to lead to capabilities of resources accessibility and learning ability, to satisfy the main mission of market presence. Thus, WEG moved to a Global-Integrated Manufacturing Configuration (GMC3).

#### *2003- – From low-cost partner to global consolidator*

In the 2000s, WEG decided to invest in foreign plants through acquisitions seeking, from the world's largest markets, those where legal and political stability prevailed. WEG has kept its main position as a world-class manufacturer, and its generic internationalization strategy shifted to global consolidator.

The mission of the network combines efficiency-orientation and flexibility-orientation. There is excess capacity and redundancy in different foreign plants, what was observed in the Chinese plant which exports almost half of its production to other subsidiaries. Recently, WEG changed its organizational structure: each foreign subsidiary was relocated to one of the

five business units and the International Department became responsible for the commercial operations only. The aim of this change was to increase coordination and synergy between the foreign and the Brazilian plants.

Dispersion of WEG's IMN can be categorized as Worldwide due to the high number of subsidiaries present in a large number of regions and countries, to serve five business units. Governance follows a global pattern since units are horizontally coordinated and there is no hierarchy among them. Processes are both standardized and ad-hoc due to the specifics of the products and the business units. Therefore, the configuration is Global-Coordinated (GMC4) and network capabilities combine manufacturing mobility and thriftiness ability, to satisfy the mission of global competitiveness.

In sum, WEG is characterized by a high level of strategic entrepreneurship. Also, it is a global consolidator in its internationalization strategy, the reasons for going abroad are to acquire global customers and scale as well as to acquire key missing technologies and capabilities. It occupies a traditional position in its GPN, as a manufacturer, although secondarily it is also a technology supplier and service operator (providing maintenance for niche markets such as the flameproof motors).

## 6 - Discussion and conclusion

The two illustrative cases revealed a clear relationship between shifts in strategic positioning and the configuration of the international network. At this level of analysis, it is not possible to identify precedence in that relationship: strategy precedes network or network precedes strategy. It seems likely that there is a co-evolution between the two. Tables 1 and 2 show the evolution of both firms according to the adopted prioritization.

Table 1 – Embraer's timeframe

Time	International Strategy	CbPF	Main mission	Configuration	Capabilities
1969-1994	Exports	Manufacturer	Capability building	GMC1	Learning ability
1994-2001	Global 1st mover	Manufacturer	Resource searching	GMC1	Resource accessibility
2001-	Global 1st mover	Integrator	Market presence	GMC3	Resource accessibility

Table 1 shows that Embraer kept a GMC1 - Home Exporting configuration after the development of the ERJ-145 airplane. However, the international network put in place allowed the company to change towards GMC3 – Global Integrated configuration. In other words, the main assembly process was kept in-house (in Brazil), while the assembly of subsystems were transferred to the risk-sharing partners, for subsequent shipment to Embraer's main assembly plant. This restructuring is consistent with the new corporate strategy devised by the headquarters: becoming a Complex Product Systems integrator and a Global First-Mover.

In its current stage, new strategic options consolidated Embraer's GMC3 configuration: the opening of new international markets, as well as new strategic business units (executive jets).

One key evidence is the decentralization of the final assembly: commercial jets in the Chinese subsidiary (now switched to executive jets), and executive jets in the American subsidiary.

Table 2 – WEG's timeframe

Time	International Strategy	CbPF	Mission	Configuration	Capabilities
1961-1990	Exports	Manufacturer	Market presence	GMC1	Thriftiness
1990-2003	Low-cost partner	Manufacturer	Dynamic responses	GMC3	Resource accessibility
2003-	Global consolidator	Manufacturer	Global competitiveness	GMC4	Manufacturing mobility

Table 2 shows that WEG has kept its position as a manufacturer but gradually changed its strategy: from exporter to low-cost partner and global consolidator. It has productive capacity spread around the world serving distinct markets. But what is most important is its objective to become a global leader in the production of electric motors.

In its current stage, new strategic options led WEG to adopt a GMC4 - Global Coordinated configuration: opening new subsidiaries, via acquisitions or greenfield projects, as well as new strategic business units (coatings and automation).

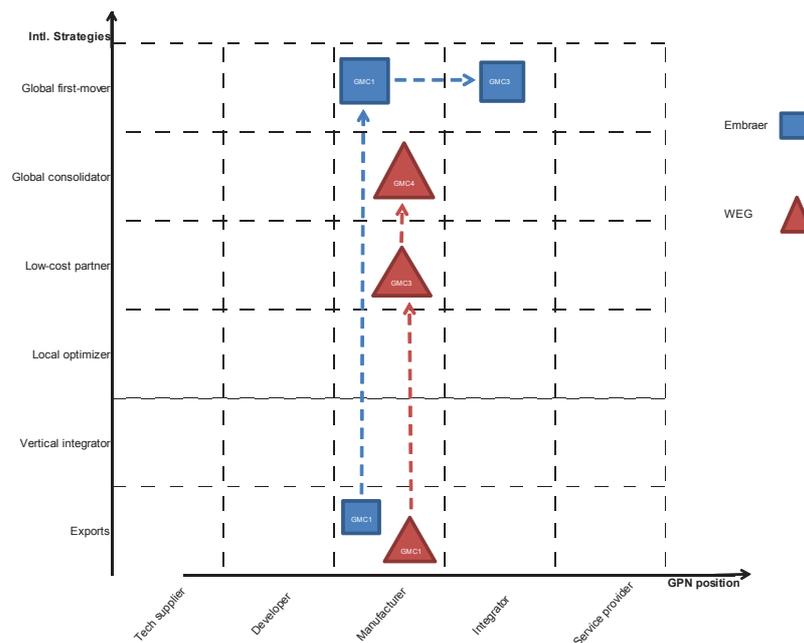


Figure 3 – Evolution of strategies and their respective network configurations.

From the illustrative cases, evidences that support the proposition were observed: changes in an EMNE's corporate strategy, which embraces the combination of generic internationalization strategy with the position in the GPN, are associated to relevant shifts in the configuration of IMNs. Figure 3 depicts the trajectory of Embraer and WEG in terms of their position in GPNs and generic internationalization strategy. For each strategy chosen there is an IMN configuration. WEG shifted its generic strategy and maintained its GPN position. As to Embraer, it shifted both generic strategy and GPN position.

From the standpoint of theoretical development, this study widens the lens in the analysis of international manufacturing networks by further integrating International Business concepts to the Operations Management framework. In addition, by considering that the firms' corporate and operational strategies are influenced by country of origin effects and position in the GPNs a new field of research is opened. Multinationals from an emerging country were studied but that seem not to be a constraint for the application of the analytical framework for multinationals of any other country.

This study has implications for researchers in that we show that strategic and network decisions are strongly interrelated and need to be considered in an integrated fashion. In addition to site location and site competence, the aspect of how markets are served from different plants need to be taken into consideration in the network design.

For managers, this research provides case studies and shows that changes, deliberate or not, in position in the GPN cannot be taken or seen in isolation. Instead, the relationship with the whole network must be considered.

Future research can propose new and updated configuration patterns for IMNs.

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