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Performance assessment process model for international manufacturing networks

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Abstract

Purpose – Multinational companies have manufacturing operations in various countries; however, there is scarce evidence on how they assess performance of the network-based operations of their factories, called international manufacturing networks (IMN). The purpose of this paper is to propose a process model for the performance assessment of IMNs.

Design/methodology/approach – The IMN performance assessment process model was developed from the extant literature and was empirically verified in its congruency and usefulness via a multiple case research. For that, in each case the general process model was derived into a specific application that fit the type of IMN on focus. Qualitative and quantitative data were collected from the case companies' reports, profiling forms and interviews, followed by within-case and cross-case analyses.

Findings – Evidence suggest that the process model, along with its derivations, is a valuable tool to describe and explain how IMN performance assessment unfolds in real organizational environments. Additionally, three propositions emerged: IMN performance assessment has distinct characteristics depending on the type of IMN adopted, which in turn depends on the company's internationalization strategy; IMN performance assessment has more strategic value and importance for companies that are globally coordinated and adopt "rooted" manufacturing strategies; and companies design their IMN performance assessment on a trial-and-error basis.

Research limitations/implications – As all case-based research, this paper has generalizability limitations. Thus, next steps may include a large-scale survey and an action research that will develop and implement a full-fledged IMN performance assessment.

Practical implications – The process model and descriptive insights provide a diagnostic tool and subsidies that may encourage managers to review and improve their current IMN performance assessment.

Originality/value – The process model contributes to addressing a 20-year gap concerning how to approach IMN performance assessment in a holistic and systematic manner.

Keywords Performance assessment, International manufacturing networks, International operations management

Paper type Research paper

1. Introduction

The number of multinational companies and, consequently, the number of their factories around the world continue to grow despite intermittent crises and recessions. Internationalization decisions may not be fully rational and planned, as Bartlett and Ghoshal (1998), among others, already stated. Nevertheless, after investments are made and factories turn operational, a systematic performance assessment of a company's international manufacturing network (IMN) becomes essential to monitor the return on investments and the realization of the predicted strategic gains. The way that such an assessment has been carried out by companies, however, remains uncharted territory. There is little knowledge on IMN performance assessment, which makes it stand out among the understudied issues in the IMN research stream (Cheng *et al.*, 2015).

IMNs, defined as a manufacturing system consisting of an intra-firm network of coordinated and interdependent factories around the world (Shi and Gregory, 1998), have

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been studied under various aspects, such as capabilities (Colotla *et al.*, 2003), typologies (Kulkarni *et al.*, 2004; Ferdows, 2009), optimization (Chan *et al.*, 2005), strategy (Miltenburg, 2009), design and operation (Friedli *et al.*, 2014), and strategic context and evolution (Fleury *et al.*, 2015). As to performance assessment, previous studies focus only on aggregate figures that measure the overall outcome of international operations (Mauri, 2009; Demeter, 2014; and Szasz *et al.*, 2016). The disciplines of international business and international strategy also measure performance through traditional aggregate metrics, such as return-on-equity and return-on-asset, or has decomposed metrics like profit margin and total asset turnover (Hu and Boggs, 2007; Verbeke, 2013).

Performance assessment in general is an intricate and context-dependent managerial practice and has been a long-debated topic (Kaplan and Norton, 1992; Neely, 2005; Franco-Santos and Bourne, 2005). Pure economic or operational approaches have recently given way to better-suited holistic combinations of both (Tangen, 2005). In what concerns the performance assessment of (extra-firm) supply chains/networks, there is a considerable number of models and frameworks like Dreyer *et al.* (2009) and Dey and Cheffi (2013). This is possibly due to stronger outsourcing trends (Cheng and Johansen, 2014) that have brought to the forefront the "footloose" manufacturing networks (Ferdows, 2009), usually studied under the supply chain management theoretical perspective (Rudberg and Olhager, 2003). On the other hand, "rooted" networks, which rely mostly on in-house manufacturing (the intra-firm IMN) and usually studied under the production/operations management (P/OM) theories, have been overlooked on that matter. Summing up, research has been scarce on how multinationals define the metrics and processes that provide meaningful information for the management of IMNs.

To fill that literature gap, this paper proposes a process model that contributes to the investigation of how multinationals have assessed the performance of their IMNs, assuming that performance assessment should be a systematic practice for IMN coordination and strategic management (Figure 1). This is due to the fact that issues like detection of misalignment between the IMN and its mission (Shi and Gregory, 1998), manufacturing strategies (Miltenburg, 2009), adoption of global production planning (Friedli *et al.*, 2014), factory upgrading (Mediavilla *et al.*, 2015), and network design/redesign due to contingencies (Fleury *et al.*, 2015), among others, should mostly rely on information provided by actual performance assessment.

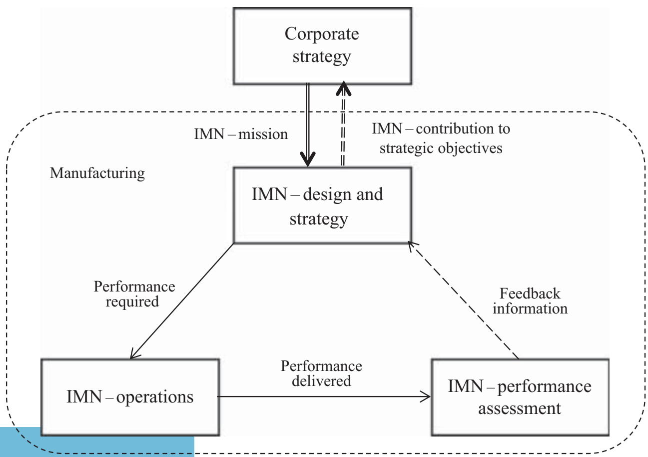

Figure 1.
IMN performance assessment as a feedback loop

Shi and Gregory's (1998) seminal article suggests the construct "performance review" as a key element in their international manufacturing model, but it was never addressed. Similarly, other researchers studied IMN redesign due to new strategies and/or contingencies (Miltenburg, 2009; Mediavilla *et al.*, 2015; Fleury *et al.*, 2015), but they did not clarify if the new strategy was triggered by a feedback information from the performance assessment, let alone if the referred IMN redesign led to a redefinition of its performance assessment process. Therefore, a better understanding of how the IMN performance assessment process really unfolds will provide valuable information for both academics and practitioners.

For the construction of the process model, concepts were drawn from the fields of international operations management/IMNs and organizational performance/performance assessment. Furthermore, this research incorporates contingency and strategic fit approaches, as organizations should seek the proper alignment between the business environment and the organization's strategy and structure/processes (Galbraith, 2000; Sousa and Voss, 2008), which is the case of the IMN performance assessment.

The process model, as the main outcome of this paper, might be seen as a "prototype": based on the referred literature, a set of purposes, processes, and key performance indicators (KPIs) that are probably utilized in real IMN performance assessment were assembled into a framework or a lens. Next, a priori applications that fit each possible IMN type were derived from the process model so that each application would predict how companies run their IMN performance assessment.

