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Paper title: Viewing Lean supply from the IMP Perspective

Abstract

Purpose

The purpose of the paper is to discuss key elements of Lean supply (LS) in light of core concepts in the IMP Perspective.

Design/methodology/approach

First, we examine the literature on Lean supply and identify and discuss important characteristics and key elements of Lean supply. Second, we present key concepts in the IMP Perspective, in particular the dyad versus network levels, and the ARA model, capturing activities, resources, and actors. Third, we cross-fertilize the concepts from these two streams of research.

Findings

We identify 12 key Lean supply elements. Relating these to core IMP frameworks, we identify areas of Lean supply that can be expanded. Firstly, we found that key elements in Lean supply mainly focus on the dyadic level and that the network level is addressed to a much lesser extent and primarily captures serial “chain” connections among relationships. Secondly, we found that key elements in Lean supply predominantly focus on the activity layer and pay much less attention to resources and actors.

Research limitations/implications / Practical implications

We suggest that Lean supply theory and practice can benefit from taking a network perspective, and by paying more attention to resource and actor concepts and issues. The study is purely theoretical.

Originality/value

To our knowledge, no previous studies combine Lean supply and the IMP perspective. We add to Lean supply by elaborating how 12 key elements in Lean supply can be expanded.

Keywords

Lean production, Networks, Business relationships, Lean supply, Supplier activities.

1. Introduction

Lean as a concept has its roots in the context of the Japanese automobile industry, most specifically Toyota. The International Motor Vehicle Program popularized the term "Lean", referring to it as a series of management practices focused on business improvement, concepts, and improvement methodologies (Womack, Jones and Ross, 1990; Shook and Marchwinski, 2014). Since the 1990s, Lean management has become popular in the Western business world among both practitioners and academics, in particular due to its methods for continuous improvement and effective production. Lean principles are implemented by numerous firms to achieve operational improvement and cost reduction (Govindan et al., 2015), and the principles have been presented, discussed, and analyzed in countless articles and books over the years (Jasti and Kodali, 2015a).

Lean implementation usually starts inside a company, often in the production department, and numerous articles address issues of lean production. There are much fewer articles that focus on how Lean principles can be applied more broadly across different activities and departments in an organization as well as with external partners: *"(...)* organisations have practiced lean production principles as 'bits-and-pieces' instead of complete package across the organisation activities*"* (Jasti and Kodali, 2015b, p.882). However, as van Weele (2015) emphasizes, suppliers play a significant role in the success of a firm's performance, since purchasing spending is often more than fifty percent of turnover. Furthermore, firms increasingly outsource products and services that are becoming more complex, and therefore supply management progressively becomes a strategic issue (Gadde, 2010). Since much of a single firm's efficiency is related to these external partners and the goods that they supply, an exclusive internal focus of Lean that disregards suppliers may be insufficient to improve competitiveness.

Although the initial focus of Lean is on the internal efficiency, firms that exclusively exploit it internally are missing out on external opportunities (Netland and Powell, 2016). Some authors stress that Lean management must be extended to suppliers after implementing it internally (Dolcemascolo, 2005; Harris, 2016). Gadde and Wynstra (2018) point out that Lean management is one way of coping with uncertainty in the supply chain. The literature that explores the extended Lean concept is growing and combines elements of Lean management, the Toyota Production System, Supply Chain Management, Logistics, and Supply Management – often called Lean Supply (LS). Lean Supply focuses on process and production enhancement and their continuous improvement beyond the boundaries of a focal company. To sustain the competitiveness of firms and value chains, Lean supply techniques focus on external integration and extended value streams that add value to products and services.

How efficiency can be improved beyond the boundaries of a firm is also addressed by the Industrial Marketing and Purchasing Group (IMP) that studies how firms interact and how business relationships develop in a network context (Håkansson, 1982, Håkansson and Snehota, 1995). A fundamental principle is that no business is an island, meaning that companies are embedded in broader networks, and what is beyond the firm's boundaries considerably affects its operations (Håkansson and Snehota, 1989). Furthermore, relationships among firms are seen as long-term, and not only single and independent transactions (Håkansson, 1982). As businesses are interdependent and interrelated in broad networks, they do not exist in isolation (Ford et al., 2003). Therefore, in this context, business relationships, not individual firms, are the central unit of analysis for capturing inter-organizational phenomena. Further, the IMP perspective and its concepts about business relationships has previously been used to provide a more holistic interpretation of customer-driven supply chains types (Martinelli et al., 2017).

Against this backdrop, the purpose of this article is to discuss key elements of Lean supply in light of the IMP perspective. Towards that purpose, we raise two research questions:

RQ1: What are the key elements of Lean supply?

RQ2: How can we interpret the key elements of Lean supply in an IMP perspective, and thereby expand the Lean supply view?

We answer these research questions first by identifying key elements of Lean supply and by reviewing articles that have conducted extended literature reviews on the concept of Lean supply. Then, we introduce the IMP perspective. After that, we analyze, discuss, and interpret the key elements of Lean supply in relation to the dyad versus network dimensions of IMP, and in relation to the activities, resources, and actors (ARA) model to conceptualize how these key elements of Lean supply could be expanded, moving from a dyadic to a network view and paying attention to additional relationship elements.

2. Lean supply: literature and characteristics

Defining Lean supply (LS) presents challenges. First, the Lean concept has been criticized for continually embracing new elements that initially did not belong to it. An example of this addition is the adoption of team-based work in the Western version of Lean, while in the Japanese original Lean context presented little of team-work organization (Benders and Van Bijsterveld, 2000). Secondly, other authors have observed that many Lean definitions are too general and have even become broader over time (Shah and Ward, 2007). This paper considers Lean application in supply which, since its initial definition in the context of the Toyota production system (Womack et al., 1990), has evolved to a broader scope, with somewhat inconsistent definitions (McIvor, 2001). Much has been written about the application of Lean directed toward suppliers, with a large portion of these being prescriptive guides and based mainly or exclusively on practice (see, for example, Womack and Jones, 1996; Myerson, 2012).

