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How Do Different Supply Chain Configuration Settings Impact on Performance Trade-Offs?

Yasmine Sabri*
Department of Management, Economics and
Industrial Engineering, Politecnico di Milano,
Piazza Leonardo da Vinci, 32, 20133 Milan – Italy
Department of Industrial Economics and Management,
KTH Royal Institute of Technology,
Lindstedsvägen 30, 10044 Stockholm, Sweden
Email: ysara@kth.se

Guido J.L. Micheli
Department of Management, Economics and
Industrial Engineering, Politecnico di Milano,
Piazza Leonardo da Vinci, 32, 20133 Milan – Italy
Email: guido.micheli@polimi.it

Cali Nuur
Department of Industrial Economics and Management,
KTH Royal Institute of Technology,
Lindstedsvägen 30, 10044 Stockholm, Sweden
Email: cali.nuur@indek.kth.se

Abstract: The notion of 'fit' in the supply chain management literature (SCM) has evolved following the adoption of the contingency approach in an endeavour to achieve greater organisational effectiveness. In this paper, we investigate the possible approaches to achieving a state of fit between supply chain configuration settings and performance indicators, while taking into account the contextual factors related to different industry sectors and geographical dispersion levels. This study addresses the pressing issue of the performance trade-offs faced by companies to achieve a higher service level and customer satisfaction (effectiveness) on the one hand, while being cost-efficient on the other hand (efficiency).
The paper contributes to the SCM literature and practice through synthesising a conceptual framework that scrutinises the relationships between six individual configuration settings and nine effectiveness/efficiency indicators. The study's findings explain the motivations behind different configuration decisions, which help in obtaining the most appropriate fit between supply chain configuration and performance.

Keywords: supply chain configuration; supply chain design; supply chain fit; contingency approach; efficiency; effectiveness; performance management; performance trade-offs.

Biographical notes: Yasmine Sabri is a PhD candidate of Erasmus Mundus European Doctorate in Industrial Management. She is currently enrolled in Department of Management, Economics & Industrial Engineering, Politecnico di Milano, Italy, and Department of Industrial Economics and Management, KTH-Royal Institute of Technology, Sweden. Yasmine holds an MSc in Production Engineering and Management from KTH-Royal Institute of Technology. Yasmine has received the "Best Research Paper" award during the 1st annual EDIM PhD Conference in 2014. Her research interests are Supply Chain Configuration, Humanitarian Relief Chains Management, and Performance Management.

Guido J.L. Micheli is Assistant Professor of Industrial Plant Engineering at Politecnico di Milano – Italy, and co-Director of the specialised international Master in Supply Chain & Purchasing Management (MSCPM) at MIP – Graduate School of Business. He holds a PhD in Management, Economics and Industrial Engineering, an MSc in Mechanical Engineering, and a MoA. He has published papers on several international journals, including Journal of Purchasing and Supply Management, Management Decision, Risk Management, International Journal of Production Research, Production Planning & Control, International Journal of Logistics Systems and Management, and International Journal of Physical Distribution and Logistics Management.

Cali Nuur is an Associate Professor in industrial Economics and Management with specialization in Industrial Dynamics, at KTH- Royal Institute of Technology, Sweden. His research focuses on the one hand on knowledge formation processes behind industrial and technical change and transformation, and on the other on the sustainability conditions providing necessities as well as opportunities to fundamental industrial transformation.

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1. Introduction

Today's markets are becoming increasingly globalised and interconnected; thus, operations are becoming more dynamic and complex to manage. This uncertain environment, which is characterised by demand fluctuation and stiff competition, forces companies to be in continuous pursuit of new solutions to manage their supply chains effectively. Companies need to have control over their supply chain stages through measuring the supply chain's performance as well as monitoring its financial indicators to establish successful operations. Exerting this control not only facilitates demand fulfilment and responsiveness, but it also guides researchers and practitioners to identify the shortfalls and bottlenecks occurring in operations management. Moreover, monitoring performance indicators provides insights into how to plan for future decisions.

Recently, the 'hows' of supply chain management have attracted further attention from researchers. One of the relevant questions concerns how to design and configure a supply chain (Melnyk et al., 2014). The growing emphasis on the peculiarity of supply chain configuration since the beginning of the millennium (see e.g. Lapide, 2006) suggests adopting guiding principles to achieve a competitive supply chain, rather than replicating a predefined set of practices to be employed as 'best practices', hence the importance of following the contingency approach in supply chain configuration, which builds on the proposition that there is no 'one-size-fits-all' solution. The supply chain configuration's importance arises from its impact on supply chain decisions and accordingly on the performance, which is the reason behind various studies analysing the configuration. For example, Meixell and Gargeya (2005) explore different configurations of global supply chains; Cagliano et al. (2008) define clusters of global and local supply chains; von Haartman (2012) examines Fisher's (1997) model and highlights that the level of innovation and technological maturity are more complex phenomena that influence supply chain design; Caniato et al. (2013) develop four configuration archetypes based on the level of outsourcing and the location of manufacturing and sales points; Farahani et al. (2014) scrutinise supply chain network competitive design in various industries with different contextual factors to identify a framework for competitive network design; Dubey et al. (2015) propose a design for supply chain networks with respect to the sustainability and responsiveness dimensions; and other studies (see e.g. Brandenburg et al., 2014; Holweg and Helo, 2014) develop a supply chain network design based on maximising value creation. The configuration constituents are defined in many studies, predominantly as entities (e.g. supplier, manufacturer or distributor), the size and geographical location of these entities, the relationships between them, the information flow, the supply chain structure and the organisational structure (Randall and Ulrich, 2001; Min and Zhou, 2002; Tang, 2006; Chandra and Grabis, 2007; Srai and Gregory, 2008; Marsillac and Roh, 2014). Hence, it is evident that the configuration exerts an impact on almost all supply chain decisions, which often extend beyond the realm of traditional logistics management and usually incorporate operations management, information technology, marketing decisions, distribution channel design and customer service practices (Harland, 1996; Beamon, 1998; Christopher and Peck, 2004).