The empirical verification of the process model's congruency (internal coherence) and usefulness was conducted through its application in three multinational companies. First, they filled out profiling forms drawn from the literature and organized along the lines of the process model, encompassing the constructs associated to the IMNs as well as their international manufacturing strategies. Next, the resulting information was discussed with two directors in each company during separate interviews conducted according to semi-structured questionnaires. The discussion on how each company has actually assessed IMN performance not only included the technical aspects extracted from the profiling forms but also corporate policies and organizational behavior.

Evidence suggests that the process model is a valuable tool for describing and explaining how IMN performance assessment unfolds. Also, its application provided insights about what type of multinationals makes better use of its feedback information. The process model is a research tool for academics, especially in what concerns the development of prescriptive models in the future. It can also be employed by corporate managers to review and evaluate their current IMN performance assessment process for it to better connect and align the strategic and operational levels (Franco-Santos *et al.*, 2007).

This paper has the following sections: Literature review; Assembling the IMN performance assessment process model; Research design; Fieldwork and discussion; and Concluding remarks.

2. Literature review

The main purpose of the literature review was to gather the necessary and sufficient elements to construct the IMN performance assessment process model.

2.1 IMNs – mission and organizational elements

In 1998, Shi and Gregory expanded Hayes and Wheelwright's (1984) Factory Manufacturing System by extrapolating its elements into a broader set of organizational "levers" which, when combined, make up an IMN system. Shi and Gregory's (1998) general model, with its missions, capabilities, and typology, still prevails in the research stream. This approach seeks to generalize the new missions of international manufacturing systems and link them to required strategic capabilities of IMNs, implying that IMNs need new structures and mechanisms to deliver the capabilities and satisfy the missions. In this context, IMN performance is the outcome of the whole set of factories, located both in the home country as well as internationally. Also noteworthy is Ferdows' (2009) typology for directing manufacturing strategy. It is based on product uniqueness and production process exclusivity, thus creating a range of types from totally "rooted" (in-house manufacturing), like Intel's strong IMN, to totally "footloose" (outsourced), like Ikea.

IMN design comprises two organizational elements: configuration and coordination.

Configuration. It is the structural and static element associated with factories: from location and risk management (Kumar *et al.*, 2016) to product-process decisions and allocation of resources (Meijboom and Vos, 1997). It is composed of two "levers":

(1) Geographic dispersion is the actual result from the interplay between purposeful company's strategic decisions and external drivers, especially market opportunities. Shi and Gregory (1998) propose four geographic options: domestic, where factories are located in the home country, serving both home and export markets; regional refers to factories in a particular region, usually sharing similar cultural values; multinational, with trans-regional dispersion, which means factories in several countries; and worldwide, with greater dispersion among continents.

(2) Each factory in the network plays a different role. Ferdows's (1997) six roles: offshore, source, server, outpost, contributor, and lead still prevail in the IOM literature. In the international business literature there are similar taxonomies like Bartlett and Ghoshal's (1998) four types of subsidiaries: strategic leader, contributor, implementer, and "black hole"; Birkinshaw and Morrison's (1995) types of subsidiaries: local implementer, specialized contributor, and world mandate.

Coordination. It is the infrastructural element of an IMN, encompassing dynamic integration and management across factories (Meijboom and Vos, 1997; Cheng *et al.*, 2015). It is composed of two "levers":

(1) Governance, involving mechanisms that direct and control the IMN, such as authority/leadership structures, performance measurement, and decision-making rules. Governance may be either multidomestic, with weak coordination and more independent factories, or global, with strong coordination and more interdependent factories.

(2) Operations processes, referring to the management of materials, information, and knowledge flows across factories. The set of practices associated to each network process may be standardized, tailored, or ad-hoc (Shi and Gregory, 1998; Zhang and Gregory, 2011).

As per Shi and Gregory (1998), the combination of configuration and coordination creates seven different IMN types: Home-Exporter (GMC1), Regional-Exporter (GMC2), Global-Integrated (GMC3), Global-Coordinated (GMC4), Regional-Uncoordinated (MMC1), Multidomestic (MMC2), and Glocalized (MMC3). For Miltenburg (2009), each type is tied to a particular international manufacturing strategy a company may choose.

2.2 Performance assessment

Performance is a multidimensional and contextual concept that can be disaggregated into constituent dimensions that reflect the company's competitive priorities (Neely, 2005; Slack and Lewis, 2011). The literature presents a whole range of frameworks and models aiming at describing the performance assessment process, like the (Kaplan and Norton, 1992). Other studies also discussed problems in performance assessment systems that failed as they did not meet the organizational requirements properly (Bourne *et al.*, 2003).

From a P/OM perspective, performance assessment is a "set of metrics used to quantify both the efficiency and effectiveness of actions" (Neely, 2005). In order to highlight the strategic and connective objectives a performance assessment must have, the definition by Ittner *et al.* (2003) will be adopted: "A strategic performance measurement: (1) provides information that allows the company to identify the strategies offering the highest potential for achieving the its objectives; and (2) aligns management processes, such as target setting, decision-making, and performance evaluation, with the achievement of the chosen strategic objectives."

3. Assembling the IMN performance assessment process model

For Aguilar-Saven (2004), conceptual process modeling enables a common and comprehensive understanding, for analysis or improvement, of a business process. For instance, modeling can facilitate the development of software that supports informational processes, as is the case of performance assessment.

The IMN performance assessment process model herein proposed is conceptually based on the performance pyramid (Cross and Lynch, 1992), which is a conceptual model focused on the strategy-operations connection that cascades down performance goals based on (top-down) competitive priorities, and then consolidates performance measures based on the (bottom-up) results achieved by the operational system. The process model can be depicted in a dynamic and contextual fashion (Figure 2), and will be described in the upcoming sections.

Once the company's strategic process sets its international manufacturing strategy, which in turn sets the IMN's mission and type, the process model assumes that the IMN performance assessment receives a purpose and runs in five steps:

(1) IMN's mission is quantified, by setting performance goals (at the headquarters);

(2) IMN's performance goals are disaggregated (headquarters + factories);

(3) operations are performed, and data from real/delivered performance are gathered (factories);

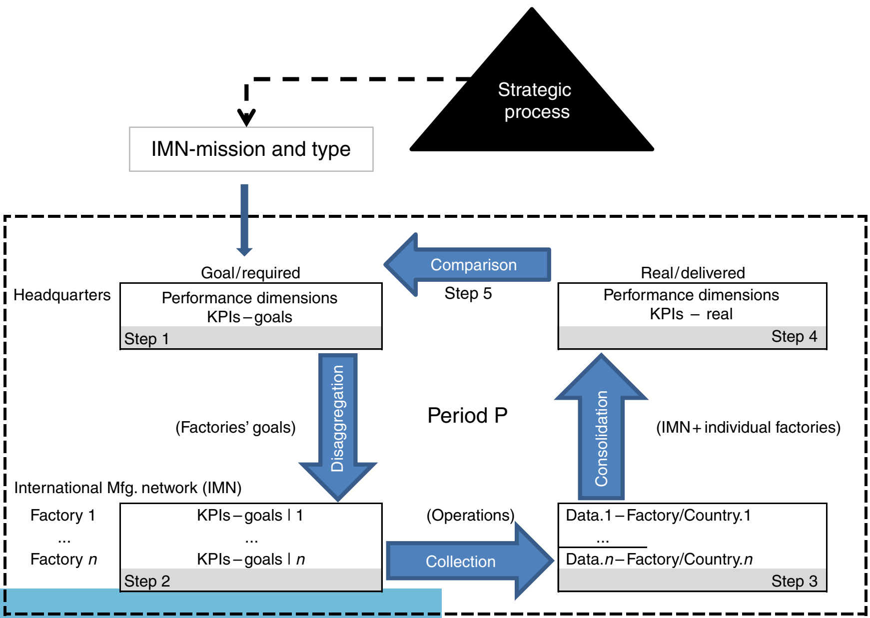

Figure 2. IMN performance assessment process model

(4) data from real/delivered IMN performance are manipulated, that is, consolidated and measured according to the KPIs (headquarters); and

(5) "goal × real" IMN performance assessment is made (headquarters).