Most of the Lean supply literature belongs to the area of supply chain and operations management (e.g., Srinivasan and Mandyam, 2012: Schniederjans et al., 2009), but some authors explore LS elements of logistics and resource/material management (e.g., Kerber and Dreckshage, 2011: Martin, 2007). In addition, there are studies that do not use the term Lean supply explicitly, but address relevant issues, such as the Japanese context of supplier development (e.g., Flood, 1993: Sako, 2004).

Several authors have stressed that the use of Lean principles in different settings requires research and adaptation (Ugochukwu et al., 2012; Netland and Powell, 2017). However, the variety and generality in the literature on Lean supply presents a challenge when addressing it, because the concept has been adapted to different purposes and appears as opaque. Therefore, we shall first discuss Lean supply (LS) characteristics and elements, leading to an LS model. Towards that purpose, we first present literature that has provided a summary of different phases in research on the subject, and then we address literature reviews that have aimed to provide an overview of Lean supply. However, since literature reviews are only relevant when a sufficient amount of literature on the issue to be reviewed has been amassed, these reviews capture research from earlier phases.

2.1 Lean supply research phases

Some studies have examined the research phases that Lean and Lean supply approaches have gone through. Hines et al. (2004) define four stages in the evolution of the general Lean approach focusing on: 1) cell and line (1980-1990), 2) shop-floor (mid-1990s), 3) value stream (mid to late 1990s), and 4) value system (2000 and onward). Thus, although Lean research started with an operational level focus, it has evolved to embrace a product's entire value-chain, or supply chain (Hines et al., 2004: Scherrer-Rathje et al., 2009). Thus, the last two stages of Lean research are strictly related to Lean supply.

Singh and Pandey (2015) reviewed the Lean literature related to Lean supply, focusing mainly on suppliers rather than on general Lean management, and identified 3 research phases: network management (1996-2001), Lean environment (2003-2009) and "Leagility" (2010-2013), where the latter phase addresses supply chain characteristics and strategies that combine agile and Lean

approaches (Singh and Pandey, 2015). Other authors have also addressed the differences between agile and Lean supply strategies (Naylor et al., 1999) and suggested that differing types of supply chains are appropriate for each strategy. We shall return to this discussion later. First, we shall present and compare four LS literature reviews which will enable us to identify key characteristics and elements of Lean Supply. One of the reviews is from the Lean environment phase, and the other three studies are from the leagility/value-system phase.

2.2 Literature reviews on Lean supply

The first study we discuss is the seminal work by Shan and Ward (2007), which reviewed the extant literature in order to capture and validate key elements of Lean production using different methods, for example, a verification based on input from specialists. This article first describes in depth the challenges of working with Lean concepts. Further, it discusses the literature thoroughly, and as a final contribution, presents 10 operational factors of Lean production: supplier feedback, JIT (Just-in-time) delivery, developing suppliers, involved customers, pull, flow, low setup, controlled processes, productive maintenance, and involved employees (Shan and Ward, 2007). Although their study focuses on production aspects, Lean is addressed as a total system, including and highlighting the supplier base system, in line with the production view presented by Fujimoto (1990). Apart from the two last factors (productive maintenance and involved employees) that are exclusively discussed as a matter of internal organization, the other factors presented in this study are relevant for Lean supply discussions.

In 2012, Ugochukwu et al. presented a comprehensive review of articles on Lean in the supply chain. To extract these characteristics of Lean from 40 articles, they used structured content analysis and identified eight characteristics: integrated supply chain members, effective communication and information sharing, effective demand management (demand pull), end customer focus, continuous improvement, low inventories and few suppliers, continuous flow, and long-term contracts between supply chain members (Ugochukwu et al., 2012).

In 2014, Martínez-Jurado and Moyano-Fuentes (2014) reviewed studies that combine literature on Lean management, supply chain management, and sustainability. Based on 14 articles, they compared traditional and Lean supply chains. In doing this, the following supply chain characteristics were considered: relationship type, relationship horizon, supplier base type, supplier selection and evaluation, supplier development and support, communication and information sharing, supplier involvement in product development, delivery practices, supplier quality assurance, and problem solving and improvement (Martínez-Jurado and Moyano-Fuentes, 2014).

When comparing traditional and Lean supply chains on these characteristics, Lean supply is presented as comprising of:

> Collaborative and long term relationships, a small supplier base, low vertical integration and systems (sub-assembly) supply, single or dual supply from close suppliers, multi-criteria supplier selection, supplier development and technical support, frequent communication with information sharing, participation in product development and design, frequent delivery, focus on quality assurance and lastly, joint problem solving (Martínez-Jurado and Moyano-Fuentes, 2014).

Finally, Jasti and Kodali (2015a) reviewed LS frameworks. Using both the Lean supply chain literature and expert opinions, they capture 87 elements of Lean supply (Jasti and Kodali, 2015a). From these elements, the authors create a framework based on nine pillars: information technology management, supplier management, elimination of waste, JIT production, customer relationship management, logistics management, continuous improvement, top management commitment, and leadership.

Regarding the last pillar, leadership commitment is a common debate in Lean contexts; see for example Liker (2004), who points to “leadership engagement in the philosophy” as one important principle.

