

# The Importance of Relational Tightness in Network for Lean Implementation and Firm Competitiveness

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## ABSTRACT

The purpose of this paper is to understand how firms can enhance their leanness by building close network relationships in all the three actors, resources and activities layers of substance of business relations. Thus, our aim in this article is to understand and highlight the network effects on lean firm performance. In the lean management literature, we find evidence and provide examples about activity pattern, resource constellation and web of actors dimensions effect on lean firm performance. Based on literature review of lean supply networks we propose in this article that *relational tightness in network* - “tight” or “thick” business relationships (in the three layers of actors, resources and activities) reinforce the positive relationship between lean practices and firm’s performance.

*Keywords:* lean supply chain management, lean house, business network, interdependences, interconnectedness, connected relations, substance of business relationship, activity pattern, resource constellation, web of actors, relational tightness

## INTRODUCTION

Globalization affects many parts of the world and firms always search for some new innovative management and production systems, that can be implemented in the enterprise and create a miracle change for their competitiveness. One of such systems of how to develop and control capabilities that make firms competitive in the global market is Lean Production (LP). The main idea of LP is to create value to the customer, respond to customer demands on products’ quality, time of delivery, etc., by reducing waste.

Notably, the bestselling research conducted by Womack et al. (1990) in MIT “The Machine that Changed the World” concluded on the universality of applicability of lean ideas: “We believe that the fundamental ideas of lean production (LP) are universal – applicable anywhere by anyone – and that many non-Japanese companies have already learnt this” (p. 9).

While this universality cannot be challenged as lean methods of management have spread on all continents since that statement was made 28 years ago, it can be supposed that Toyota – their example firm – benefited as well from a very strong cluster localization and from a strong network of partners that were both streamlined for effective company resource management. Notably, in the beginning, Toyota brought their own Japanese suppliers to US - “Japanese automakers frequently brought their suppliers with them to the USA, often finding this easier than to train US firms in the techniques of lean production; in the 1980s over 300 Japanese auto suppliers came to the USA” (MacDuffie and Helper, 1997)(p. 428). Only after some time in US, Toyota started working with US suppliers and transformed them into lean suppliers (Dyer and Nobeoka, 2000).

Based on these findings we argue that an average firm, not vertically integrated, without a rich network of partners and placed outside of any innovation, knowledge or industrial hub

would struggle with the effective implementation of lean principles and practices of lean philosophy.

Interestingly, Dyer and Hatch (2006) explained that “in 2000 Toyota purchased more than 70% of the total value of its parts (in US) from US suppliers...consequently, Toyota is increasingly using the identical supplier network as its US competitors” (p. 702). The authors explain what Toyota’s secret ingredient (competitive advantage) over its suppliers with an identical supplier network was – “Toyota had a relational advantage secured through knowledge sharing with its suppliers”. Following IMP school of thought, we can say that Toyota developed relational “tightness” with its network of suppliers. The term “tightness” was used by Håkansson and Snehota (1995) when describing connected relationships in the network. Håkansson and Snehota (1995) talk about “the substance of business relationship” and specify that “three different layers of substance can be identified in a business relationship” – first there is an activity layer, then, second, there is the resource layer, and third the actor layer (p. 26). The authors talk about “tightness” of connected relationships in the three layers of substance – actors, resources, activities: “Being a building element in the larger network structure, what is produced in a relationship can affect and is affected by other relationships that involve other parties. The effects on third parties and from third parties and their relationships on the relationship in any of the three layers of substance depend on how tight the connectedness of relationships is in the overall network.” (p. 27). Therefore, to the statement of Womack et al. (1990) that LP can be implemented “anywhere by anyone”, we add that the degree to which a firm can become lean depends on how tight the connectedness of relationships in any of the three layers of substance (actors, resources, activities) is in its network.

We base this article on the network approach research tradition of Industrial Marketing and Purchasing (IMP) Group. The proponents of this tradition, Anderson et al. (1994), describe an industrial network as “a set of two or more connected business relationships, in which each exchange relation is between business firms that are conceptualized as collective actors” (p. 2). Later Håkansson and Snehota (1995) developed ARA-model for analysis of such network relationships. The main ingredients of this model are network actors (web of actors), resource constellations and activity patterns in network. Håkansson and Snehota (1995) also say that solid relationship is “characterized by openness, mutual trust and respect”, and that “relationships between companies cannot be viewed in isolation” (p. 1), because of interconnectedness on the network level. What happens in one relationship between two parties affects, and is affected by what happens in another, for example, supplier’s relationships with subcontractors, can affect focal firm’s relationships with its customers.