In supply chain excellence studies (e.g. Lapide, 2006; Pettersson and Segerstedt, 2012), it is apparent that financial measures are not the sole indicators that could reflect performance. These studies emphasise the idea of scrutinising performance as a two-dimensional phenomenon, one dimension related to cost measures and the other reflecting responsiveness. Given that cost-efficiency and responsiveness are now the minimum requirements for most companies' success, supply chain performance measurement and monitoring have always been researchers' focus. However, studies tackling these performance trade-offs are scarce. Performance, as a construct, is explored quantitatively in previous studies in terms of cost measures, which reflect *efficiency*, as well as qualitatively in terms of customer satisfaction and responsiveness, which mirror *effectiveness* (see e.g. Beamon, 1999; Brewer and Speh, 2000; Chan and Qi 2003a, 2003b; Gunasekaran et al., 2004; Bhatnagar and Sohal, 2005; Shepherd and Günter, 2006; Gunasekaran and Kobu, 2007; Fugate et al., 2010; Vijayasarathy, 2010; Ip et al., 2011).

The objective of this paper is to develop a deeper level of understanding of the relationship between configuration settings and their impact on efficiency and effectiveness indicators and how this relationship varies according to different contextual factors. The findings of previous configuration studies provide a theoretical, as well as an empirical, understanding of supply chain configuration research. However, there is a lack of development of concrete propositions for establishing a state of 'fit' between the configuration settings and the performance indicators. Similarly, there is a lack of exploration and scrutiny of this state of fit within different contexts and applications.

Against this background, the paper poses interrelated questions as follows. *How do a supply chain's contextual factors affect the way in which it is configured? In what ways does supply chain configuration have an impact on supply chain efficiency and effectiveness? What are the mechanisms that underlie performance trade-offs and how can a balance be achieved between cost and service level?* More specifically, the aim of this paper is to discuss different configurations of supply chains by means of a literature-grounded analysis of previously published case studies. Anchoring our study in the findings of the literature analysis, we synthesise supply chain configurations according to three dimensions: industrial applications, geographical dispersion level and supply chain orientation (for-profit vs. not-for-profit). This paper has implications for both research and practice. It will guide researchers to a better understanding and interpretation of the appropriateness of and rationale behind different supply chain configuration settings and their relationship with supply chain performance indicators. This study will also help practitioners in their decision making regarding supplier selection, manufacturing facility location and distribution channel design.

Apart from this introduction, the paper is structured as follows: in the subsequent section, we present the methodology and the criteria for literature inclusion. In the third section, we explore the extant literature, while section four discusses the findings, draws conclusions and suggests future research.

2. Methodology

We opted for a literature review as the main research methodology, which helped us in the analysis of the vast body of supply chain articles and various literature sources available, which contributed to developing the proposed conceptual framework for supply chain configuration fit.

Figure 1 represents the research model, in which we propose that supply chain configuration settings have a direct impact on efficiency and effectiveness indicators; meanwhile, this relationship is potentially mediated by supply chain contextual factors. The predominant relationship under examination is that between the configuration settings and the efficiency/effectiveness indicators, which will be further discussed in the subsequent sections of the paper. Supply chain contextual factors usually incorporate variables such as company size, facility location, country of origin, industry type and product and process characteristics. In this paper, we consider the industry type (or industrial application) as one of the main contextual factors of a supply chain.

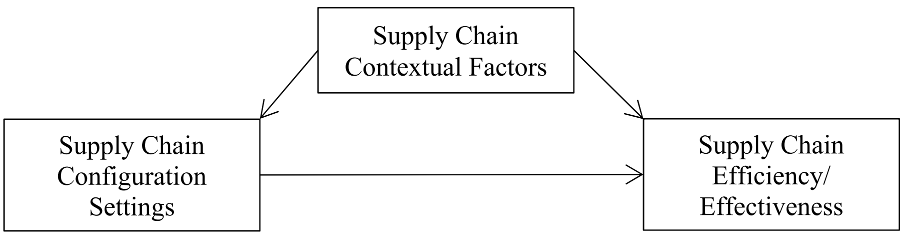

Figure 1 The Research Model

We performed a preliminary literature survey to identify the variables building the constructs of 'supply chain configuration', 'efficiency' and 'effectiveness'. This stage resulted in the identification of previously published studies and helped in examining the relationship between each configuration setting and the efficiency/effectiveness indicators. To keep the link between our research and timely practice, we looked for real-life empirical research case studies involving supply chain configuration in various contexts. In particular, the extant literature was critically reviewed by considering sources, published mainly in peer-reviewed journals, regarding the different settings of supply chain configuration and the relations among these settings within different industries in which supply chain processes take place. The initial set of keywords was identified and combined with the Boolean operators AND and OR.

The keywords covering supply chain configuration were ‘supply chain’, ‘configuration’, ‘structure’, ‘architecture’, ‘fit’, ‘design’ and ‘network design’. The keywords relating to performance dimensions were ‘effectiveness’, ‘efficiency’, ‘performance measurement’ and ‘performance management’. In a later stage, one keyword related to methodology – ‘case study’ – was introduced to filter the supply chain configuration literature. In this paper, we use ‘supply chain design’ interchangeably with ‘supply chain configuration’. A diagram representing our review methodology is provided in Fig. 2.