Nevertheless, this principle is mainly framed as a concern for the internal organization, and we have found little discussion on this issue in the LS literature we have reviewed. Therefore, in our Lean supply model, this characteristic will be left out.

To sum up the presented studies, two of them (Ugochukwu et al., 2012; Martínez-Jurado and Moyano-Fuentes, 2014) examined characteristics of Lean supply chains, based on extant literature, whereas the two others (Shan and Ward, 2007; Jasti and Kodali, 2015a) developed a conceptual model based on extant literature and empirical research.

In the next subsection, we shall compare and combine the LS characteristics into a Lean supply model that includes the key elements of Lean supply.

3. A Lean supply model

For establishing a Lean supply model, characteristics and factors from the previous studies are combined. We adopted the supply chain categories/criteria from Martínez-Jurado and Moyano-Fuentes (2014) into our model. One supplementary criterion was created to accommodate customer focus criteria that do not appear in the other studies. Table I exhibits these 12 categories/criteria, alongside similar characteristics and factors. The table's last column presents our summary, which integrates the Lean supply elements in our model:

Table I - Elements of Lean supply in different literature reviews

	Literature reviews				
Category/ Criteria	*Martínez-Jurado & Moyano-Fuentes (2014)*	*Ugocuchukwo et al., 2012*	*Jasti & Kodali, 2012*	*Shan & Ward, 2007*	**Summary/Lean supply model**
1-Delivery practices	Very frequent	Effective demand management (demand pull)	JIT production, logistic management	JIT delivery, Pull, Flow	Lean production & logistics
2-Problem-solving & Improvement	Frequent feedback, shared risk & benefit	Continuous improvement	Continuous improvement	-	Problem solving & continuous improvement
3-Supply chain type	Low vertical integration, system supply	Integrated, continuous flow	-	-	Flow Integration System supply
4-Product development with supplier	Frequent participation, early stage	-	-	-	Involvement in product development
5-Customer focus	-	End customer focus	Customer relationship management	Involved customers	Customer focus
6-Supplier quality assurance	Strict process & evaluation system	-	-	-	Supplier quality assurance
7-Communication & information sharing	Frequent with open-door policies	Effective with information sharing	Information technology	Supplier feedback	Effective with information sharing
8-Relationship type	Collaborative relationships	-	-	-	Collaboration & partnership
9-Relationship horizon	Trust & commitment	Long-term contracts	-	-	Long-term collaboration
10-Supply base type	Small & close supply base	Low inventories & few suppliers	Supplier management	-	Few suppliers
11-Supplier selection	Multiple criteria (relation, added value)	-	-	-	Supplier selection
12-Supplier development & support	Supplier development programs	-	Supplier management	Developing suppliers	Supplier development

Although there are many similarities among the elements presented in the reviewed studies, not all elements are found in every study. This is due to the previously mentioned variation in Lean concept definition, but also the fact that studies have distinct foci, methodologies, and approaches to Lean supply. Thus, we propose a Lean supply model comprised of 12 key elements. Some of the 12 LS elements are discussed exclusively in Lean supply settings, while others are addressed in supply

literature with a broader focus. We start by discussing Lean supply elements that pertain solely to Lean, proceeding to aspects that are addressed beyond the Lean field.

LS1: Delivery practices – Lean production and logistics

LS's primary focus is on inter-firm resource flow, using Lean production and logistical tools. Methods employed in Lean production intend to reduce inventory and manage the flow of production. The production tools include "kanban" (transaction exchange cards) and vendor managed inventory (e.g., Schniederjans, 2010; Myerson, 2009; Srinivasan, 2012). Just-in-time (JIT) systems are built to reduce excess material, since high levels of inventory may result in unnecessary costs (Ohno, 1988; Harris et al., 2016). Lean production relies on demand-pull production, which aims for a just-in-time delivery from suppliers. JIT is achieved by using pull systems (producing according to demand), measuring the "takt" time (production cycle or rate) to achieve continuous production flow (Shook and Marchwinski, 2014).

In short, to ensure that resources are available at the right time (or just in time), LS entails integrating external deliveries with the internal operations. Lean production tools and practices are used to achieve supply chain integration and collaborative performance improvement (Kerber and Dreckshage, 2011). These attributes of Lean supply are discussed in a later subsection.

LS2 and LS6: Problem-solving with Continuous improvement and Supplier quality assurance

To reap external benefits, Lean supply points to the integration of inter-firm resource flows. As shown by Naylor et al. (1999), the combination of integration and collaborative improvement in LS allows for exploiting the efficiency potential of suppliers (Naylor et al., 1999). Collaborative improvement is performed through joint problem solving, with mindset directed toward long-term and continuous improvement (Liker, 2004). Moreover, products and services provided by suppliers must be delivered on time and without defect, and thus supplier quality assurance is in focus. In Lean supply, supplier quality assurance is achieved through a strict evaluation system (Martínez-Jurado and Moyano-Fuentes, 2014).

LS3 and LS4: Flow integration with systems supply and supplier involvement in product development

The focus on suppliers creates favorable conditions for collaborative improvement, but requires integrated supply chain management, including working closely with those suppliers. In these cooperative relations, increased involvement in product design and development is possible. It also allows for relying on a supplier for more complex parts or entire systems. Black box components supply, or systems supply, are identified as standard practice in Lean supply settings (Fujimoto, 1999; Martínez-Jurado and Moyano-Fuentes, 2014).