3.1 Key elements for performance assessment

Franco-Santos *et al.* (2007) state that the following elements are necessary and sufficient for a robust performance assessment model:

(1) "Purposes" are the aims or functions of the performance measurement; in principle, one of the five choices prevail: performance measurement (operations monitoring); and/or strategic management; and/or communication; and/or influence on behavior; and/or learning and improvement.

(2) "Features" are constituent properties or elements of the model including performance measures, goals and support infrastructure (or infrastructural processes); and

(3) "Processes," which are the actions that, altogether, lead to the measurement of performance and deliver its outcomes. There are five processes: selection and design of metrics – identification of the stakeholder's wants and needs, specification of strategic objectives, and definition of performance dimensions; design of respective metrics and their KPIs; data collection and manipulation – composed of: periodicity of collection and manipulation; corporate periodic strategic planning, generating performance goals which are disaggregated down to factories; consolidation of delivered performance; information management – provision and interpretation of information; performance assessment – comparison and "goal × real" analysis, and connection to rewards; and system review – internal procedures for correction and improvement in view of a dynamic organizational environment.

3.2 Selection and design of metrics for IMNs

The extant IMN literature (DuBois *et al.*, 1993; Shi, 2003; Rudberg and West, 2008; Miltenburg, 2009; Fleury *et al.*, 2015) shows that cost, flexibility and innovativeness (C-F-I) are the most relevant dimensions for assessing IMN performance. For Shi and Gregory (1998) in particular, the performance dimensions C-F-I are directly related to the capabilities of thriftiness ability (focus on cost), manufacturing mobility (focus on flexibility), and learning (focus on innovativeness). In addition, the international business literature also assumes that the performance of a multinational company is predominantly measured by C-F-I, such as in Bartlett and Ghoshal's (1998) transnational solution. The three dimensions are therefore selected to compose the IMN performance assessment process model.

For a better comprehension of the dimensions C-F-I just selected, Table I shows the link between the possible IMN missions and its dimensions. That is, the dimensions help assess IMN performance, which in turn helps evaluate if the IMN mission is being accomplished.

The dimension cost requires KPIs that capture the amount of financial resources spent in the production process and in each product. Total production cost and unit production cost emerge as the most appropriate at both factory and network levels. Flexibility requires KPIs that capture the various possible changes in production planning and scheduling, especially production orders transferred between factories within the IMN, due to market uncertainty, labor cost arbitrage, exchange rates, and transportation costs (Lee *et al.*, 2017). That includes flexibility to transfer product mix and production processes (network level) and flexibility to change product mix and production volumes (factory level). Finally, innovativeness requires KPIs that capture not only "traditional" innovations in the factories but also the ones transferred/diffused within the IMN (Vereecke *et al.*, 2006; Ferdows, 2009). Product/process innovation rates (factory level) and product/process innovations due to transfer (network level) must be used as KPIs.

KPIs should meet the following criteria: be recognized in the IMN literature and be specific, measurable, achievable, relevant, time based (SMART) (Doran, 1981). The following KPIs (Table II) are then proposed for the IMN performance assessment process model:

- Total production cost: originally created for factory level (Feldmann *et al.*, 2013; Szász *et al.*, 2016) and already adapted and applied at network level (Kulkarni *et al.*, 2004; Chan *et al.*, 2005; Miltenburg, 2015); the total production cost may be minimized by exploiting the comparative advantages of different countries moderated by cost differences among factories (exchange rates and taxation included).
- Unit production cost: originally created for factory level (Vereecke *et al.*, 2006; Szász *et al.*, 2016) and already adapted and applied at network level (Kulkarni *et al.*, 2004; Chan *et al.*, 2005; Miltenburg, 2015); unit production costs may be reduced by optimizing production scales to meet demand in different countries.
- Flexibility to transfer production processes among factories within the network: originally created for the network level (Thomas *et al.*, 2015).
- Flexibility to change product mix: originally created for factory level (Friedli *et al.*, 2014; Szász *et al.*, 2016) and already adapted and applied at network level (Thomas *et al.*, 2015).
- Flexibility to change production volumes: originally created for factory level (Demeter, 2014; Friedli *et al.*, 2014; Szász *et al.*, 2016).

IMN mission (Shi and Gregory, 1998)	Focus of IMN mission	Prioritization/emphasis of performance dimensions
Global competitiveness	Products with lower price than competitors	Cost-flexibility-innovation
Potential tapping	Readiness for opportunities	Cost-innovation-flexibility
Market presence	Closeness to customers	Flexibility-cost-innovation
Dynamic responses	Response to Market changes	Flexibility-innovation-cost
Resource searching	New resources for manufacturing	Innovation-cost-flexibility
Capability building	Creation of future competitive advantages	Innovation-flexibility-cost

Source: Adapted from Shi and Gregory (1998), Bartlett and Ghoshal (1998), and Fleury *et al.* (2015)

Table I. IMN mission and related performance dimensions

Dimension	Metric/KPI	Level
Cost	1: total production cost	Network/Corporate
	2: unit production cost	Network/Corporate
	3: total production cost	Factory
	4: unit production cost	Factory
Flexibility	5: flexibility to change product mix	Network/Corporate
	6: flexibility to change production processes	Network/Corporate
	7: flexibility to change product mix	Factory
	8: flexibility to change production volumes	Factory
Innovativeness	9: product innovation – received transfer	Network/Corporate
	10: process innovation – received transfer	Network/Corporate
	11: product innovation rate	Factory
	12: process innovation rate	Factory

Table II. IMN performance dimensions and their KPIs

In the three cases, flexibility is a mechanism to optimize production in conditions of global economic and institutional instability:

- Product innovation transferred between factories or from the headquarters: originally created for network level (Vereecke *et al.*, 2006; Ferdows, 2006; Keupp *et al.*, 2011; Lang *et al.*, 2014; Thomas *et al.*, 2015); the interplay among factories in distinct environments enhances innovativeness in terms of products.
- Process innovation transferred between factories or from the headquarters: originally created for network level (Vereecke *et al.*, 2006; Ferdows, 2006; Keupp *et al.*, 2011; Lang *et al.*, 2014; Thomas *et al.*, 2015); the interplay among factories in distinct environments enhances innovativeness in terms of processes.
- Product innovation rate: originally created for factory level (Vereecke *et al.*, 2006; Ferdows, 2006; Cheng *et al.*, 2011; Mediavilla *et al.*, 2015; Thomas *et al.*, 2015).
- Process innovation rate: originally created for factory level (Vereecke *et al.*, 2006; Ferdows, 2006; Cheng *et al.*, 2011; Mediavilla *et al.*, 2015; Thomas *et al.*, 2015).

