Paper title: Lean processes across firm boundary: developing suppliers towards lean management

Abstract: The industrial marketing and purchase group (IMP) focuses on business relationships develop in a network context. Interacting in those business networks, there are different types of players, and suppliers play a significantly role in firms performance. Contributions within and outside IMP tradition studied how a buying firms can manage and develop its most important suppliers

Another interest field for researches and practitioners is Lean management, with roots in the Toyota production system. While the initial focus of Lean is on internal operational efficiency, companies that only exploit it internally are missing external opportunities. The efficient Lean implementation must include the supply base. However, applying Lean principles in the supply base is a complex task, with implications to the inter-firm and network management. This study investigates how the IMP literature can add to our understanding of Lean management beyond company`s boarders, or Lean supply (LS), by applying supply management in networks concepts to Lean supply.

LS features are analyzed within the core concept of IMP; resource ties, actor bonds, and activity links, or ARA model. Six issues emerge from this analysis and the ones appearing at the same ARA elements are grouped as strategical relational (relationship focus), resource (material flow, local inventories, and process improvement) and the analysis of the relationship dynamic (atmosphere and view on supply change). Those are proposed as the features of the LS network view.

The implications for Lean supply Network are high inter-firm activities management, crucial interdependencies within material flow, and need of a structure for capability transfers and interaction. Pertinent to the relationship dynamic issue, the implication is transparency, information flow, and integration as much as less change in the supply base. All the previous implications confirm the requirement of sophisticated supply management on the strategical relational theme.

Keywords: Lean supply management, Lean supply features, Business relationships and networks

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INTRODUCTION

The Industrial Marketing and Purchasing Group (IMP) studied how firms interact and 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 a broader network, and what is beyond the firm`s boundaries considerably affects its operation (Håkansson and Snehota, 1989). There are different types of actors interacting in business networks, and the ones influencing a company's direct value are customers, suppliers, complementors and competitors (Ritter et al., 2004). Among those, suppliers play a significant role in the firm`s performance, since the purchasing spend value of the turnover is usually more than 60% (e.g. Van Weele, 2014). Contributions within and outside IMP tradition have studied how buying firms can manage and develop their suppliers (e.g. Ford, 1980, Gadde et al., 2010, Handfield et al., 2000, Monczka et al., 2015).

Another field for business researchers and practitioners is Lean management (LM) and how organizations make their operation more efficient. While the initial focus of Lean management is on internal operational efficiency, companies that only exploit it internally are missing external opportunities (Fujimoto, 1999, Netland and Powell, 2016). The literature also demonstrates that Lean companies' success is due to their highly effective supplier integration (Hines et al., 1998). Thus, the efficient Lean implementation must include the supply base, since it is a source of competitive advantage outperforming a solely internal focus (Hines et al., 1998, Harris et al., 2016).

Nonetheless, applying Lean principles in different settings, such as in the supply base, is a complex task that requires research and adaptation (Ugochukwu et al., 2012). Further, inter-firm management is more complex than internal Lean, since the managerial control lies beyond the company's borders (Jasti and Kodali, 2015). Thus, this study investigate how the IMP literature can add to our understanding of Lean supply, by combining supply management in networks with Lean supply features.

To do so, we under present Lean management and its uses in different industries and distinct firm`s functions. Afterward, Lean philosophy in supply network management is exposed, and Lean applied to the supply side, or Lean supply (LS) is presented. In the subsequent section, LS features will be analyzed within the core concept of IMP; resource ties, actor bonds, and activity links (Håkansson and Snehota, 1995). The paper then presents the emerging issues and themes of the Lean supply network view. We close up discussing the implications for LS Network practice.