As discussed by Ugocuchukwo et al. (2012), Lean supply includes not only flow integration but also extended value stream mapping (EVSM). A Value stream mapping can be performed by a firm with the aim to draw a diagram of the flow of materials and information related to a specific product or product family (Shook and Marchwinski, 2014). In its extended version, EVSM, the mapping considers flows beyond the internal organization, to the supply chain. Lean supply literature stresses EVSM as an efficient tool for improvement in the value chain. It allows supply chain members to visualize, in a simple but comprehensive manner, processes and product families in value streams (Jones and Womack, 2002; Dolcemascolo, 2006). Jones and Womack (200) conclude that "Extended mapping cuts through this clutter to focus on just one stream in order to think of improvements that can eventually apply to all streams" (Jones and Womack, 2002, p.3). Thus, external firms are part of the overall product's value addition.

LS5: Customer focus

To specify the value for the customer is one of the traditional Lean principles (Womack and Jones, 1996). Nevertheless, its significance to the extended value chain cannot be separated from the production context. This principle is related to the focus on value adding and different approaches to production planning.

Concerning the customer demand focus, there are two approaches to production planning: speculation or postponement. While the production only starts when demand (order) is known, a postponement strategy is adopted – what is known as "make-to-order" production. If production is based on demand prediction, there is a speculation strategy, or "make-to-stock". Pull systems and Lean production employs a make-to-order, or postponement strategy (e.g., Srinivasan, 2012), but is sometimes confused with a make-to-stock strategy. This misconception is addressed by Hopp and Speerman (2004), who conclude that Lean is a strategy to minimize production variability, which employs a pull system to limit the amount of work in processing. In their view, the critical element in Lean is not the pull production, but the strategy to limit the amount of work in progress (Hopp and Spearman, 2004). Furthermore, production systems usually employ a hybrid make-to-order/make-to-stock strategy, depending on the position of the order/inventory interface within the production flow. To sum up this discussion, the use of work-in-progress limits is a characteristic typical of Lean, but the discussion on production strategy has a broader reach. For our analysis, however, we shall consider Lean supply predominantly as a pull system that makes use of JIT techniques to reduce stock and variability in production, which makes possible a smooth supplier integration and collaborative relationship. In conclusion, Lean production practices (variability reduction with pull and JIT systems), together with the integration of the value chain, are essential to Lean supply. This type of supply/value chain setup is only possible within close relationships with suppliers, requiring advanced supply management. Relationships and supply management are the next LS dimensions addressed.

LS7, LS8, and LS9: Collaboration and partnership, with effective communication and Information sharing, in Long-term relationships.

LS collaboration can only take place within partnerships like business relations, where suppliers are willing to work closely with the buyers. First, the responsiveness of Lean supply chains is recognized as a consequence of close relationships with suppliers (Qrunfleh and Tarafdar, 2013). Furthermore, LS partnerships allow not only for implementing flow integration but also for collaboration in the continuous improvement of operations (Harris et al., 2016; Fujimoto, 1999).

In the literature, it is emphasized that the LS approach to suppliers is distinct from traditional purchasing, implying that in the relationship supplier information and interests are treated with high regard, parties pursue open communication, and the relationship is oriented towards integration and partnership (Kerber and Dreckshage, 2011).

For these reasons, the literature portrays Lean buyer-supplier relationships as long-term and stable (c.f. e.g., Lamming, 1993; Kerber and Dreckshage, 2011; Jasti and Kodali, 2015a; Harris et al., 2016). To integrate the supply chain and resource flows, as well as to perform collaborative improvement, requires a coordinated effort. This requirement is stressed by Lamming (1993, p. 188), "for lean supply to be a reality, customers must (…) accept ideas that come from upstream, as readily as they expect to influence their supply chain partners." This implies a willingness to collaborate intensely in business relationships, as well as advanced supply management, covering the dimensions discussed in the next section.

LS10, LS11, and LS12: Small supplier base, Multi-criteria Supplier selection, and Supplier development and support

Supply management is not a practice exclusive to LS but is a prerequisite for implementing it. In the context of Lean, the relationship between buyers and suppliers is seen as being different from traditional transaction-oriented ones. In the 1990s, Japanese Lean companies were observed to have closer relationships and a smaller supplier base (Flood, 1993; Lamming, 1993). Later, a small supplier base became identified as a Lean supply characteristic (Ugochukwu et al., 2012; Martínez-Jurado and Moyano-Fuentes, 2014).

Moreover, supplier selection in this setting is distinct from traditional purchasing (Kerber and Dreckshage, 2011). In LS, supplier selection is not based on lowest price and competitive bidding, but considers multiple criteria, in particular previous relations, supplier capability, value added, and the true cost of changing suppliers (Martínez-Jurado and Moyano-Fuentes, 2014; Harris et al., 2016)

Beyond value chain integration, Lean supply objectives are achieved by sharing best practices with suppliers. As Hines et al. (1998) pinpoint, Toyota's success may be attributed to their highly effective integration with their suppliers, which allows for sharing of management and production practices. Moreover, as presented by Liker (2004), one principle of the Toyota (or Lean) philosophy is to challenge and help suppliers to improve.

LS settings create favorable conditions for sharing best practice and supplier development, since intense business relationships are necessary for integrating the resource flows and for performing collaborative improvement. Although this is not a primary aspect in Lean supply discussions, the closeness of these relationships is identified as a supplier efficiency enhancer (Qrunfleh and Tarafdar, 2013).

Having presented the key elements which combine to form our model of Lean supply, we shall now present the key concepts of the IMP perspective.

4. Characteristics of the IMP tradition

In the IMP research tradition, a business relationship is considered to have value in itself. It is seen as an asset that has more impact on company efficiency than a focus on competitiveness or a single firm's efficiency (Olsen, 2013). Thus, the unit of analysis in IMP is the single business relationship (dyads) and the network of relationships, which, evidentially, are complex arrangements (Håkansson and Snehota, 1995).