Based on the mission-performance dimension set (Table I), the KPI set (Table II), and the necessary and sufficient conditions for the existence of a sound performance assessment (Franco-Santos *et al.*, 2007), the process model for the study of IMN performance assessment has the following: categories, elements, and possible attributes (Table III).

When applied to real cases, the process model should not only provide a sound description of the performance assessment adopted by the company, but also help address two critical questions: is the IMN delivering performance that is the combined performance of its factories? Is the IMN's performance contributing to accomplish the company's strategic objectives?

4. Research design

4.1 Process model derivation for each IMN type

For a proper empirical verification and analysis, each IMN type requires a particular derivation of the general process model. In other words, prior to the actual application, each element of the process model has to be filled with an ideal attribute, best suited for each IMN type. Table IV shows the six possible derivations. The type GMC1 is outside of the scope, for it does not have international factories.

4.2 IMN-performance causal relationships

It is important not only to link the organizational elements of the IMN to the performance it is expected to deliver, but also to identify the causalities that contribute to the design of the performance assessment (Turkulainen and Ketoviki, 2012). The causality table proposed (Table V) is based on previous empirical research and functions as an auxiliary tool for IMN performance assessment design and analysis.

Each cell corresponds to the link between the organizational elements geographic dispersion (O1), roles of factories (O2), governance (O3) and operations processes (O4), and the performance dimensions: cost (P1), flexibility (P2), and innovativeness (P3). Each element (rows) influences each dimension (columns). As they may be somewhat conflicting, it is not possible to optimize simultaneously all of the performance dimensions (Hayes *et al.*, 2005). Therefore, the IMN performance assessment process model has to be sufficiently robust to embrace such complexities.

4.3 Methodological aspects

The empirical part followed an inductive case-based research (Mena *et al.*, 2013; Ketoviki and Choi, 2014), which was devised to verify the process model's congruency (internal coherence)

Category	Elements	Possible ideal attributes	Attributes' sources
Purpose(s)	–	Performance measurement; and/or Strategic management; and/or Communication; and/or Influence on behavior; and/or Learning and improvement	Franco-Santos *et al.* (2007)
Processes	Selection and design of metrics	Dimensions: cost-flexibility-innovation	Bartlett and Ghoshal (1998) Shi and Gregory (1998)
		Metrics and their KPIs (Table I) Causalities (Table II)	The author
	Data collection and manipulation	Periodicity: 1 month 3 months 6 months Annually or ad hoc	Planning review cycles (Tangen, 2005)
		Goal setting: Corporate level (disaggregated to factories); or Regional level (disaggregated to factories); or Factory level (directly – no superior levels)	Shi and Gregory (1998)
		Data consolidation: Corporate level Regional level Factory level (no consolidation)	Shi and Gregory (1998)
	Information management	Info for decision making Info as formality	Franco-Santos *et al.* (2007)
	Performance assessment	IMN performance generates rewards IMN performance does not generate rewards	Franco-Santos *et al.* (2007)
	System review	Existent Non-existent	Franco-Santos *et al.* (2007)

Source: Adapted from Franco-Santos *et al.* (2007)

Table III. Elements and attributes of the process model

and usefulness, as well as to enable the compilation of both descriptive and theoretical insights. Multiple cases, while limited to a manageable number, provide richer data for increased generalizability (Barratt *et al.*, 2011). The unit of analysis is the IMN as the manufacturing system of a multinational, regardless other operations-related functions (supply, distribution, etc.). Given the focus on the strategic level, the empirical part was conducted exclusively from the headquarters' perspective.

Data collection in each case began with secondary data from the company's websites and reports, with focus on the history of international strategy and operations, as well as a rough mapping of its IMN, with the location (country) of each factory and the management style (centralized/decentralized). The information allowed the elaboration of a longitudinal account of the company's international manufacturing. Next, prior to interviews, the company filled out a profiling form containing objective and coding-friendly data (see the Appendix for details).

The form's first section focused on identifying the IMN's mission and type, by pinpointing its configuration and coordination. Configuration embraced the geographic dispersion and strategic role of each factory as measured by the relative importance of three drivers: market, technology, or cost. Coordination embraced the governance adopted by the IMN, as measured by the organizational structure, periodicity of global operations planning,

			Coordination	
			Multidomestic	Global
Configuration	Worldwide		MMC3 – ideal attributes	GMC4 – ideal attributes
	Purposes and processes	0 – purpose(s)	"Operations monitoring" and/or "learning"	"Strategic management" and/or "communication" and/or "learning"
		A – dimensions and Metrics/KPIs	Cost – 2, 4	Cost – 1, 2, 3, 4
			Flexibility – 7, 8	Flexibility – 5, 6, 7, 8
			Innovativeness – 10, 12	Innovativeness – 9, 10, 11, 12
		B1 – periodicity	6 months or annually	1 month or 3 months
		B2 – performance goals	Factories only	Regional level, disaggregated down to factories
		B3 – consolidation	No consolidation – factory-level only	Regional level and corporate level
		C – information management	Information as formality	Information for decision-making and strategy
		D – assessment and rewards	Rewards not tied to IMN performance	Rewards tied to IMN performance
		E – process review	Existent	Existent
	Multinational		MMC2 – ideal attribut es	GMC3 – ideal attributes
	Purposes and processes	0 – purpose(s)	"Operations monitoring" and/or "learning"	"Strategic management" and/or "learning"
		A – dimensions and Metrics/KPIs	Cost – 2, 4	Cost – 1, 2, 3, 4
			Flexibility – 7, 8	Flexibility – 5, 6, 7, 8
			Innovativeness – 10, 12	Innovativeness – 9, 10, 11, 12
		B1 – periodicity	6 months or annually	1 month or 3 months
		B2 – performance goals	Regional, disaggregated to factories	Corporate level, disaggregated to factories
		B3 – consolidation	No consolidation – factory-level only	Total consolidation
		C – information management	Information as formality	Information for decision-making and strategy
		D – assessment and rewards	Rewards not tied to IMN performance	Rewards tied to IMN performance
		E – process review	Existent	Existent
	Regional		MMC1 – ideal attributes	GMC2 – ideal attributes
	Purposes and processes	0 – purpose(s)	"Operations monitoring" and/or "communication"	"Strategic management" and/or "operations monitoring" and/or "learning"
		A – dimensions and Metrics/KPIs	Cost – 2, 4	Cost – 1, 2, 3, 4
			Flexibility – 7, 8, 9	Flexibility – 5, 6, 7, 8
			Innovativeness – 11, 12	Innovativeness – 9, 10, 11, 12
		B1 – periodicity	6 months or annually	1 month or 3 months
		B2 – performance goals	Corporate level (whole region), disaggregated to factories	Corporate level, disaggregated to factories
		B3 – consolidation	No consolidation – factory-level only	Total consolidation
		C – information management	Information as formality	Information for decision-making and strategy
		D – assessment and rewards	Rewards not tied to IMN performance	Rewards tied to IMN performance
		E – process review	Existent	Existent
	Local/national		Not internacionalized	GMC1 – OUT OF SCOPE

Table IV.
Process model derivations

periodicity, and nature of reports (operational and/or financial), existence of performance assessment (factory-level and/or IMN-level), and operational processes at network level (standardized, customized, or ad-hoc). The second section addressed the elements of the IMN performance assessment process model, in order to pinpoint how IMN performance is currently assessed (purposes, metrics selection and design, data processing, information management, rewards and review process) (for more details, please see Table IV).