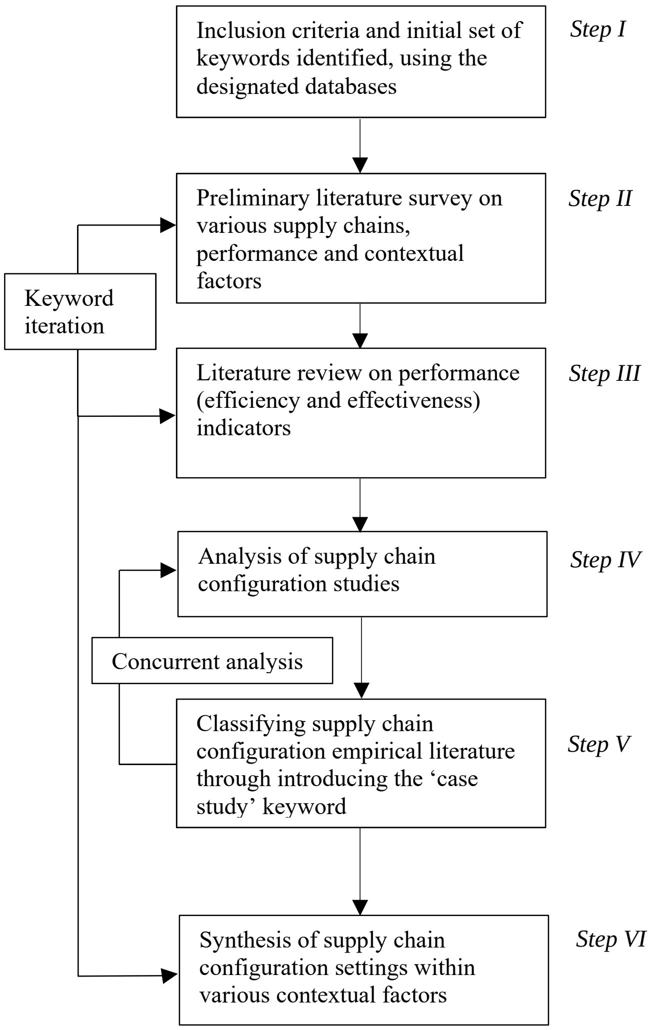

Figure 2 Review Methodology Schematic

The literature survey was performed iteratively by extending the exploration to related sources (i.e., the whole journal or book in which the paper or chapter under analysis had been published), references (i.e., checking all the cited papers within the paper or chapter under analysis) and authors (i.e., checking all the publications of the author(s) of the paper or chapter under analysis). To guarantee completeness in the literature survey, as well as high-quality papers, the following databases were used: WebOfKnowldge WOK, Scopus, ScienceDirect, IEEE Xplore and Google Scholar.

The literature analysis and review in this paper followed a rigorous approach by identifying a framework for articles' selection and inclusion. The inclusion criteria for articles were based on incorporating articles covering supply chain configuration, management and performance measurement, constructs' definitions (i.e. efficiency and effectiveness indicators) and articles with a literature review or case study as the methodology. Furthermore, to capture previously published literature for construct definition, papers' publication date was not among the inclusion criteria. The final pool of literature, after applying the inclusion criteria, yielded 36 studies as follows: 9 studies on supply chain configuration contexts, 16 studies on supply chain configuration settings and characteristics and 11 studies on supply chain performance. The outcome is depicted in Table 1.

The rationale behind the inclusion criteria was to identify configuration settings according to the complex cases of supply chains operating in different contexts. Based on the literature survey's preliminary findings, the supply chain contextual factors were synthesised according to three prevailing dimensions: different industrial sectors, either global or local operations, and profit or not-for-profit orientation.

Table 1 – Outcome of the Literature Inclusion Criteria

CONTEXT	APPLICATION	MAIN CHARACTERISTICS	CONTRIBUTORS
Industrial SC	Food industry	Perishables – medium to short product life cycle, high selling volumes, low demand fluctuation.	Reiner and Trcka (2004); Aramyan et al. (2007)
	Electronics industry	Medium to short product life cycle.	Chiang et al. (2007)
	Automotive industry	Innovation, product diversification, high product complexity, medium to short product life cycle.	Pires and Neto (2008)
	Luxury goods industry	Innovation, premium quality, product diversification, exclusiveness, short product life, low selling volumes, demand seasonality.	Brun et al. (2008); Caniato et al. (2011)
Global SC	Generic	High complexity, affected by the international situation, longer lead times, affecting inventory levels.	Meixell and Gargeya (2005); Cagliano et al. (2008); Caniato et al. (2013)
Local SC	Generic	Concentrated networks, easier to control, shorter lead times.	
For-Profit SC	Industrial context SC	Profit as the main target, demand-driven, focus on cost savings.	Industrial case study references
Not-for-Profit SC	Humanitarian SC	Rescue and aid as the main target, disaster/emergency-driven, focus on saving lives, predefined products.	Jahre et al. (2009); Pujawan et al. (2009); Costa et al. (2012)

3. Supply Chain Configuration, Context and Performance

3.1. Supply Chain Configuration

There is an increasing need to design supply chains based on 'tailored' practices, rather than replicating 'best practices' from other supply chains. As highlighted by Lapide (2006), supply chain excellence can be achieved through establishing an alignment between the business practices and the competitive strategy of the overall business. There is a myriad of supply chain configuration and design studies. Meixell and Gargeya (2005) review the literature on different configurations of global supply chains, and they review model-based literature focusing on logistics and goods movements. Their main findings highlight the inclusion of external suppliers' location as well as the focal firm's location in the models used; moreover, they advocate broadening the performance indicators used to incorporate real-life measures. The most interesting finding concerns the examination of different industry settings, since this implies different features of supply chains. Cagliano et al. (2008) define the trends of global and local supply chains with respect to sourcing and distribution using data collected from the fourth edition of the International Manufacturing Strategy Survey, which facilitates the addition of a longitudinal dimension to their study. The paper's findings highlight the importance and spreading of globalisation and identify four clusters of global supply chain trends (local supply chain, global seller, global purchaser and global supply chain). Fisher's (1997) propositions on designing a supply chain based on the level of product innovativeness predominate in the supply chain literature; some studies examine Fisher's model and propose different findings. For instance, von Haartman (2012) examines Fisher's (1997) model using a single-case study, highlighting that the level of innovation and technological maturity are more complex phenomena that influence supply chain design. Von Haartman (2012) also reflects on supply chain centralisation and asserts that supply chains should be more flexible and decentralised. Caniato et al. (2013) develop four configuration archetypes based on the level of outsourcing and the location of manufacturing and sales points: locals, shoppers, barons and globals. Their study examines how supply chain improvement programmes affect their performance; meanwhile, they propose that this relationship is moderated by the supply chain configuration. Farahani et al. (2014) scrutinise the competitive design of supply chain networks in various industries (e.g. automotive, maritime, food, airlines and hi-tech) with different contextual factors to identify a framework for competitive network design; their study highlights how supply chain designs operate when in competition.

Sustainability, as a relatively recent trend, has also captured researchers' focus. Dubey et al. (2015) propose a design for supply chain networks with respect to the sustainability and responsiveness dimensions. Using qualitative as well as mixed-integer linear programming, they examine the social and environmental dimensions in supply chain network design and develop a robust model for a responsive, sustainable supply chain. It is worth mentioning that there is a plethora of supply chain design studies using operational research, modelling and simulation techniques (see e.g. Amini and Li, 2011; Amin and Zhang, 2012; Jafarian and Bashiri, 2014; Mari et al., 2015).