In the IMP perspective, interaction among firms is conceptualized as a process that underlies interconnected episodes that combine to form long-term relationships which go beyond single, independent transactions (Håkansson, 1982). Long-term relationships are seen as an effective and natural organizational form, whereas an arm's length relationships with external parties are viewed as an inefficient way of managing business exchanges. Businesses are always part of networks, and companies rely on external parties to achieve their goals and improve their performance, being dependent on these external relations, for example with suppliers (Håkansson and Snehota, 1995; Gadde et al., 2010).

How buying firms can engage with, manage, and develop their suppliers has been addressed by contributions both from within and outside of the IMP tradition (Ford, 1980; Monczka et al., 2016). The IMP view on supply has been advocated by Gadde et al. (2010) in particular, who present a supply network view on challenges in purchasing and a framework for analyzing supplier relations and discuss supply network strategies.

In IMP, business relationships are seen "as the pattern of interactions and the mutual conditioning of behaviors over time" (Ford et al., 2003, p.38). The analysis of business relations takes place by understanding the elements that make up a relationship and how these elements affect the way relations develops (Ford et al., 2003). Beyond the discussion of the (dyadic) relationship and the extended network, IMP frameworks deal with how relationships evolve in the business landscape, through interaction and interplay among the relationship primary elements which are resources, activities, and

actors (Håkansson and Snehota, 1995), also known as the ARA model. In the next section, we address each of the elements in this framework (Håkansson and Snehota, 1995; Håkansson et al., 2009).

4.1 Actors

Actor bonds "arise in business relationships as two related actors mutually acquire meaning in their reciprocal acts and interpretations" (Håkansson and Snehota, 1995, p. 197). Bonds play an essential role in shaping the identity of a company as an actor, and also in the development of trust, expectations, and commitment in the relationship (Håkansson and Snehota, 1995). What ultimately determines an actor's identity is the specific interactions (Gadde et al., 2010) in its relationships, informed by a given atmosphere and market environment (Håkansson, 1982).

A buyer's decision about how to interact with suppliers is based on his perception of previous relational episodes, the atmosphere, and the perceived value of the interactive relationship (Håkansson and Snehota, 1995). This decision affects the actor's identity within the network or supply chain. Since there is a limit to how much interaction a firm can engage in, they make choices, positioning themselves in response to previous relational episodes (Gadde et al., 2010).

The following aspects exhibit the intricacy of buyer-supplier actor bonds creation. Companies deal with each other on the basis of their interpreted identities, which lead to mutual interaction and trust, both at the individual and collective (network) level (Håkansson and Snehota, 1995). Thus, the positioning of the firm in the network and its identity are consequences not only of the firm's current bonds but also of the interpretations of these aspects both from their own perspective and that of third parties. As a consequence, the bonds formed by interaction among actors have implications for the individual actors and the webs they make up, but also for the resources they possess and the activities they perform, both individually and within the network (Håkansson et al., 2009).

4.2 Resources

No company possesses all the needed resources for its operation, so firms interact to access resources they lack (Håkansson and Snehota, 1995; Gadde et al., 2010). In inter-company relationships, firms acquire, access, provide and develop resources, that, as a result, tie them together (Håkansson and Snehota, 1995). As a consequence, buyers become strongly dependent on the resources delivered by specialized suppliers (Gadde et al., 2010).

Suppliers may be seen as a sophisticated collection of production resources, products, knowledge, and relationships (Gadde, 2010). In the IMP perspective, resources are considered heterogeneous, which means that their value results from the manner in which they are combined within and across firm boundaries, and the resulting resource ties that connect the firms' resource collections into wider constellations. Resources are not only accessed through interaction, but "interaction is the major means by which companies systematically combine their resources, activities, and actors to harvest collective gains from such combining" (Olsen, 2013, p. 162). Learning in and across relationships is thus a significant benefit that results from interaction in the resource layer.

4.3 Activities

Activity links arise when what takes place in one company is related to activities in others, and where the various activities in different firms are dependent on the activity structures of others (Håkansson and Snehota, 1995). Consequently, "Activity links in a relationship between two companies are affected by adjustments in the activity structures of the companies involved" (Håkansson and Snehota, 1995, p.50), and with higher interdependencies the inter-firm activity management increases (Gadde et al., 2010).

For single firms, activity management is relevant not only to dealing with interdependencies in dyadic relationships but also to engage with the broader network. Thus, "the division of individual activities among firms need to be analyzed in the context of the activity structure they are part of" (Dubois, 1998, p. 35).

A firm's current combination of activities and how it is related to the overall networked activity pattern determines the overall capability of the company, i.e., it's capacity to perform different activities (Håkansson and Snehota, 1995). Companies may change the boundaries of their activities, such as outsourcing those which are performed internally to other firms, which leads to new activity combinations. New combinations may provide economic advantages (e.g., standardization, scale and scope economies) and may change and increase activity interdependencies (Håkansson and Snehota, 1995). Thus, firms manage their activities to improve efficiency internally as well as across boundaries, considering the possibilities in and restrictions on the activity structures of the other parties to which their activities are linked.

The activity pattern comprises all the activities in which a firm and its network(s) are involved, including indirect activity links (Håkansson and Snehota, 1995). Activity patterns evolve through interactions in space and over time (Håkansson et al., 2009). By interacting in space, activities are linked and become interdependent. Over time, linked activities can become more specialized, adjusted, and more efficient in the activity pattern (Håkansson et al., 2009). Thus, an important managerial task is to evaluate new activity combinations, considering the specialization in the current activity pattern.