Then, two interviews using semi-structured questionnaires were conducted, in order to double-check the data previously gathered as well as to obtain further understanding of the international manufacturing strategy, the IMN evolution, and its performance assessment. The first and main interviewee was the head of international operations. For triangulation purposes, there was a second separate interview with the head controller, looking for likely inconsistencies and complementary information.

Data analysis consisted of three steps: history of the company's international evolution – internationalization strategies, IMN's mission, and type; causality analysis between the IMN and its performance, along with the performance assessment process; and

Organizational set – IMN Organizational elements (causes)	Performance delivered – according to dimensions C-F-I P1. Cost (effect)	P2. Flexibility (effect)	P3. Innovativeness (effect)
Configuration (structure)			
O1. Geo. Dispersion	More dispersion, more cost (Meijboom and Vos, 1997)	More dispersion, more flexibility (Shi and Gregory, 1998)	More dispersion, more innovativeness (Vereecke *et al.*, 2006)
O2. Role of factories	More complex roles, more cost (Mediavilla *et al.*, 2015)	More complex roles, more flexibility (Mediavilla *et al.*, 2015)	More complex roles, more innovativeness (Mediavilla *et al.*, 2015)
Coordination (infrastructure)			
O3. Governance	More globally oriented, less cost (Vereecke *et al.*, 2006)	More globally oriented, more flexibility (Vereecke *et al.*, 2006)	More globally oriented, more innovativeness (Vereecke *et al.*, 2006)
O4. Operations processes	More standardized processes, less cost (Shi and Gregory, 1998)	More standardized processes, more flexibility (Meijboom and Vos, 1997)	More standardized processes, more innovativeness (Zhang and Gregory, 2011)

Table V.
Causal relationships in IMNs

final analyses and discussions. The interviewees later validated notes and initial reasoning, and a final in-depth report was made. Within-case analyses in each case were complemented with cross-case analysis, in order to search for further patterns (Barratt *et al.*, 2011) and compile findings.

The theoretical sampling for the fieldwork defined that the cases had to be large multinational companies (MNEs) with same institutional environment but in different industries, with different international strategies and IMN types, for the observation of their IMN performance assessment. The minimum number was two cases (extreme opposites) and the maximum, six cases (all of the IMN types eligible). This led to three Brazilian MNEs (names were changed) in Figure 3 and their profiles in Table VI.

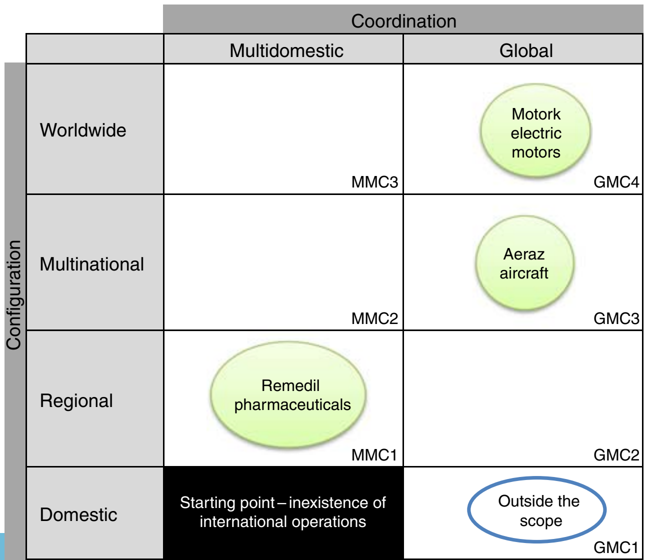

Figure 3.
Theoretical sampling for the fieldwork

Table VI.
Profile of case companies

Profile	Remedil	Aeraz	Motork
Industry/Main business	Pharmaceuticals	Aircraft	Electric motors
Foundation	1972	1969	1961
Exports	2002	1975	1972
International manufacturing	2010	2002	2000
Manufacturing strategy trend	Rooted	Footloose	Rooted
IMN type	Regional-Uncoordinated|MMC1	Global-Integrated|GMC3	Global-Coordinated|GMC4
Countries with factories (home country included)	Brazil (5 sites), Argentina (1), Chile (1), Peru (1), Colombia (1), Guatemala (1), Uruguay (1)	Brazil (3 sites), USA (1), Portugal (1)	Brazil (7 sites), Argentina (1), Colombia (1), USA (2), Mexico (1), Portugal (1), Austria (1), Germany (1) India (1), South Africa (1), China (3)
Countries with customers	17	61	95
Employees	6,500	19,000	31,000
Net revenues (2015)	US$1 billion	US$6 billion	US$4 billion

5. Fieldwork and discussion

5.1 Remedil represents the regional-uncoordinated IMN (MMC1)

One of the leading pharmaceutical companies in Latin America, it produces generic drugs, creating its rooted manufacturing network through a strategy of acquisitions; in 2016, it had 11 factories in seven Latin American countries. Its current IMN mission is basically market presence.

In order to meet regional market needs, flexibility (at factory-level instead of network-level) is prioritized over cost and innovativeness. As for IMN configuration: geographic dispersion augmented from local to regional, due to foreign factories acquisition; factory roles grew in significance and autonomy, such as the case of a factory in Argentina that was recently revamped in order to produce most of the medications sold locally. As for IMN coordination, it shifted from centralized to decentralized/multidomestic, with little production integration among factories. Thus, Remedil runs a regional un-coordinated manufacturing network – MMC1, according to Shi and Gregory (1998).

The actual performance assessment process evolved as the IMN expanded. Table VII describes each element and attribute observed in the current performance assessment, and compares with those predicted in Table IV for an MMC1.

Performance goals (B2) are set at corporate level (Latin America is not divided into sub-regions) and disaggregated to each factory. The performance assessment exercise looks at factories individually, with no formal consolidation (B3); its purpose is essentially monitoring and communication between factories and headquarters. Thus, the information generated is used for operational, not strategic, decision making (C).

As for the KPI set, Remedil utilizes those related to costs at both factory and network levels (KPIs 2 and 4), but there are no systematic KPIs in use for either flexibility or innovativeness, even though the annual factory planning report shows some figures related to them. Both observations match MMC1 type.