LEAN MANAGEMENT AND ITS APPLICATION

Lean management has roots in the automobile industry, most specifically from the Toyota production system (Ohno, 1988). The term Lean was popularized by the International Motor Vehicle Program studies (Womack et al., 1990) and the traditional Lean principles[1] were developed by Womack and Jones (1996). Lean is about product creation with enhanced added value (Wig, 2013) and is an approach to business improvement, concepts, and improvement methodologies, or a series of management practices (Shook and Marchwinski, 2014). Although Lean principles have roots in auto-manufacturing, studies have explored its application in other company functions (Hines et al., 2004) and across firm`s boundaries (MacDuffie and Helper, 1997). However, applying Lean in other settings implies research and adaptation of the principles (Ugochukwu et al., 2012). Netland and Powell (2016) present Lean in 15 different functions and organizational processes, and as many as 17 different industries. In their

[1] Womack and Jones (1996) appointed the five principles of Lean as follows: (i) specify the value for customer, (ii) identify all value chain steps, eliminating steps that do not add value to product (iii) create flow in the process (iv) let demand pull value and (v) repeat all stages to achieve perfect value creation. As mentioned, they are not applicable in all settings, and in this paper, the Lean applied in supply will be at focus.

analyses, they conclude that “one size fits all” Lean is a strategy for failure and that the relevance of the Lean principles depend on the settings.

In summary, Lean management is an approach to business improvement originated from the Toyota production system. Since the coining of the Lean term, there is an attempt to adopt this practice to different industries and company functions. This paper addresses in the next section its specific application in a supply management setting.

LEAN IN SUPPLY MANAGEMENT

The outsourcing of material and services is increasing as firms focus on core competencies and become more specialized (Ford et al., 2003, Gadde et al., 2010). This trend, standard practice in the Lean Japanese auto manufactures since mid-twentieth century (Fujimoto, 1999), appear to be spreading throughout industries. Supplier management gain significance on an inter-industry and on value-chains levels. Scherrer-Rathje et al. (2009) affirm that Lean means also improving throughout a product’s entire value-chain, extending from within the firm to the supply network. Externally adding value to products allows exploiting the strengths of specialists organization (Dyer and Nobeoka, 2000). In this sense, value-adding occurs besides internal operation, as it crosses to other firm’s resources and material. Further, “Lean implementation focuses on material, which is imperative to efficient operation” (Harris et al., 2016). Although the initial focus of LM must be on the internal efficiency, companies exploiting exclusively internal Lean are missing opportunities externally (Fujimoto, 1999), (Netland and Powell, 2016).

Moser (2007) proposes that “ supplier management includes all activities necessary to manage a company’s supply base or individual supplier relationships and select, evaluate, develop or source specific suppliers to generate competitive advantages for the buying firm” (Moser, 2007, p.24).Van Weele (2014) goes further affirming that supply and purchase management concentrates in internal and external issues, as it "(…) focuses on structuring and continuously improving purchasing processes within the organization and between the organization and its suppliers" (Van Weele, 2014, p.8). This paper will concentrate on the external approach of the Purchase and Supply management (PSM), or Supply management, where the aim is the effective managing of the supply base (Monczka et al., 2015). The PSM perspective entitled supply network management, or supply network is interested in the characteristics of the supplier-buyer relation (Gadde et al., 2010) and it will be used to unfold this study. Supply network is inspired by the works presented by the IMP group (e.g. Ford et al., 2003, Gadde et al., 2010).

To sum up, due to improvement possibilities beyond internal firm operation, Lean management addresses the issue of material originated at the supply base. As outsource increases throughout industries, supply management gain importance. Purchase and supply management have an internal and external approach (between firms), and the latter is relevant for this study, through the supply network perspective. Nevertheless, supply management and the buyer-supplier relationships are also evoked in Lean management literature, specifically on the theme Lean supply (LS). This theme will be presented along with its features in next section.

LEAN SUPPLY FEATURES

Hines et al. (2004) define Lean supply as value-adding across companies, in value chains or networks. Its objectives are efficiency improvement and cost reduction, through waste elimination in the value chain, as well as the partnership with suppliers (Qrunfleh and Tarafdar, 2013). Lean supply primary goal is to improve efficiency and resource flow in integration with suppliers. LS also focus on business relationship and partnership. In Lean supply literature, relationships are presented as long-lasting (Lamming, 1996, Fujimoto, 1999,

Jasti and Kodali, 2015). The stable LS relationships seem to emerge from the intensity required for achieving integrated flow efficiency. In the subsequent sub-sections, we discuss the two key features in Lean supply, the extended flow of resources and materials and the buyer-supplier relationships.