In addition, activity patterns contain specific as well as standardized activities, where the latter are activities performed to produce standardized goods, i.e., goods that can be used by different agents, and the former are activities related to a specific or particular type of products.

In activity patterns, one can also distinguish the concept of activity configuration, which consists of the set of activities needed to create a specific outcome, such as a product or service (Håkansson et al., 2009; Dubois, 1998). Addressing an activity pattern as particular parts or subnetwork structures that underlie building products may allow firms to focus on production efficiency and joint continuous improvement in business relationships. By delimiting the activity structure to that of particular products is beneficial for the analyses of the firm's activities, as these structures are intricate, due to the interconnectedness of activities (Dubois, 1998). However, since the different activity configurations and structures in the pattern are interdependent, other relevant configurations and structures must be considered in the analysis and management of activity structures (Dubois, 1998).

Having described key concepts in the IMP perspective we shall, in the following section, integrate the Lean supply model with the distinctions between dyads and network levels and actor, resource, and activity (ARA) layers.

5. Analyzing LS elements in light of IMP concepts

As discussed in the preceding section, business relationships are the central unit of analysis in the IMP perspective. They are understood through the connectedness of the ARA elements among firms in dyadic relationships and networks. In contrast, LS presents tools that are to be used, usually by a buying firm, to improve the efficiency in its value chain and supply base. Despite the differences, the elements presented in the Lean supply model are related to the actor, activity and resource layers in different ways. Furthermore, the LS elements are related either to the dyadic relationship or to the network of relationships as well, such in the cases where the focus of LS is on the supply chain. To explicate these relations, we shall now discuss each of the 12 Lean supply elements (LSE) in relation to the two IMP frameworks: the dyad versus network dimension, and the activities, resources, and actors (ARA) model.

LS1: Delivery practices – Lean production and logistics

To adopt Lean production in the supply chain is the aim of Lean supply. To achieve such an aim, many aspects of the relationship need to be considered. It must first take into account single relationships of a company, but it also involves the complex network of its suppliers. Furthermore, all elements of the relationship (activities, resources, and actors) may be involved when transferring Lean production principles and practices beyond the internal organization to suppliers, in order to improve activity

management in the supply chain and in the suppliers' organizations. One example is the l Extended value stream mapping (EVSM), an LS tool based on the drawing of a product flows which cuts across several firms and actors and involves both logistics and production resources in the activities performed in a particular value chain.

LS2: Problem-solving with continuous improvement

To adopt a continuous improvement and problem-solving mindset in the supply chain also involves both the dyadic and the network levels. This implies the possibility to transfer a philosophy of work focused on continuous improvement to the supply chain, which requires activating all relationship elements, especially inter-firm resources. Moreover, firms adopting principles of Lean supply are observed to perform problem-solving activities with second-tier suppliers within an advanced activity structure (Sako, 2004; Liker and Choi, 2004)

LS3: Flow integration and systems supply

The LS value stream/chain perspective involves looking beyond dyadic relations to complex arrangements. In LS, "firms along similar value streams often have complex relations with each other. (…and) value stream arrangements for each product involves several firms at different supply chain levels" (Jones and Womack, 2002, p.3). In practice, however, integration of flows will start at the lower business relationship level. Even though different actors are involved in flow integration and systems supply, it is often mainly the production departments of the buyers and suppliers, and the activities that have taken place (such as EVSM) and the resources involved (such as systems/components), which are fundamental to achieving flow integration.

LS4: Supplier involvement in product development

The resource layer is particularly important for supplier involvement in product development, since it focuses on creating new combinations of resources across company boundaries. Nevertheless, activities and actors are also part of this discussion. For example, when engineers from different firms are developing a new design, they need to trust each other and coordinate interdependencies across their joint and individual product development activities. In LS literature, this element is mainly applicable to dyadic relationships, and relates only a little to involvement in networks of suppliers at an early stage.

LS5: Customer focus

The customer focus element of Lean supply is, as discussed, related to the production techniques adopted in terms of demand. It seems mainly to be related to dyadic relations with suppliers when, for example, agreeing on delivery terms. However, customer focus has consequences for the approach to actors (suppliers and customers) and inter-firm activities (as when implementing pull systems and inventory reduction) at the network level.

LS6: Supplier quality assurance

Supplier quality assurance, done through evaluation systems, is predominantly discussed as activities directed at supplier relationships. These activities pertain to the dyadic level because they emphasize a single supplier's improvement through evaluation activities that focus on feedback in the dyad between a buyer and its respective supplier.

LS7: Effective communication and Information sharing

Effective communication in LS applies primarily to each business relationship at the dyadic level, such as when a buyer and a supplier share information about production. This element is connected to all relationship layers, since information sharing requires activities to be aligned, trust and understanding among involved actors in different departments and firms to be developed, as well as possibly confidential information on and insight into resources to be shared.

LS8: Collaboration and partnership

In Lean supply, the collaboration and partnership element includes all layers of a relationship (the actors, activities and resources), because this element deals with the actor bonds between buyers and suppliers (such as expectations, trust, and mutual orientation), with their resource ties (production system, products and shared knowledge) and their activity links (such as joint problem solving and improvement). It applies, however, primarily to the dyadic level, since collaboration practices are primarily devoted to improving single relationships to (first tier) suppliers.

LS9: Long-term relationships

Similar to LS element 8 (collaboration and partnership), long-term relationships involve the firm's bonds as a whole, including both relationship levels (network and dyad), and all three ARA elements. This is so because the maintenance of long-term relationships in LS settings is an endeavor that involves exploring these ties in depth (Liker and Choi, 2004) and is comprised of many different activities and much resource mobilization and actor engagement.