The performance assessment exercise (B1) takes place every three months, more frequently than predicted for multinationals adopting multidomestic coordination, what may be interpreted either as a propensity to centralized management or an effort to review and improve its IMN performance assessment process (E). Finally, even without a consolidated

Table VII. Remedil's IMN performance assessment: ideal and observed

Elements	MMC1 type's ideal attributes	Attributes observed
Purposes and processes		
0 – purpose(s)	"Operations monitoring" and/or "communication"	Existent element and equal attribute ("monitoring" plus "learning")
A – Dimensions and metrics/KPIs	Cost – 2, 4	Existent and equal
	Flexibility – 7, 8, 9	Existent and different KPIs
	Innovativeness – 11, 12	Existent and different KPIs
B1 – periodicity	6 months or annually	Existent and different (3 months)
B2 – performance goals	Corporate level (whole region), disaggregated to factories	Existent and equal
B3 – consolidation	No consolidation – factory-level only	Existent and equal
C – information management	Information as formality	Existent and equal
D – assessment and rewards	Rewards not tied to IMN performance	Existent and different
E – process review	Existent	Existent and different

IMN performance assessment, corporate managers profit from a reward system (D), which is unexpected for MMC1 type.

In sum, there is high fit between the attributes predicted by the process model for MMC1 type and those displayed by Remedil. The deviations observed seem to be explained mostly by two factors: the propensity for centralized management and the limited time of experience in the management of an ever increasing number of factories dispersed through a politically, economically, and culturally disintegrated region.

5.2 Aeraz represents the global-integrated IMN (GMC3)

It is one of the world's largest aircraft manufacturers, with three aviation-related business units. In order to maintain its first-mover strategy in a hi-tech industry, since 2002 it is expanding its international manufacturing via greenfield investments: in 2016, it operates five factories in three countries. The high outsourcing level and establishment of risk-sharing partnerships point to a combination of rooted and footloose manufacturing strategies (Ferdows, 2009). The internal IMN produces complex components and performs assembling and logistic activities. Therefore, the IMN mission combines market presence and dynamic responses.

In order to meet the diversified global demands, flexibility (at factory level, not at network level) is prioritized over cost and innovativeness. As for IMN configuration geographic dispersion augmented from local to multinational and foreign factories assumed increasingly important roles; for example, the factory in the USA has been recently expanded to host the entire business unit of executive jets. Coordination remained centralized/global from the very beginning of internationalization, in order to avoid duplication and small volumes. The whole internal and external supply chain follows standard production processes and protocols issued at headquarters, responsible for the final product assembly and delivery. Thus, Aeraz adopts a global-integrated manufacturing network – GMC3, according to Shi and Gregory (1998).

As the IMN evolved, its performance assessment changed accordingly. Table VIII describes each element and attribute observed in the current performance assessment, and compares with those predicted in Table IV for a GMC3.

Performance goals (B2) are set at corporate level (in each business unit) and disaggregated to each factory, with consolidation at corporate level (B3). The purpose of the IMN performance assessment is essentially "strategic management," consistent with the GMC3 type combined with the monitoring of operations following the sales and operations planning (S&OP) method.

Table VIII. Aeraz's IMN performance assessment: ideal and observed

Elements	GMC3 type's ideal attributes	Attributes observed
Purposes and processes		
0 – Purpose(s)	"Strategic management" and/or "learning"	Existent element and equal attribute ("strategic mgmt." plus "monitoring")
A – dimensions and metrics/KPIs	Cost – 1, 2, 3, 4	Existent and equal
	Flexibility – 5, 6, 7, 8	Existent and different KPIs (factory only)
	Innovativeness – 9, 10, 11, 12	Existent and different KPIs (Kaizen-related)
B1 – periodicity	1 month or 3 months	Existent and equal (1 month – S&OP related)
B2 – performance goals	Corporate level, disaggregated to factories	Existent and equal (S&OP related)
B3 – consolidation	Total consolidation	Existent and equal
C – information management	Information for decision-making and strategy	Existent and equal (S&OP related)
D – assessment and rewards	Rewards tied to IMN performance	Existent and different
E – process review	Existent	Existent and equal

As to the KPI set (element A), Aeraz has all the KPIs for cost (1-4), but has no IMN-level KPIs for flexibility because this is a factory-level requisite. Innovativeness is measured as the number of Kaizens. Additionally, Aeraz has quality-related KPIs that compare the quality levels of its intra-firm network with those of the extra-firm network.

The IMN performance assessment occurs (B1) monthly as predicted, also due to the use of global S&OP. The information generated (C) is used for both strategic and operational decisions and the company systematically reviews its IMN performance assessment process (E) due to continuous improvement policies. Finally, corporate managers profit from a reward system (D).

In sum, there is high fit between the attributes predicted by the process model for GMC3 type and those displayed by Aeraz. The differences may be justified by two factors. First, the company seems to be more concerned with the performance assessment of its external suppliers than with the internal manufacturing network, what is consistent with its image for pioneering global distributed manufacturing. Second, due to the nature of the product, which requires permanent innovation efforts, innovativeness is assumed as a qualifier and, in such conditions, cost and flexibility become the focal KPIs what, to some extent, is different from other industries.

5.3 Motork represents the global-coordinated IMN (GMC4)

Motork is one of the world's largest electric motors manufacturers, which accounts for 70 percent of revenues, along with four other business units. In order to maintain its global consolidation process, Motork expanded international manufacturing through acquisitions. Currently, the electric motors division has 20 factories in ten countries. The exclusive production processes, verticalization, and emphasis on product-service solutions suggest a deeply rooted manufacturing strategy (Ferdows, 2009). The IMN mission is market presence.

As a supplier in global value chains, Motork prioritizes flexibility (at factory level, not at network level) over cost and innovativeness. As for configuration, geographic dispersion shift from local to worldwide; simultaneously, foreign factory roles became more and more strategic. For example, the factory in Germany is to become an innovation hub for the whole IMN. Through the years, coordination shifted from centralized/global to decentralized/multidomestic and then back to global, in order to take full advantage of IMN's interdependence and synergy, especially to gain flexibility and production volume

(Fleury *et al.*, 2015). Thus, currently Motork has a global-coordinated manufacturing network – GMC4, according to Shi and Gregory (1998).

As the IMN evolved, its performance assessment equally evolved to meet the increasing need for information gathering and processing. Table IX describes and compares each element and attribute observed in the current performance assessment with those predicted in Table IV for a GMC4.

The purpose set by managers for the IMN performance assessment is essentially "strategic management," which is consistent with the GMC4 type. Nevertheless, it also has the purpose of monitoring operations. As to the KPI set (element A), Motork adopts all of them (1-12).

The IMN performance assessment occurs (B1) monthly, in line with predictions and explained by the secondary purpose of monitoring operations. Performance goals (B2) are set at corporate level (in the business units) and disaggregated to each factory, and there is a consolidation at corporate level (B3). Thus, the information generated (C) is used for strategic decision making, which was predicted, as well as for operational decisions. Corporate managers profit from a reward system (D), and the board of directors review themselves the IMN performance assessment process (E).