Another interesting perspective is to develop supply chain network design based on maximising value creation. This notion is represented in the work of Holweg and Helo (2014), in which they consider the value chain as a design of links between suppliers and manufacturers to create value. Using a case study to reflect on how to employ product and process architectures as an equivalent to the value chain, they propose five domains for the value chain architecture. Brandenburg et al. (2014) propose a conceptual framework for the design of value-based supply chains, in addition to assessing the performance outcomes and impact of supply chain configuration on value creation.

The configuration of a supply chain is mainly concerned with the companies/entities involved (nodes), where they are located geographically (geographical dispersion level), how raw material is provided (supplier network design), how they communicate with each other (information flow), the way in which the final product reaches the final customers (distribution channel design), what kinds of links exist between these nodes (e.g. integration/collaboration/coordination) and the cash flow between these nodes. The main advantage of having such a configurable system is that it can be reconfigured instead of being replaced, leading to cost savings and achieving wider differentiation ranges to meet the customer demand for customised products (Chandra and Grabis, 2007). The configuration plays an important role in maintaining stable operations, as it encompasses all the stages responsible for delivering the final product to the customers. Furthermore, it influences production, inventory and marketing costs; thus, it should be managed properly to optimise the revenue flow, operational performance and organisational objectives to add value for customers (Randall and Ulrich, 2001). As pointed out by Power (2005), the level of inventory (i.e. investments) depends on the supply chain's cycle times, which accordingly depend on the physical distance within the supply chain on the bigger scale of the whole supply network.

Based on the literature findings, we synthesise the different approaches to configuring and designing a supply chain and we propose to categorise these approaches based on *product characteristics*, *functions and operations*, and *systems*.

The idea of designing and configuring supply chains based on the *product characteristics approach* is introduced by Fisher (1997), whose study initially proposes customised supply chain configuration for products with different functions from the same product family. For instance, in car manufacturing, luxurious sports cars are usually innovative, while regular user cars are mostly functional. Therefore, manufacturers need to have different distribution channel designs, that is, a different configuration for each car type depending on its innovation and due to the differences in demand. Meanwhile, other authors, for example Marsillac and Roh (2014), argue that supply chain configuration depends almost entirely on the product type and the product characteristics. Another interesting finding from an empirical study by Selldin and Olhager (2007) is that companies that match their product characteristics to the supply chain configuration perform better than those that do not.

The second categorisation of supply chain configuration approaches is based on the *operations and practices* performed by the supply chain's members, as well as the relationships and the governance of its organisational links. For example, Tang (2006) defines the configuration as dealing with supplier selection, manufacturing facilities and distribution channel design. Vachon et al. (2009) discuss the alignment of the supply chain and focus on configuring relationships with suppliers and supplier practices. Other studies concentrate on designing supply chains based on the governance of supplier and distributor channels and relationships (e.g. Stock et al., 2000; Sahay et al., 2003) or the planning and control of operational activities such as production and distribution (Persson and Olhager, 2002).

A *systems approach* in designing a supply chain, as defined by Chandra and Grabis (2007), is concerned with the main constituents of supply chain configuration: the entities (e.g. supplier, manufacturer, distributor), the size and location of these entities, the relationships between these entities, the information flow (information system) between these entities, the supply chain structure and the organisational structure.

Accordingly, they view a supply chain as a system of interconnected units and then classify several approaches to configuration, such as process-related, product-related, organisation-related, service-related, competitive strategy-related and resource-related approaches. As highlighted by Chandra and Grabis (2007), the uncertainty arising from the dynamic relationships between different entities, as well as the decision-making process regarding supply and demand variability, is of high significance. Min and Zhou (2002) also adopt the *systems approach* to supply chains; they view a supply chain as a system of integrated and synchronised series of business processes, with the main goal of increasing the operational efficiency, profitability and collaborative competitive advantage among the supply chain members. Randall and Ulrich (2001) categorise supply chain configurations based on two characteristics: the geographical dispersion between entities (i.e. nodes) and the production scale (capacity) with efficiency.

Table 2 – Synthesis of the Supply Chain Configuration Literature

CONFIGURATION APPROACH	MAIN CHARACTERISTIC	CONTRIBUTORS
Products' Characteristics	Designing the configuration based on product types and characteristics	Fisher (1997); Selldin and Olhager (2007); Marsillac and Roh (2014); von Haartman (2012)
Operations and Practices	Designing the configuration based on operations, practices and relationships between supply chain members	Stock et al. (2000); Persson and Olhager (2002); Sahay et al. (2003); Tang (2006); Vachon et al. (2009)
Systems Approach	Designing the configuration based on the view that a supply chain is a system of interconnected units or entities	Randall and Ulrich (2001); Min and Zhou (2002); Chandra and Grabis (2007); Lundin and Norrman (2012)

3.2. Configuration Settings and Scenarios

An analysis of supply chain configuration would be incomplete if the contextual factors are not taken into consideration, since supply chain design is 'context sensitive' (Melnyk et al., 2014). In general, configuration is the integration of subunits/subsystems to form a whole unit/system. Fisher (1997) proposes what he describes as an 'ideal supply chain configuration', in which companies start by determining the demand, then the type of products (functional or innovative), followed by the supply chain priorities (responsive, efficient, reliable or flexible).

While Fisher (1997) adopts the product characteristics approach to configuring supply chains effectively and stresses the determination of the demand as the first step, Min and Zhou (2002) and Chandra and Grabis (2007) argue that the first step in configuring a supply chain is to identify the value-adding members or partners within the chain, that is, to start by identifying the entities, their sizes and their physical location. The second step is to determine the relationships and links between these entities, the way in which they communicate (information flow) and the way in which they manage their processes (organisational structure). Finally, this is followed by determining the operational variables (demand level and product features).

There are several settings of supply chain configuration based on the industry/sector, as depicted in Table 3. The configuration is studied in four distinctive industrial sectors: the food industry (e.g. Reiner and Trcka 2004; Aramyan et al., 2007), electronics industry (Chiang et al. 2007), automotive industry (Pires and Neto, 2008) and luxury industry (Brun et al., 2008; Caniato et al., 2011). Exploration of the global/local perspective in supply chain configuration is also undertaken (Meixell and Gargeya, 2005; Cagliano et al., 2008; Caniato et al., 2013). Furthermore, humanitarian supply chain configuration is investigated as a case of a not-for-profit supply chain (Jahre et al., 2009; Costa et al., 2012). The variables covered within these case studies are the number of nodes, the size of nodes in terms of the number of employees, the geographical location and dispersion, and supplier and distribution networks' design, in addition to collaboration and integration with customers and suppliers.