LS10: Few suppliers in the supply base

This is another LS element related to how firms relate to their suppliers, and the number of suppliers used for single products, systems, or categories. This element embraces aspects of actors, resources, and activities, since the number of suppliers may affect the way in which resources and components are currently combined, how activities are coordinated and conducted, as well as how actors agree on conditions and align expectations of supply and sourcing arrangements. This element primarily relates to single suppliers; however, in sourcing structures that involve two or more suppliers, the network elements are clearly also present. This applies especially to the case wherein suppliers are required to collaborate or coordinate their offerings and efforts.

LS11: Multi-criteria supplier selection

This element has similarities to the previous one (LS10: few suppliers in the supply base). All ARA elements are involved, due to the involvement of actors at different levels (operational, tactical, and strategic) in the buying firms, the consideration of allocation and acquisition of components in production and their importance in the purchasing portfolio, together with activities that go far beyond simple supplier choices. While this aspect concerns the manner in which firms approach their network of supplier relationships, it mainly has implications for the suppliers that are selected (or not), i.e., the dyadic level.

LS12: Supplier development and support

Advanced relationship management is necessary to achieve supplier development and support in LS terms. The complexity comes to the fore in the initiatives and structures that leading Lean firms establish

for training and transferring capabilities to suppliers (Hines et al., 1998; Sako, 2004). These structures comprise, for example, supplier associations, training centers, and employee transfers or visits among firms (Liker and Choi, 2004). All elements of the ARA model are activated, and both the dyadic and the network level can be involved.

In table II, the Lean supply elements and IMP concepts are juxtaposed:

Table II: The presence of Lean supply elements in the IMP framework (dyad/ network and ARA model)

Lean supply elements	Main discussions	Dyads	Networks	Activities	Resources	Actors
LS1-Delivery practices: Lean production and logistics	JIT systems, pull production	X	X	X		**x**
LS2-Problem solving & continuous improvement	Joint, long-term	X	X	**x**	X	**x**
LS3-Flow Integration and system supply	EVSM, black box components	X	X	X	X	**x**
LS4-Supplier involvement in product development	Product Design	X		**x**	X	**x**
LS5-Customer focus	Variability reduction, stocks and production	X		X		**x**
LS6-Supplier quality assurance	Evaluation system	X		X		
LS7-Effective communication with Information sharing	Open, high regard	X		X	**x**	X
LS8-Relationship type: collaboration & partnership	Coordinated effort, integration	X		X	X	X
LS9-Relationship horizon: long-term collaboration	Stable relations	**x**		X	X	X
LS10- Few suppliers in the supply base	Small supply base	**x**	X	X	X	**x**
LS11- Multi-criteria supplier selection	Previous relations, supplier capability, change costs	**x**	X	X	X	X
LS12-Supplier development & support	Management/production Best practices sharing	**x**	X	**x**	X	X

Where:

x: part of this element

X: central in this element

Based on the juxtaposition of these frameworks, we shall now discuss the patterns observed in table II.

6. Analysis and discussion

6.1 Dyadic versus Network level

As shown in table II, the dyadic level is present in all key elements of Lean supply. In many ways, the dyadic dimension of Lean supply is close to the main thoughts on business relationships addressed by the IMP perspective, focusing on building robust, collaborative, and long-term relationships with suppliers. However, one main difference is that within Lean supply, working closely with suppliers is seen as a necessary condition, since "(…) in order to provide the service required (…) competition in lean supply thus includes collaboration with competitors and between customers and suppliers." (Lamming, 1993, p. 196). In this view, the market requirements compel firms into the collaboration, and deep supplier relationships exist as a means to achieve Lean production and management in the extended supply chain. Within the IMP perspective, on the other hand, a business relationship is one of the fundamental building blocks. Thus, in the IMP perspective, business relationships are the usual way of conducting business in an interactive business world (Håkansson and Snehota, 2018). This involves working closely with the most important suppliers of the firm on issues such as innovation, new product development, efficiency, cost reduction, adaptation, etc.

As we can see from table II, the network level is also addressed in Lean supply, but in fewer of the key elements than the dyadic level. In Lean supply, the network level is mainly discussed in relation to three situations. First, it appears in relation to logistics and integrated flow (LS1 and LS3), where the discussion is often connected to integration in the value chain covering the third, second, and first-tier suppliers and the buying firm. However, the focus is mainly on supply chains and thus on serially connected relationships – rather than full-blown networks with unitary relationships among the different suppliers – and with supplier-supplier interactions at the same tier while supplier-other customer relationships are seldom taken into account. Second, the network dimension is discussed in relation to supplier base reduction and selection of preferred suppliers (LS10 and LS11). In these elements, the network dimension is visible in the sense that the buying firm analyzes its supply network to, for example, reduce the number of active first-tier suppliers and organize the supply chain/network into different tiers. Third, the network dimension is discussed in relation to continuous improvement and supplier development (LS2 and LS12), where network learning and knowledge sharing from the buying firm to and among its important suppliers is explicitly addressed (see e.g. Dyer and Nobeoka, 2000). In these situations, the Lean supply approach to discussing (supply) networks bears much resemblance to the network level in the IMP perspective, taking the wider networks (and not only the chain) into account.

To sum up, most of the discussion on the Lean supply perspective focuses on the dyadic level. Network discussions are present to a much smaller extent and pertain predominantly to serial connections.

6.2. Activities, resources and actors (ARA) model

First, the IMP perspective stresses that individual firms create activity links to increase capacity and achieve efficiency improvement in relationships with suppliers, and this manner of dealing with efficiency improvement is also evident in Lean supply.