In sum, there is high fit between the attributes predicted by the process model for GMC3 type and those displayed by Motork. Performance assessment directly feeds the coordination and strategic management of the IMN. The overall performance of the IMN receives greater importance than individual factory performance.

5.4 Cross-case analysis

After the within-case analyses and prior the cross-case analysis, it is mandatory to evaluate the appropriateness of the process model constructed. Blatter and Haverland's (2012) congruency analysis was then carried out in order to evaluate the model's internal coherence. This was done by counting the coincidences between the elements confirmed and the total of elements, followed by counting the coincidence between the predicted/ideal attribute and the observed/actual attribute, in each element (please see Table IV for the process model's derivations).

Every element (purpose(s), selection and design of measures, data collection and manipulation, information management, assessment *per se*, and system review) was clearly employed by the case companies. In what concerns metrics selection and design, it was shown that the performance dimensions C-F-I, which reflect, respectively, the capabilities of thriftiness ability, manufacturing mobility, and learning, were found in different proportions

Elements	GMC4 type's ideal attributes	Attributes observed
Purposes and processes		
0 – purpose(s)	"Strategic management" and/or "communication" and/or "learning"	Existent element and equal attribute ("strategic mgmt." plus "monitoring")
A – dimensions and metrics/KPIs	Cost – 1, 2, 3, 4	Existent and equal
	Flexibility – 5, 6, 7, 8	Existent and equal
	Innovativeness – 9, 10, 11, 12	Existent and equal
B1 – periodicity	1 month or 3 months	Existent and equal
B2 – performance goals	Regional level, disaggregated down to factories	Existent and equal
B3 – consolidation	Regional level and corporate level	Existent and equal
C – information management	Information for decision making and strategy	Existent and equal
D – assessment and rewards	Rewards tied to IMN performance	Existent and equal
E – process review	Existent	Existent and equal

Table IX. Motork's IMN performance assessment: ideal and observed in each case, what is associated to the IMN's strategy and mission. As for the KPI set, only the KPIs for cost were found in all cases. As flexibility and innovativeness are visible to managers at factory-level but hardly at network level, network-related KPIs were considered less relevant. Other dimensions and its KPIs, like quality, were found, but were of secondary importance and company specific.

Once the process model's congruency was verified, cross-case analysis followed. Barratt *et al.* (2011) affirm that the pattern matching should be based on inductive replication, in which similarities and differences are compiled, until patterns start to emerge (Table X).

Within-case analyses and cross-case analysis both led to the evidence that IMN performance assessment can vary in three aspects: its features; the ways it provides feedback information for IMN coordination and feedback; and its effect, that is, the importance for IMN coordination and strategic management. This is because the redesign of an IMN leads to the redesign of its respective performance assessment. In other words, by the force of internal alignment, the attributes of the general performance assessment process model (see Table III) change in order to meet the new IMN type's features and requirements. Consequently, in each case the ideal attributes pre-defined for the IMN type (see Table IV) emulated with high congruency the actual attributes observed.

Evidence also suggest that feedback information flows to corporate managers through two possible non-mutually exclusive ways:

(1) Structured (direct feeding): the performance assessment process purposefully supports IMN strategic management. Prevailing IMN performance assessment attributes include more KPIs (focus on network, but including factories), shorter periodicity; information outcomes guide strategic decisions, performance linked to executive compensation. The best example was Motork, with rooted manufacturing strategy and globally coordinated IMN (type GMC4).

		Coordination	
		Multidomestic	Global
Configuration	Worldwide	The company uses feedback from PA for operational purposes more than strategic ones (items 0and C) Factory-level KPIs prevail over network-level KPIs (item A) Periodicity is low (item B1) As geographic dispersion is high goals disaggregation and performance consolidation are more complex; performance goals are cascaded down considering regions and sub-regions, performance assessment is consolidated accordingly (items B2 and B3); Rewards not tied to performance (item D) MMC3	The company uses feedback from PA for strategic purposesmore than operational ones (items 0 and C) Network-level KPIs prevail over factory-level KPIs (item A) Periodicity is high (item B1) As geographic dispersion is high goals disaggregation and performance consolidation are more complex; performance goals are cascaded down considering regions and sub-regions, performance assessment is consolidated accordingly(items B2 and B3); Rewards tied to IMN performance (item D) GMC4
	Multinational	The company uses feedback from PA for operational purposes more than strategic ones (items 0 and C) Factory-level KPIs prevail over network-level KPIs (item A) Periodicity is low (item B1) As geographic dispersion is limited, goals disaggregation and performance consolidation involve two levels: HQ and factory (items B2 and B3); Rewards not tied to performance (item D) MMC2	The company uses feedback from PA for strategic purposesmore than operational ones (items 0 and C) Network-level KPIs prevail over factory-level KPIs (item A) Periodicity is high (item B1) As geographic dispersion is limited, goals disaggregation and performance consolidation involve two levels: HQ and factory (items B2 and B3); Rewards tied to IMN performance (item D) GMC3
	Regional	The company uses feedback from PA for operational purposes more than strategic ones(items 0 and C) Factory-level KPIs prevail over network-level KPIs (item A) Periodicity is low (item B1) As geographic dispersion is limited, goals disaggregation and performance consolidation involve two levels: HQ and factory (items B2 and B3); Rewards tied to performance, probably as an incentive for the integrated view if the IMN (item D) MMC1	The company uses feedback from PA for strategic purposes more than operational ones (items 0 and C) Network-level KPIs prevail over factory-level KPIs (item A) Periodicity is high (item B1) As geographic dispersion is limited, goals disaggregation and performance consolidation involve two levels: HQ and factory (items B2 and B3); Rewards tied to IMN performance (item D) GMC2
	Domestic	Starting point inexistence of international operations	Outside of scope GMC1

Note: Items in italics were inferred from the others

Table X.
Comparative analysis

(2) Unstructured (indirect feeding): the performance assessment process is not designed to support IMN strategic management purposefully. Actual performance data from factories (reports, analyses, etc.) are collected for discussion only by factory managers that participate in the company's strategic process (Bourne *et al.*, 2003). Prevailing IMN performance assessment attributes include less KPIs (focus on factories); longer periodicity; information outcomes guide only operational decisions; performance is not linked to executive compensation. The best example was Remedil, with multidomestic coordination (type MMC1). Evidence suggest that the unstructured way coexists with the structured one, due to the usual sharing of infrastructure (information technology platforms), reports, and people (factory managers).

The outcomes from the application of the process model suggest that not only IMN performance assessment can vary in its attributes, but its importance as a practice for IMN coordination and strategic management can vary, too. From the standpoint of IMN typology, performance assessment is more valuable for globally coordinated types of IMNs, like the Aeraz and Motork cases, because centralized management sees the IMN as a manufacturing system that directly contributes to the company's strategic objectives. Additionally, from the standpoint of the manufacturing strategy, feedback information seems more valuable for multinationals with more rooted strategies, like the Remedil and Motork cases, due to the importance of in-house manufacturing as a competitive advantage. For that reason, companies that combine globally coordinated IMNs with rooted manufacturing strategy should display more structured and systematic ways of assessing IMN performance.