Table 3 – Analysis of Different Scenarios of Supply Chain (SC) Configuration Based on the Literature

SC SCENARIO	NODES (*NUMBER OF ENTITIES*)	NODE SIZE (*NUMBER OF EMPLOYEES*)	PHYSICAL LOCATION DISPERSION	SUPPLIER NETWORK DESIGN	DISTRIBUTION NETWORK DESIGN	COLLABORATION AND INFORMATION SHARING	REFERENCES
Global SC	Number of nodes increases	Larger firm size due to increase in production facilities	Complex network; becomes more dispersed and more global	Global sourcing of raw material and global manufacturing strategies, leading to dramatic changes	Becomes more complex due to global distribution	Increases and considered extremely important to overcome risks such as political situations, transportation disruption and currency variations	Meixell and Gargeya (2005); Cagliano et al. (2008); Caniato et al. (2013)
Local SC	Number of nodes tends to decrease	Smaller firm size due to lack of capital	Concentrated network	Local sourcing. More direct relationship with suppliers	Local distribution	Maintains a good level of coordination and collaboration with suppliers	
Food Industry SC	Dependent on the activities performed	Case study in medium-sized firm	Concentrated network	Local sourcing	With the increase in supply chain distribution stages, demand volatility increases due to ordering policies and retailer promotions	Higher customer coordination by the implementation of customer satisfaction measures, such as ECR and CRM	Reiner and Trcka (2004)
Electronics SC	Dependent on the activities performed	Larger firm size	Complex network	Global sourcing	Global distribution	Increased information and capability sharing	Chiang et al. (2007)
Automotive Industry SC	High number of nodes	Large firm size, higher number of employees, but decreasing due to automation	Complex network	Global sourcing, multi-tier supplier network	Global distribution with a diverse network of retailers	High collaboration and knowledge sharing; high customer responses measures	Pires and Neto (2008)
Luxury Goods SC	Number of nodes tends to decrease	Medium to high firm size depends on the industry (e.g. cars/jewellery)	Concentrated network	Local sourcing, smaller number of suppliers to ensure higher quality	Global distribution with selected retail outlets to have higher-end customers	High collaboration Extremely high customer response measures and coordination	Brun et al. (2008); Caniato et al. (2011)
Not-For-Profit SC	Number of nodes increases due to multiple stakeholders	Mix between extremely big international organisations and small local organisations	Complex network	Global sourcing, high number of suppliers	Local distribution	Extremely high collaboration needed between international and local organisations	Jahre et al. (2009); Costa et al. (2012)

3.3. Supply Chain Performance

Performance measurement is essential for process control, effective planning and the decision-making process. Determining performance metrics facilitates integration and understanding between supply chain members (Chan and Qi, 2003b). Lapide (2006) argues that fiscal measures alone cannot represent supply chain performance. He demonstrates that a company that is struggling financially could have an excellent supply chain (such as Amazon.com at its beginning), while other companies could have high financial performance with poor supply chain practices (for example the Levi Strauss clothing company during the 1980s), emphasising the need to adopt a broader angle when scrutinising supply chain performance (Meixell and Gargeya, 2005; Gorane and Kant, 2014).

Despite the various metrics and measures associated with supply chain performance, it is still challenging to incorporate all these measures into one index due to the complexity of supply chain networks (Beamon, 1999). Pettersson and Segerstedt (2012) suggest a supply chain excellence index, which combines cost measures as well as customer satisfaction-related measures, such as product availability, speed of delivery and lead time.

In this study, we propose to classify the operationalisation of the supply chain performance construct into three approaches: *quantitative*, *qualitative* and *blended*.

The *quantitative approach* is perhaps the most well-known and commonly used set of indicators for performance control. It represents financial and cost measures, for instance cost minimisation, sales maximisation, profit maximisation, inventory minimisation, return on investments increase (ROI) (Chan and Qi 2003a), market share, return on total assets, average annual market share growth, average annual sales growth, average annual growth in return on total assets and average production cost (Tan et al., 1999). Other measures to be considered are the average inventory levels, sales and demand fulfilment rates. The *quantitative approach* also involves measures of customer responsiveness, for example the fill rate, product lateness, lead time and customer response time, in addition to quantitative productivity measures, such as capacity utilisation and resource utilisation (Chan and Qi, 2003a), as well as the overall customer service levels and overall product quality (Tan et al., 1999).

The *qualitative approach* largely involves parameters affecting customer satisfaction, for example flexibility, information and material flow integration, effective risk management, supplier performance (Chan and Qi, 2003a) and the overall competitive position (Tan et al., 1999). Customer perceptions and satisfaction are considered to be the most important performance indicators of a supply chain by Christopher (2011), since the customer is the ultimate measuring rod of supply chain success.

While the quantitative measures are the most known ones and compare assets against the current market value, some arguments favour return on investments and assets as valid performance indicators, since the financial and accounting data used in the determination of these parameters cannot provide an accurate estimation of the opportunity costs or the time value of money. In addition, regarding the effect of the company size on the validity of financial indicators, ROI is suitable as a performance indicator for mid-size firms, while it fails when the firm is larger.

Other alternative approaches to performance measurement are based on supply chain levels – *strategic*, *tactical* and *operational* – in which performance metrics are clustered based on the supply chain level. The strategic level includes top management decisions, firm policies, corporate financial plans and competitiveness. The *tactical level* is represented by middle management decisions, resource allocation and measuring the fulfilment of strategic-level objectives. The *operational level* includes line managers' decisions, mostly operational objectives and decisions related to meeting tactical-level objectives. These metrics are also aligned with the four stages/phases of the supply chain: plan, source, make and deliver (Gunasekaran et al., 2004; Srai and Gregory, 2008).