Lean supply extended value flows of resources

LS deals essentially with material and resource flow in the extended value chain (Harris et al., 2016). Trough inter-firm flow integration and conjoint flow improvement (Naylor et al., 1999), it is possible to exploit the efficiency potential of external firms. Since in a given value chain resources transit between firms, the value addition also takes place beyond company`s border. Mapping the value flow is a fundamental n Lean tool, and to extend the mapping to the supply base allows a buyer-firm to identify improvement opportunities in the value chain (Harris et al., 2016).Nonetheless, extended value mapping requires that involved firms share production information and perform open-book transactions (Harris et al., 2016). Sending pull signals or information about demand makes possible to manage the material and resources across firm's boundaries, integrating the value flow. For the integration to take place, companies must open inventory and production data, which can be confidential. Hence, information management emerges as a critical topic in LS, where effective communication and data sharing are acknowledged as its essential traces (Ugochukwu et al., 2012).

Aside from sharing information for a more efficient resources flow and operation, the consequent inter-firm transparency and openness leads to conjoint problem solving (Harris et al., 2016). Shared information and integration on long-term LS relations also facilitate supplier innovation and product development (Harris et al., 2016, Fujimoto, 1999), with higher value creation potential (Möller and Törrönen (2003).

LS is primarily concerned with improving the material and resource flow across companies, and this presumes transparency and information sharing from the companies involved. Although LS focus is on inter-firm material and resources flow, it creates favorable conditions to conjoint problem solving and innovation. This type of integration only take place within stable business relations. Business relations in an LS setting is addressed at the following sub-section.

Lean supply relationships

Authors indicate that Lean buyer-supplier relationships are long-term and stable (Liker, 2004, Harris et al., 2016, Fujimoto, 1999). Developing long-standing ties requires engagement and investment in suppliers. Fujimoto (1999) identifies two approaches that endorse commitment to suppliers. The first is based on the transactional costs theory, where firm's expenses may be reduced by reaching resources outside the company. The second view, argues that cooperation and trust culture may enhance the inter-firm efficiency (Fujimoto, 1999). Moreover, changing from one supplier to another may reduce profitability, as the supplier change "true cost" is commonly underestimated by buyers (Harris et al., 2016). Evidence of this fault is that crude market forces, such as supply and demand law, seem to be playing a more critical role in supply investment decision (Lamming, 1996) and the Lean supply considers beyond these market forces.

LS partnerships open up not only to flow integration, as previously mentioned, but also to collaboration in the continuous improvement of operations (Harris et al., 2016; Fujimoto, 1999) which usually takes place as a buyer initiative. Through supplier development activities, buyers attempt to enhance supplier's performance (Cousins and Lamming, 2008). (Handfield et al., 2000) define supplier development as any activity undertaken by buyers to improve a supplier's performance. Supplier development implies an intervention to develop or transfer simple or more complex capabilities to suppliers (Sako, 2004). Achieving success in supplier

development has shown to be challenging, but necessary (Handfield et al., 2000). Sako (2004) affirms that, in a Lean context, the primary aim of supplier development is to transfer continuous improvement capabilities. Authors found that to transfer complex capabilities, such as continuous improvement, requires considerable investments from buyers and advanced inter-company processes (Lambert and Cooper, 2000, Sako, 2004).

The Lean buyers are encourage to challenge and support suppliers to adopt Lean and continuous improvement (Liker, 2004). Lean companies, such as Toyota, invest in developing a network of suppliers (Hines, 1994). In this matter, buyer's intervention takes place, and suppliers may be unwilling to cooperate. Even so, in examples of literature, suppliers were first skeptical but later became positive and engaged (Harris et al., 2016). Also, Liker and Choi (2004) testify that suppliers involved in a Lean network are eager to learn the techniques of top-class companies. It was also verified that such networks in Toyota enabled knowledge transfer and organizational learning (Dyer and Nobeoka, 2000) and that supplier integration was primarily achieved through the establishment of supplier associations (Hines et al., 1998). Therefore, in LS it is important to support suppliers in adopting Lean. To achieve this, supply development and supplier associations are common practice.