6. Concluding remarks

This paper is an initial incursion into the unchartered territory of IMN performance assessment in multinational companies. To achieve that, we had to follow a route that was inductive and iterative, since although performance assessment should be one of the key practices for the strategic management of IMNs (Figure 1), there are no models or frameworks available. Thus, we proposed a general IMN performance assessment process model (Figure 2), along with a map that contains the possible derivations of the process model, where each derivation is ideally fit for each IMN type (Table IV). For empirical verification and analysis purposes, those derivations required some assumptions, all of them compiled in the elements that are necessary and sufficient for the existence of a sound performance assessment (Table III). Among these elements, the KPIs stand out (Table II), with each KPI linked to the performance dimensions of cost, flexibility, or innovation. The three dimensions, when combined, result in the possible missions of an IMN (Table I).

The empirical verification of the process model's congruency and usefulness led to a case-based research in three companies selected, each one corresponding to one IMN type (out of the six possible types). The process model's derivations were compared to the companies' data on actual premises, procedures, and decision making regarding IMN performance assessment. The analyses revealed the complexities of such a company-wide process, involving many managers in different hierarchical levels and organizational units, dispersed around the world. As the process model was presented to the directors interviewed, they started to rethink their own IMN performance assessment, in order to find possible ways to redesign it according to the process model. In sum, there existed a high congruency between the process model achieved and the empirical evidence gathered, as well as it was a valuable tool to describe and explain how IMN performance assessment unfolds in real organizational environments.

The contributions herein delivered are the proposal of a general process model for IMN performance assessment (Figure 2), along with a map of the process model's derivation, fit for each type of IMN (Table IV). In addition, three propositions emerged from the empirical findings: IMN performance assessment has distinct characteristics depending on the type of IMN adopted, which in turn depends on the company's internationalization strategy; IMN performance assessment has more strategic value and importance for companies that are globally coordinated and adopt "rooted" manufacturing strategies; and companies design their IMN performance assessment on a trial-and-error and ad hoc basis, with layer upon layer of previous attempts.

As all case-based research, this paper has generalizability limitations. The next steps include both quantitative and qualitative research, for theoretical purposes. On the quantitative front, a survey can be conducted in order to examine the explaining power of the IMN performance assessment process model as well as include in-depth discussion of issues taken as given in this study, such as the IMN strategy (represented by the IMN's mission), the company's long-term manufacturing strategy (rooted × footloose) and related organizational contingencies, etc.; and the performance dimensions for IMNs and respective KPIs (the survey will not only include the dimensions cost, flexibility and innovation, but also speed, quality, etc.). The data forms used, especially those containing the (codified) elements of the process model, will supply the basic inputs for the survey's questionnaire. On the qualitative front, an action research can be conducted by developing and implementing a full-fledged IMN performance assessment in a multinational company, to carry out an in-depth study concerning IMN strategic management.

Finally, this study can be applied for practical purposes as well. The process model and descriptive insights may encourage managers to review and improve their current IMN performance assessment in order to achieve optimal utilization as a practice for IMN coordination and strategic management.

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Appendix. Profiling forms

Data form A – current IMN mission (required performance)			
Item	D1. Cost	D2. Flexibility	D3. Innovativeness
IMN mission – priority and percentage	_ position - _%	_ position - _%	_ position - _%

Table AI. Data form A – current IMN mission

Data form B1 – current IMN configuration (structure)				
Factory	Since	City	Country	Drivers for the factory - prioritization
1	dd/mm/yyyy			_ - Cost (_%) _ - Technology (_%) _ - Market (_%)
2				_ - Cost (_%) _ - Technology (_%) _ - Market (_%)
...	...	...	...	...
n	...	...	...	_ - Cost (_%) _ - Technology (_%) _ - Market (_%)

Table AII. Data form B1 – current IMN configuration

Data form B2 – current IMN coordination (infrastructure)		
Item	Response	
1 – Is there a formal statement regarding international manufacturing management?	Yes/No (_)	Global (_), Multidomestic (_)
2 – Organizational structure of manufacturing	Global (_), Divisional (_), Matricidal (_), Regional (_), Local (_)	
3 – Periodic reports to headquarters	Yes/No (_)	Financial (_), Operational (_), Both (_)
4 – Global planning (S&OP)	Yes/No (_)	Trimestral (_) Semester (_) Annual (_)
5 – Knowledge transfer/diffusion	Yes/No (_)	HQ to factory (_), Factory to HQ (_), Among factories (_), All (_)
6 – IMN performance assessment	Yes/No (_)	Apart from factories (_), Along with factories (_)
7.1 – Standardized processes	Transfer of Components (_), End products (_), Information (_)	
7.2 – Customized processes	Transfer of Components (_), End products (_), Information (_)	
7.3 – *ad-hoc* processes	Transfer of Components (_), End products (_), Information (_)	

Table AIII. Data form B2 – current IMN coordination

Table AIV. Data form C1 – current IMN performance assessment

Data form C1 – current IMN performance assessment	
Please fill out this form only if item 6 of data form B2 is affirmative	
0 – Purpose(s)	Strategic management (_), Operations monitoring (_), Communication (_), Learning (_)
A – Dimensions and Metrics/KPIs	Created internally (_), Taken from technical literature (_), Given by consultants (_)
	Please inform KPIs in data form C2 below
B1 – Periodicity	1 month (_), 3 months (_), 6 months (_), Annual (_), *ad hoc* (_)
B2 – Performance goals	Factory only (_), IMN/Corporate disaggregated to factories (_), Regional (_)
B3 – Consolidation	Totally consolidated (_), Regionally consolidated (_), No consolidation (_)
C – Information management	Information is formality (_) Information is essential for decisions (_)
D – Assessment and rewards	IMN performance not tied to bonus (_) IMN performance tied to bonus (_)
E – Process review	Inexistent (_) Existent (_)

Table AV. Data form C2 – metrics/KPIs for the IMN performance assessment

Data form C2 – Metrics/KPIs for the IMN performance assessment				
No.	Metric/KPI	Level	Existent?	Other KPIs not listed
1	C – Total production cost	Network/Corporate	Yes/No (_)	Cost | Please state other KPIs in use:
2	C – Unit production cost	Network/Corporate	Yes/No (_)	
3	C – Total production cost	Factory	Yes/No (_)	
4	C – Unit production cost	Factory	Yes/No (_)	
5	F – Flexibility to change product mix	Network/Corporate	Yes/No (_)	Flexibility | Please state other KPIs in use:
6	F – Flexibility to change production processes	Network/Corporate	Yes/No (_)	
7	F – Flexibility to change product mix	Factory	Yes/No (_)	
8	F – Flexibility to change production volumes	Factory	Yes/No (_)	
9	I – Product innovation – received transfer	Network/Corporate	Yes/No (_)	Innovativeness | State other KPIs in use:
10	I – Process innovation – received transfer	Network/Corporate	Yes/No (_)	
11	I – Product innovation rate	Factory	Yes/No (_)	
12	I – Process innovation rate	Factory	Yes/No (_)	

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