The *blended approach* can include the balanced scorecards introduced by Kaplan and Norton (1992), who investigate performance measurement including the representation of both financial and non-financial performance indicators. They categorise these mainly into four different dimensions: customer, innovation and learning, financial and internal business. In a later work, Brewer and Speh (2000) incorporate what they call 'integrated and non-integrated' measures in a firm to motivate employees to view the goals of the firm and performance related to the supply chain network as a whole instead of the individual firm. They identify 16 measures and link them to the supply chain level. They also categorise non-financial performance indicators as quality-oriented measures, time-based measures and flexibility-oriented measures as well as cost-oriented measures, which as a matter of fact contradicts their classification as a *non*-financial indicator.

3.4. Performance Trade-Offs: Efficiency vs. Effectiveness

Supply chain performance is considered to be two-dimensional, in which efficiency and effectiveness incorporate most of the performance goals of minimising costs, eliminating waste and achieving on-time deliveries while ensuring customer satisfaction.

Efficiency is defined using a variety of parameters, including improving output while minimising input (Zokaei and Simons, 2006), the ratio between the level of inputs and the level of outputs (Fugate et al. 2010), the ratio of the resources utilised to the results achieved (Mentzer and Konrad 1991) and the ability to provide the desired product/service mix at a level of cost that is acceptable to the customer (Langley and Holcomb, 1992). Effectiveness is defined as the value proposition of the supply chain to the end customers (Zokaei and Simons, 2006), the degree to which a goal is achieved (Mentzer and Konrad, 1991), the ratio between the real output and the expected output and the ability to achieve pre-identified objectives (Fugate et al., 2010).

Whilst Davis and Pett (2002) argue that there is no clarity in developing the performance constructs and the existence of trade-offs between efficiency and effectiveness as performance dimensions, other researchers, for example Mentzer and Konrad (1991) and Fugate et al. (2010), point out that effectiveness and efficiency should not be two contradictory outcomes; on the contrary, improving operational efficiency can lead to overall effectiveness and customer satisfaction. In addition, Bhatnagar and Sohal (2005) highlight the recent shift in the focus on supply chain performance from being cost-oriented to incorporating other functions, such as customer satisfaction, asset utilisation, productivity and quality. Furthermore, in their study, Fugate et al. (2010) suggest that supply chain managers realise that the objectives of efficiency and effectiveness are not totally mutually exclusive. Thus, to enhance competitive advantages and achieve a pioneering position in the market, supply chains should not rely only on cost-efficient mechanisms. Instead, a broader effectiveness view should be adopted (Walters, 2006).

Most of the efficiency and effectiveness indicators discussed in the literature represent an outcome or output of the operation. Christopher (2011) points out the importance of establishing a state of competitive benchmarking to incorporate performance indicators into the process, thus enabling practitioners and academics to evaluate process success during performance evaluation. Bhatnagar and Sohal (2005) propose a similar concept in assessing performance with respect to processes, that is, inventory, quality, flexibility, lead time and customer service. The main critique of the previously mentioned metrics is that most of the currently used supply chain performance measurements are ‘internal logistics-focused’ or ‘financial’ measures.

Table 4 and Table 5 present an analysis of supply chain efficiency and effectiveness, in addition to grouping the indicators under each construct.

Table 4 – Supply Chain Efficiency Indicators

VARIABLE	PARAMETERS	INDICATORS	REFERENCES
Supply Chain Efficiency	**Quantitative Cost and Investment Measures**	Cost minimisation	Beamon (1998); Vijayasarathy (2010)
		Sales maximisation	Beamon (1998)
		Profit maximisation	Beamon (1998); Brewer and Speh (2000); Ip et al. (2011)
		Inventory minimisation	Beamon (1998, 1999); Tan et al. (1999); Brewer and Speh (2000); Bhatnagar and Sohal (2005)
		ROI and ROA increase	Beamon (1998); Tan et al. (1999); Brewer and Speh (2000)
		Working efficiency/ production rate	Ip et al. (2011)
		Profit growth rate	Ip et al. (2011)
		Total distribution cost	Gunasekaran et al. (2004)
		Operating cost	Bhatnagar and Sohal (2005); Pettersson and Segerstedt (2012)

Table 5 – Supply Chain Effectiveness Indicators

VARIABLE	PARAMETERS	INDICATORS	REFERENCE
Supply Chain Effectiveness	**Customer Responsiveness, Quality, Flexibility**	Demand fulfilment rate/ Customer fulfilment	Beamon (1998); Brewer and Speh (2000); Chan et al. (2003); Bhatnagar and Sohal (2005); Ip et al. (2011)
		Product lateness/on-time deliveries	Beamon (1998, 1999); Bhatnagar and Sohal (2005)
		Stock-out frequency	Beamon (1998, 1999); Bhatnagar and Sohal (2005); Vijayasarathy (2010)

Order lead time	Beamon (1998, 1999); Gunasekaran et al. (2004); Bhatnagar and Sohal (2005); Pettersson and Segerstedt (2012)
Defect rate/product reliability	Ip et al. (2011); Pettersson and Segerstedt (2012)
Customer response time	Beamon (1998, 1999)
Employee fulfilment	Ip et al. (2011)
Total cycle time	Gunasekaran et al. (2004)
Flexibility	Beamon (1998); Brewer and Speh (2000); Chan et al. (2003); Mandal (2015)
Supplier performance	Chan et al. (2003); Gunasekaran et al. (2004)

3.5. Supply Chain Fit and Alignment

The notion of 'fit' in the supply chain management literature has evolved due to the adoption of the contingency approach, which hinges upon the idea of the absence of an optimal way to design a business; rather, such organisational effectiveness (i.e. fit) is contingent (dependent) on the contextual factors that exist in its internal and/or external environment (Drazin and Van de Ven, 1985; Fry and Smith, 1987).

Despite being used interchangeably in the extant literature, a closer look at the two definitions of supply chain fit and alignment concludes that there are inherent differences between them. As proposed by Wagner et al. (2012), supply chain fit is defined as the strategic consistency or matching between product and process with supply chain design characteristics. Chopra and Meindl (2007) define the 'zone of strategic fit' of a supply chain by matching the supply chain strategy to the competitive strategy to satisfy customer requirements. Similarly, Stock et al. (2000) use supply chain fit as a notion of consistency between the supply chain structure (i.e. the design) and the operational practices; more specifically, they examine the practices of extended logistics. In other words, supply chain fit is the ability of a supply chain to respond to supply and demand uncertainties while achieving positive output. Thus, supply chain configuration fit is the achievement of consistency between supply chain configuration, performance and contextual factors to achieve organisational effectiveness (Flynn et al. 2010).