In short, buyer-supplier relationships, with integration and conjoint improvement is another Lean supply feature. The LS relations are long-term and stable, requiring investment and resources from the parts to evolve. The suppliers may see the intervention and relation development as a threat, but the examples indicate that the relationships are mostly cooperative.

We can sum up that Lean supply aims to add value beyond company borders. Efficiency is pursuit through demand management on inter-firm resource flows, where integration and information sharing are pre-conditions. In LS, buyers may develop suppliers, transferring Lean and continuous improvement (CI) capabilities. This business relationship is affected, by interactions for flow integration and CI capabilities development. The long-term relations open ups for exploiting conjoint problem solving and innovation processes. With LS features and topics exposed, they will be next applied to the Supply network view, using as a framework the relationship interaction core elements: activities links, actors bonds and resource ties.

SUPPLY NETWORK FEATURES APPLIED TO LEAN SUPPLY

In this section, the Supply network concepts will be used to analyze Lean supply features. The basic assumptions from the Supply network perspective, as in Lean supply, the relationship among firms are long-term, rather than the occurrence of single independent episodes (Håkansson, 1982). The organizations rely on other businesses to achieve their goals and performance, thus depending on external relations (Håkansson and Snehota, 1995) and this applies especially to suppliers. In the IMP tradition, 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 of a relation, and how they affect the way relations develops (Ford et al., 2003). The business relationships evolve through interaction among its primary elements, which are activities links, actors bonds and resource ties (Håkansson and Snehota, 1995), also known as ARA model. These elements will be applied to Lean supply features, as presented by Håkansson and Snehota (1995) and at the Supply network (Gadde et al., 2010). The following sub-sections discuss "resource ties," "activity links" and "actor bonds" concepts to analyze Lean supply features.

Resource ties

No company possesses all the needed resources for its operation; so, they interact to access the ones 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, ties them together (Håkansson and Snehota, 1995). Thus, buyers are strongly dependent on the resources

delivered by specialized suppliers (Gadde et al., 2010). One essential goal in supply network management is to synchronize the inter-firm flow to the internal operation (Gadde et al., 2010), in a similar way as in the LS. In this context, the concepts of synchronization and availability are fundamental: how to get enough resources (availability) when it is needed (synchronization) (Gadde et al., 2010). Regarding availability, the task is to identify the most crucial interdependencies within material flows, to avoid unnecessary inventory (Gadde et al., 2010).

In LS resources can be two-fold: First, they are material and resource that flow between firms, with focus on the value chain material and inventory. It entails synchronizing the external delivery to the internal operation, to assure that resources are available at the right time (or Just in time). To keep inventories implies costs that in Lean supply are to be reduced (Harris et al., 2016). The Just-in-time (JIT) technique deals with excessive material, reducing inventory and its costs (Ohno, 1988). Thus, material flow interdependencies are high in LS setting. Lean supply proposes the supermarket strategy to reduce unnecessary inventory. In this strategy, suppliers feed pre-determined inventory areas at the buyer's premise, similarly to the reposition of goods in supermarkets (Harris et al., 2016) aiming to weaken the interdependency and consequently the resource ties.

Furthermore, Lean resources or capabilities can be transferred to suppliers, where the buyer intent is to develop continues improvement (CI) capabilities on suppliers, which are managerial principles and tools. To move and replicate complex capabilities, such as CI, is fundamental to develop an organizational structure (Sako, 2004). The inter-organizational structure is coupled by activity links, the topic of the next section.

Activity links

Links arise since activities taken place in one company are related to activities in others, and various activities in firms are dependent on the activities structure of others (Håkansson and Snehota, 1995). “Activity links in a relationship between two companies are affected by adjustments in the activity structures of the companies involved.” (Håkansson and Snehota, 1995) and with higher interdependencies the inter-firm activity management increases (Gadde et al., 2010).