Moreover, the IMP perspective emphasizes the distinctions and relations between standardized activities and activities adapted expressly to particular counterparts. In Lean supply chains, activities may be seen as highly specialized, due to many interdependences originating from the use of Lean

production and logistic tools, such as just-in-time inventory systems. Thereby, Lean supply may contain a higher amount of specific activities than standardized ones. Activities in Lean supply settings thus cannot be easily adjusted, i.e., standardized, to firms that do not apply LS, which, in turn, makes it more challenging to adjust LS activity combinations, or to implement Lean supply.

Furthermore, the IMP concept of activity configuration (Håkansson et al., 2009; Dubois, 1998) bears a resemblance to the concept and tool that is the extended value chain in LS literature (Jones and Womack, 2002; Dolcemascolo, 2006). Addressing the activity pattern as particular parts or sub-networks structures that concentrate on building products may allow firms to focus on production efficiency in joint continuous improvement and business relationships, as seen in Lean supply. However, since the different activity configurations in the pattern are interdependent, other relevant structures must be considered in the analysis and management of activity structures (Dubois, 1998). Related activity structures and configurations are not taken into consideration in Lean supply when, for example, analyzing specific product value streams.

Second, as shown in table II, activity layer discussions are present in all Lean supply elements and are central to many of them. Thus, the activity layer captures the main commonalities between LS and the IMP perspective. For example, delivery practices: Lean production and logistics (LS1) and effective communication and information sharing (LS7) relate to how transparent activity links can be created by analyzing if there are overlapping activities, if there are activities that are redundant, if any activities can be moved between the parties, or if any activities are missing (Dubois, 1998). In our view, this can add to the Lean Supply objective to create efficiency and reduce waste in the supply chain.

Third, as we can also observe in table II, discussions pertaining to resource ties are present in many elements of LS. Sharing resources with suppliers, such as in system supply arrangements (i.e., modular components), allows for the development of the suppliers' capabilities (Fujimoto, 1999).

Finally, in table II, we can observe that almost all LS elements contain actor layer aspects, except in LS6: supplier quality assurance. Actor bonds are especially important for creating trust, commitment, and expectations in business relationships and networks, and these bonds develop gradually over time. Furthermore, actor bonds give form to a firm's network identity, which affects the firm's position in the network.

Based on the analysis and discussion, we shall now present the conclusions and implications of our research.

7. Conclusions

The aim of this article was to discuss key elements of Lean supply in light of IMP literature. To achieve this aim, we first identified 12 key elements of Lean supply that combine to form a Lean supply model. We then discussed these elements in relation to the key IMP concepts, comprising the dyadic versus the network levels, and the activities, resources, and actors (ARA) model.

Furthermore, we conceptualized how LS elements could be expanded, first by moving from a primarily dyadic level to a network level. On the surface, the IMP and Lean supply approaches to relationships bear some resemblance. However, as we identified, the discussion from the Lean supply perspective focuses mostly on the activity layer in the dyadic level.

The IMP perspective, on the other hand, focuses on interdependency, where business relationships are embedded in and form larger networks. Thus, by taking an IMP perspective, many of the identified key elements and characteristics of Lean supply can be elaborated on and conceptualized more clearly.

Although the network dimension is also fundamental to Lean supply, it has only received relatively limited attention, and only in some of the Lean supply elements. The initial focus in Lean supply on value chain integration mainly concerns serial connections. The few elements that discuss aspects beyond the value chain are supplier development and supplier associations. Thus, LS may benefit from taking on a more comprehensive network perspective which, in turn, may enable a better understanding of and possibilities for improving efficiency in the extended supply chains and networks.

Furthermore, the discussion on the activity layer is present in all Lean supply elements. This is due to the focus of Lean supply on continuous efficiency improvement. The resource and actor layers are central in fewer Lean supply elements than the activity layer. These other ARA layers could benefit from increased attention in Lean supply discussions. As an example, LS3: flow integration and system supply involves a large number of different actors. Nevertheless, the actor layer discussions are not central in these LS elements. Furthermore, supplier development and system supply (LSE12) involves a large amount of resource adaptation and trust. Yet, resource and actor layer discussions are not central to this Lean supply element.

In summary, the key elements in Lean supply attend primarily to the dyad level, and only secondarily to serial connections at the network level. Furthermore, the key elements focus primarily on the activity layer and efficiency creation and pay much less attention to the resource and actor layers. Therefore, it would strengthen the LS approach to devote energy toward networks and all ARA elements.

In this paper, we have focused on how the IMP perspective and its main concepts can enrich the understanding of Lean supply. An interesting topic for further research is to verify how Lean supply literature can influence the IMP perspective. For example, this can be done by exploring the LS concepts concerning the extended value chain and efficiency focus related to single product groups that cut across different companies, which can be compared with the IMP perspective and concepts.

Our study enables us to offer some managerial implications for companies that aim to develop and practice Lean supply. In particular, when considering how the firm's suppliers can become more Lean, the focus on lean tools, practices, and activities in single relationships may be supplemented with considerations at the network level as well as with considerations of resource and actor layers. In particular, a buying company may consider whether actors in the supplier's network level should be taken into account, for example in supplier selection, when making continuous improvement in the supply chains and value streams, but also when undertaking supplier development. Furthermore, a buying company may consider whether the focus on activities could beneficially be complemented with more in-depth considerations of resources and capabilities that are required for reaping efficiencies. Moreover, a more comprehensive consideration of actor layer concepts like trust, expectations, and commitment could benefit Lean supply. For example, the supplier's efforts towards lean operations lead by the customer may critically depend on the extent to which the supplier trusts the buying firm's intentions and competence, but also the expectations the supplier has regarding the future development of the relationship in the wider context of its own and the buying company's networks.

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