On the other hand, supply chain alignment is further concerned with relationships and appropriate proportioning of incentives among the supply chain members. Based on a study of 156 Indian companies, Sahay et al. (2003) find that a supply chain is aligned when the strategies of the supply chain are perfectly aligned with the business strategies; they break down the business objectives of a company and interpret these objectives in terms of supply chain objectives. According to Lundin and Norrman (2012), a supply chain is successful when the supply chain members' incentives are aligned. Simply, if supply chain members have aligned goals regarding the financial, responsiveness and information-sharing aspects, then the supply chain will be in alignment. Misalignment is caused by hiding information or having different financial goals or unwanted business behaviours. Whilst Lundin and Norrman (2012) use a broader definition of supply chain alignment, Vachon et al. (2009) suggest in their study that supplier competencies can be a source of alignment or misalignment, defining supply chain alignment in terms of reducing the variation between supplier competencies as opposed to customer requirements.

4. Results and Discussion

The paper examines supply chains according to various contextual factors, represented by different industry types. These results (deduced from the studied literature) are anchored in the research model, in which we examine the predominant relationship between supply chain configuration settings and their impact on efficiency/effectiveness indicators; these relationships are presented in detail in the supply chain configuration fit matrix that we present in the subsequent section. In the supply chain literature, configuration is often directly linked to performance measures, as well as to operational performance. This study analyses different supply chain configuration settings and examines their contextual factors. The findings are reflected in supply chain performance. Since it is necessary not to overlook the wide span of performance indicators, the study takes into consideration both efficiency and effectiveness dimensions. Despite conventionally focusing on cost measurement, supply chain performance indicators are gradually becoming broader and non-fiscal to reflect the relationship with customer satisfaction and delivery rates.

4.1 Supply Chain Configuration Fit Matrix

The supply chain configuration fit matrix, illustrated in Table 6, is constructed from the reviewed literature. The matrix covers six configuration settings and deduces their direct relationship with nine different efficiency/effectiveness indicators. The (+) or (-) signs denote the existence of a significant positive or negative relationship, respectively, and a blank refers to a neutral (or unmentioned) relationship. Subsequently, we scrutinise each relationship in detail.

Table 6 – Supply Chain Configuration, Efficiency and Effectiveness Fit Matrix
(Chiang et al., 2007; Pires and Neto, 2008; Costa et al., 2012; Caniato et al., 2013)

	Nodes	**Nodes' Size**	**Physical Location Dispersion**	**Supplier Network Design**	**Distribution Network Design**	**Collaboration and Information Sharing**
Demand Fulfilment rate	-		-		-	
Lead Time	+		+		+	-
Defect Rate						
Stock-Out Frequency				+	+	-
Customer Response Time	+			+	+	

Manufacturing Costs			+	+	+	
Distribution Costs			+	+	+	
Operating Costs			+			-
Inventory Investment			+	+		-

4.1.1 Nodes

The number of supply chain members (nodes) involved is negatively correlated with the demand fulfilment rate and positively correlated with the lead time and customer response time. This means that the larger the number of members existing in a supply chain, the longer customers will wait before they receive their order. This can be explained by the concept of flexibility in a supply chain, in which the more entities exist in a chain, the higher is the possibility of complexity and a less responsive performance. The management and planning of a supply chain in such a case becomes very challenging. However, this can be avoided strategically through top management decisions by adopting concrete strategies for collaboration between supply chain members and operationally by investing in information-sharing tools.

4.1.2 Physical Location Dispersion

A major influencer on supply chain performance is location. It is found to be positively correlated with all cost measures (manufacturing, distribution, operating costs and inventory investments), that is, efficiency indicators, in addition to being positively correlated with the lead time while being negatively correlated with the customer response rate. These analysis results relate to the fact that the more dispersed the geographical level, the higher the costs that a supply chain will incur. From a network perspective, it is worth mentioning that the more dispersed a network is, the more fragmented and weaker it becomes. This highlights the importance of forming physical clusters and strategic alliances within the supply chain to strengthen relationships and to decrease costs by enhancing information sharing.

4.1.3 Supplier Network Design

Another influencer is the supplier network design, which is positively correlated with the stock-out frequency, customer response time, manufacturing and distribution costs and inventory investments. The supplier network design shows greater importance on the efficiency side (cost and investment) than on the effectiveness side. This reflects the importance of further exploration of buyer–supplier relationships regarding whether it is better to foster long-term or short-term relationships, whether it is better to depend on a single supplier or a network of suppliers, how to deal with supplier criticality as well as make-or-buy decisions, which affect cost measures directly.

4.1.4 Distribution Network Design

This is considered to be the third major influencer on supply chain performance indicators; it is positively correlated with the lead time, stock-out frequency, customer response time and manufacturing and distribution costs, while it is negatively correlated with the demand fulfilment rate. The analysis shows that the design of the distribution network is strongly related to the effectiveness indicators, which stresses the importance of retailers' and distributors' influence on customer satisfaction. A dispersed and complex distribution network would lead to higher supply chain costs and might damage the supply chain flexibility and responsiveness by increasing the possibility of stock-out incidents.

4.1.5 Collaboration and Information Sharing

Naturally, collaboration and information sharing also have huge significance. Their influence spans the efficiency and effectiveness indicators equivalently. However, it is negatively correlated with all the following indicators: lead time, stock-out frequency, operating costs and inventory investments. Therefore, a stronger relationship between supply chain members can increase the supply chain surplus and enable the chain to be more flexible when dealing with supply and demand uncertainties. Collaboration is often considered as a challenge, since it involves the human factor and fostering collaborative strategies and information-sharing techniques. Partnerships and alliance formation could enhance the collaborative competitive advantage of supply chain members.

4.2 Configuration Contextual Factors

In the following three sections, we further discuss the dimensions of the configuration contextual factors explored.

4.2.1 Geographical Dispersion Level Dimension

Although considered to develop cost-efficient solutions, this study finds that the globalisation of a supply chain increases the lead times and increases the complexity of the supplier and/or distributor networks, which accordingly affect the supply chain's effectiveness. Globalisation also increases the uncertainties, which might cause supply chain disruptions. Nevertheless, local supply chains can serve as an effective model; however, they are challenged by cost inefficiencies and relatively lower revenues.