As mentioned, interdependence with a supplier can be reduced by owning inventories (Gadde et al., 2010). Just-in-time implementation leads to strong interdependencies as it broadens the inter-firm activity management (Gadde et al., 2010). In JIT context, activities should facilitate integration and information sharing, leading to a more efficient material and resource flow. For information sharing to take place, activities structure must allow transparency and trust among actors (Araujo et al., 2016), and the interacting actors influence how firms and suppliers position themselves. Coming after, the LS application of the actor concept and the bonds their interaction entail.

Actor bonds

“Actor bonds (AB) arise in business relationships as two related actors mutually acquire meaning in their reciprocal acts and interpretations” (Håkansson and Snehota, 1995). Bonds play an essential role in shaping the identity of a company as an actor, and also in the development of trust and commitment in the relations (Håkansson and Snehota, 1995). What will ultimately determine an actor identity is the specific interaction situation (Gadde et al., 2010), in a given market environment and its atmosphere (Håkansson, 1982). In this study, the actors are buying firms and its suppliers. A buyer`s decision on how to interact with suppliers is based on the perception of previous relational episodes, its atmosphere and ultimately its value (Håkansson and Snehota, 1995). This decision affects its actor’s identity on a value chain or network. Since it is not possible to perform countless interacting, firms make choices,

positioning themselves as a response to previous relational episodes (Gadde et al., 2010). Those aspects exhibit the intricacy of buyer-supplier actor bonds creation. Relational decisions can be a challenge, and wrong firm positioning may easily take place. However, not interacting may become more costly, and firms do establish actor bonds, taking the interaction risks, for example when outsourcing products and activities.

A buyer can also underestimate the supplier value, as in LS distinct aspects form the true cost of replacing supplier. Thus, analyzing the importance of this business relationships is difficult (Ford et al., 2003). Features such as trust development and learning, appear during business interactions, and are not easily quantifiable. The Lean supply literature mentions environment and transaction costs as main explanations for firms to outsource and consequently develop suppliers. To perform capability transfer and development of suppliers cause a higher incidence of actor bonds and stronger interdependency.

In the previous discussions, we have applied the supply network concepts to the Lean supply principles, addressed within each relational elements (ARA). We will subsequently summarize our analysis.

Summary- Supply network applied to Lean Supply

The critical issues emerging from the previous discussion on relationship elements applied to Lean supply features are: (i) The focus of the relationship with suppliers. In the supply network view, relationships are vital to a firm's success and should be managed appropriately, whereas in Lean supply perspective, the buyer-supplier relation must be integrated, and partnership usually takes place. In both views, long-term relations are appointed. This issue turns out on all elements debates, and will be further entitled as "relation focus". (ii) The approach to "local inventories" is dealt in activity links and resource ties analysis. Inventories are presented as a way to deal with interdependencies. For supply network, low inventory implies interdependencies and LS suggests the supermarket inventory practice to deal with it. (iii) The handling of the inter-firm material flow (material flow) is also discussed at activity links and resource ties sections, as much as (iv) the improvement of the inter-firm processes and capabilities (or process improvement). Issues (iii) and (iv) represent the double meaning of resources in LS, the inter-firm material flow, and Lean capabilities. Finally, the discussion on (v) the relation atmosphere and (vi) the approach to changes in the relationships (or supply change) are done both at the debate on resource ties and actor bonds. In Lean supply, the relational atmosphere is of integration and information sharing, whereas supply network presents similar concepts, such as transparency, trust, and commitment. The approach to change in supply base is analogous at supply network and LS, moving away from the idea that suppliers are easily exchangeable. The principle of true cost in LS implies a more careful evaluation of buyer-supplier relationships and supplier associations are mechanisms to nurture these relations. Summed up in table 1 are those six critical issues, their connection with the discussions on the different relation elements and its distinctions on LS and supply network view. The table also displays the implications of the issues to LS Network practice, which are addressed in next session.

Table 1 - Similar issues from supply network and LS and its implications on LS network view

Presence in rel. elements debate	Key issues	Supply Network view	Lean Supply view	Implications on LS Network view
Resource ties (RT), actor bonds (AB) & activity links (AL	i-Relationship focus	Relationship management. Long-term relations	Relationship integration, partnership	Complex supply management.
RT and AL.	ii-Local inventories	Low inventory, implies higher interdependence	Low inventory, Supermarket inventory	High inter-firm activities management
RT and AL.	iii-Material flow	Synchronization and availability, Lower inventories	Value stream flow, low inventory	Identify the crucial interdependencies in the physical flow
RT and AL.	iv-Process improvement	Development of processes for interaction	Transferring Lean capability/continuous improvement	Structure for capability transfers and interaction
RT and AB.	v-Relation atmosphere	Transparency, trust, and commitment	Information sharing, integration	Transparency, information flow, integration
RT and AB.	vi-Relation change	Cost of business relations, business or network partners	True cost evaluation, partnership, association	Less change in the Supply base, correct actor positioning

THE LEAN SUPPLY NETWORK

The six identified issues emerged in distinct discussions on the three relationship elements and Lean supply. To draw the strengths of this analysis, the issues that appear at the same elements can be grouped as the following themes: strategical relational (relationship focus), resource (material flow, local inventories, and process improvement) and lastly, the analysis of the relationship dynamic (atmosphere and view on supply change). The themes arisen from the grouping (strategic relational, material and process flow, relation dynamics) are proposed as the basic features of the Lean supply network view.

The implications for Lean supply Network practice related with material and process flow theme are (i) high inter-firm activities management, (ii) to identify crucial interdependencies within material flow, and (iii) need of a structure for capability transfers and interaction. Pertinent to the relationship dynamic theme, the implication is transparency, information flow, and integration as much as less change in the supply base. All the previous implications confirm the requirement of sophisticated supply management on the strategical relational theme. We concluded proposing the features and identifying the implications for LS network practice. The last section states our final considerations.

FINAL CONSIDERATIONS

This paper identified six issues emerging from the combination of LS and the ARA model elements. They were grouped in three themes that are suggested as features of the LS network view. The implications for LS network were described, concluding that it implies complex supply management, with special attention to the issues and themes identified.

It is worthy to note that this study concentrates on the buyer-supplier interface management and their two main aspects, how to make suppliers more efficient and how to coordinate different actors (Monczka et al. (2015). The LS network theme -material and process flow- is related to how to make suppliers more efficient. It includes initiating and organizing processes for interaction with suppliers, with significance for resource allocation

and organizational design (Gadde et al., 2010). In this LS network theme, the efficiency improvement focus can be as much on the material and resource flow, as in the Lean capabilities transfer. Since supplier's capabilities can influence a company's differentiation (Monczka et al., 2015), the structure of processes within companies is vital for creating superior competitiveness and profitability (Lambert and Cooper, 2000). Sako (2004)`s article on automobile producers adopters of Lean philosophies, found the need for a structure not only to interact with suppliers but also to transfer internal capabilities.

Another LS network theme, relation dynamics, involves how to coordinate different actors. The Supply network view explains the occurrence of fewer suppliers due to purchasing specialization and high-involvement relations (Ford et al., 2003). In Lean supply, a more integrated approach to suppliers may justify the existence of long-term business relations and supplier associations. However, little is said in the literature about the implications of LS on other members of the supply base, at the network level. The inter-firm material flow is mostly focused on the dyadic (buyer-supplier) relationship. A contribution from Supply network to Lean supply can be to verify the interrelatedness of the supplier base, for instance in the supply associations. It could be that companies from ties further apart are more important to the flow efficiency and to the value addition. A possibility is to use triad models in LS, as they can open for better investigation of a company`s network (Ritter, 2000, Vedel et al., 2016).

The found implications for LS network practice predicts complex supply management. In this regard, issues related to buyer-supplier interaction are in a way overlooked in LS literature. A contribution from Supply Network to LS could be to address essential aspects in relationship development with suppliers such as the level of involvement (high and low) and relationship regularity (Ford et al., 2003, Gadde et al., 2010).

Finally, the supply network perspective adds the interaction complexity, actor's identity and the positioning analysis to supplier development. Some findings show "that the number of suppliers and the corresponding involvement proved to be the typical dimensions of the relative positioning of actors." (Gadde et al., 2010, p. 145). In LS, firms positioning may be favorable to less change in the supply base.

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