4.2.2 Motive behind Supply Chain Formation: For-Profit vs. Not-For-Profit Dimension

In not-for-profit supply chains, due to the existence of a huge number of stakeholders involved in humanitarian operations, the demand fulfilment rate decreases and the complexity of the network increases because of the coordination and collaboration challenges. For-profit supply chains are generic; they incorporate almost all industrial supply chains and coincide with global/local supply chains. It is quite challenging to specify certain features of these supply chains, since we believe that they are very context-specific and hence contingent on their internal and external environments.

4.2.3 Industrial Sector Differences: Fit or Misfit? Alignment or Misalignment?

A supply chain, as a network of multiple stakeholders, faces the challenge of 'fit', that is, matching the supply chain configuration settings with its contextual factors to achieve greater responsiveness and maintaining cost-efficient operations. From the previously mentioned definitions of the ‘fit’ and ‘alignment’ notions in the extant literature, it is obvious that they do not necessarily indicate the same meaning. For instance, if a supply chain is aligned (i.e. the financial and operational targets and the incentives of the supply chain members are aligned), it can be a result of a ‘fit’ between the supply chain configuration settings and the contextual factors. In other words, if a supply chain achieves a fit, it can push its members to align the supply chain strategies with their firm-level business strategies, leading to greater incentives for all supply chain members. This can be explored further as a topic in future research. Misalignment or misfit can thus be a result of institutional pressures within the supply chain, for example if the profit within the supply chain is not fairly distributed or in the case of one supply chain member driving other members to buy more or to sell at lower prices. All these practices among supply chain members lead to a configuration that does not provide satisfactory performance.

4.3 Reflection

In summary, as illustrated in Table 7, we find that physical location dispersion and distribution network design are the major influencers on supply chain performance, each of them influencing six of the studied performance indicators. Supplier network design falls in the second position by exerting an impact on five performance indicators, and collaboration and information sharing come last by influencing four performance indicators. The efficiency indicators are mostly influenced by physical dispersion and supplier network design, while the effectiveness indicators are mostly influenced by distribution network design and collaboration and information sharing influence both efficiency and effectiveness equally.

These results are consistent with the concepts discussed previously in the literature. The configuration decisions analysed adhere to the conceptualisation of efficiency and effectiveness indicators, that is, the configuration settings, and do not contradict the theoretical background presented earlier.

Table 7 – Summary of Supply Chain Configuration Settings’ Impact on Performance Indicators

	Effectiveness Indicators (Number of)	**Efficiency Indicators (Number of)**
Physical Location Dispersion	2	4
Distribution Network Complexity	4	2
Supplier Network Complexity	1	4
Collaboration and Information Sharing	2	2

It is worth noting that, although all the configuration decisions influence both efficiency and effectiveness indicators, there is no one single configuration setting that only affects efficiency *or* effectiveness, which conforms to the idea that was highlighted in the literature review outcome and our initial propositions that effectiveness and efficiency should no longer be viewed as mutually exclusive variables. This sheds light on the importance of incorporating both parameters when measuring a supply chain's performance. Our study's findings are also backed by the findings of the empirical study performed by Selldin and Olhager (2007) among Swedish manufacturing companies, in which the findings oppose Fisher's (1997) suggestion of having a pure physically efficient or pure market responsive supply chain. In fact, Selldin and Olhager's (2007) findings suggest that most of the companies lie in the range in the middle section of Fisher's model, that is, neither 100% efficient nor 100% responsive. Our findings are also confirmed by Wagner et al.'s (2012) study, in which they highlight that in the same supply chain and with the same configuration settings, part of the supply chain was more efficient while the other part was more flexible (they used the case of an oil and gas supply chain). This finding was also presented by Chopra and Meindl (2007), who suggest that companies can improve their performance by configuring part of it to be efficient and letting the other entities focus on responsiveness.

5. Conclusion and Future Research

This paper proposes a configuration fit matrix that scrutinises the relationship between configuration decisions and performance indicators. A number of recent studies analyse supply chain configuration as well as supply chain performance; however, the merging of these two important streams of research is not fully employed. Hence, the main theoretical contribution of this paper lies in bridging the gap in supply chain management research by exploring the relationships between individual supply chain configuration settings/decisions and individual efficiency and effectiveness indicators, while taking into account the contextual factors of three different dimensions: industrial, globalisation and not-for-profit. Furthermore, the paper proposes possible remedy actions (recommendations) to avoid and overcome the challenges associated with certain configuration decisions.

Supply chain configuration has significant importance and influence on decisions regarding the (re)designing and (re)structuring of supply chain networks. However, despite its importance, configuration (and reconfiguration) is not a miraculous solution for achieving a higher level of performance: configuration is often challenged by the network structure, design decisions, institutional pressure among the supply chain players and the collaboration level between suppliers, as well as inventory investments, which are related to supply chains' cycle times. These challenges represent an opportunity for companies to seek a proper fit between configuration and performance, rather than mainly focusing on performance measurements while overlooking the significant impact of the configuration decisions. This state of fit can be achieved strategically, as well as on the tactical and operational levels, through aligning the strategies and performance indicators with the configuration settings, which can provide practitioners with a wider angle in their quest for supply chain excellence.

The limitation to our analysis is that the findings are based on selected articles from literature sources, with specified inclusion criteria that we put forward and highlighted in the methodology section, which undoubtedly limited the number of studies to be reviewed. In addition, these literature sources represent certain contextual factors and do not necessarily cover all the possible contexts that could be found in the literature or in real life.

Future research prospects might include further polishing of the configuration fit matrix and deeper investigation of the different indicators, which will definitely be reflected in further development of the proposed research model. This can also include the investigation of supply chain configuration settings within additional distinctive contextual factors (for example, companies that employ globalisation strategies versus those that do not, companies that have a well-defined organisational structure compared with family-owned companies undergoing organisational changes) and including the most relevant supply chain settings. Other future research directions could also include investigating the configuration with respect to the value chain perspective, in addition to mapping supply chain configurations based on their tendency to be effectiveness-driven and/or efficiency-driven and developing the way forward to achieve a balance between these two performance dimensions.

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