**Thus, the purpose of this paper is to understand how firms can enhance their leanness by building close network relationships (“tight” substance of business relationships) in all the actors, resources and activities layers.**

For example, Perez and Sanchez (2002) found that “networking automotive suppliers did more in-house training, team work and had a greater diffusion rate of lean production practices, than non-networking suppliers” (p. 266). Dyer and Nobeoka (2000) write that “Toyota’s network appears to be highly effective at facilitating interfirm knowledge transfers (meaning knowledge about LM) and may be a model for the future” (p. 347). Also, according to Håkansson and Snehota (1995) what happens in one relationship between two parties affects, and is affected by what happens in another, due to interconnectedness. In line with this idea, we can assume, for example, that any firm that strives to be lean and faces standard challenges of lean management implementation, such as 1) resource management, 2) people

management and 3) standardization (Bhasin, 2012, Achanga et al., 2006, Atkinson, 2010, Boyer and Sovilla, 2003), can diminish/reduce these challenges by proactively choosing lean actors into its network.

Why Toyota built friendly relations with its suppliers taught them its lean principles and made them its long-term partners? Already back in 90s Toyota understood the importance of suppliers for firm performance – indeed, Nightingale (2005) states that for each dollar used in supplier training, other hundred comes back as profit; furthermore, he concludes that partner relations with suppliers are crucial for successful lean supply chain management.

**As a conclusion, our aim in this article is to understand and highlight the network effects on lean firm performance.**

## METHODOLOGY

Literature review research method was used to write this conceptual paper about the importance of tightness of connected business relationships, in all three layers of relationships' substance – actors, resources and activities, to the network for lean implementation and firm competitiveness. According to Bryman (2012) literature review is “a critical examination of existing research relating to the phenomena of interest and of relevant theoretical ideas” (p. 14). Following Bryman (2012), we have developed literature search algorithm (see Figure 2 in appendix), where we described how we arrived to the final 16 empirical studies that were considered to be relevant, reviewed and analyzed in this article. Google Scholar search engine was used to start the search for quality research papers. The following keywords were used: “lean manufacturing”, “Toyota production system”, “just in time manufacturing”, “lean supply chain management”. Since, the main interested of our study is the network, we have used the keyword “network” in combination with other keywords. The main focus was made on the empirical studies of lean manufacturing firms that managed the network of partners. We were interested to understand the “function of business relationships that can be characterized with respect to three essential components: activities, actors and resources” (Anderson et al., 1994)(p. 2). Specifically, in this study we are interested in the “network functions”, which Anderson et al. (1994) call “secondary functions”, which “concern chains of activities involving *more than two firms*, and shared network perceptions by *more than two firms*” (p. 3). Therefore, the empirical papers that discussed the network of the lean firms, but which discussed only the primary functions (dyads in the network), but no secondary functions, were disregarded.

As presented in Figure 2 “Literature search algorithm” the search process was quite complex, after search with keywords, examining titles and abstracts, 369 articles were selected and full papers were read and only 16 were considered to be the most relevant and used to discuss the research question of this study. Certainly, there are many limitations to the search methodology, for example not all the papers were available for free. We have also searched databases ABI/INFORM and Emerald insight, with the same keywords, to doublecheck that we did not miss out any relevant articles using the Google Scholar search engine. Following Bhamu and Sangwan (2014), we would like to add that we “wish to make clear that all the papers reviewed may not have these two keywords and all the papers having these key words may have not been reviewed...many papers were reviewed from cross-references because these contained the required information” (p. 883).

We would also like to explain how we used Google Scholar search option – “search within citing articles”. For example, we used “lean manufacturing” key words combination in

Google Scholar. Google Scholar finds “about 985000 results”. First found in Google Scholar is the article of Shah and Ward (2003) that was cited 2565 times (by the 13<sup>th</sup> of June 2019), then we use the option to click on “cited by 2565” and then we can click on the option to “search within citing articles”. We use this option and use the new key word “network” and we search within the articles that cited Shah and Ward (2003). Google Scholar shows “about 1010 results”. When we used the combination “network AND lean” to search within Shah and Ward (2003) article Google Scholar generated 967 results. We used such a procedure several types for the most cited and influential articles about either network studies or lean management studies. With the each search we followed the same procedure: 1) read titles and abstracts, 2) after reading abstracts select relevant articles for full reading. We also found cross references – in the text while reading full article and “scanning” the bibliography list.

As you can see in Figure 2. “Literature search algorithm” in the step 11 - the final result was collected and read fully 369 articles. After reading these articles we selected 16 articles that fully satisfied the research aim of this study. The time period of the reviewed articles is 1997 – 2016. As well, in Appendix in Table 3 we present the list of reviewed articles with short description of each and in Table 4 we listed the main research firms of the reviewed articles.

## THEORETICAL BACKGROUND

### Lean House

The success of Toyota did not leave indifferent other firms and, to this day, is hunted by managers from all over the world, who are wondering: How did they do it? What is the secret of their success? How did they outperform their competitors, like Chevrolet and Hyundai (Cole, 2011), Nissan and U.S. big three – General Motors, Ford and Chrysler (Lincoln et al., 1998)?

Toyota’s best practices are the result of the hard work of its workers and managers who “were constantly learning new methods and variations on old methods through actual price on the shop floor” (Liker, 2004b)(p. 32). However, applying these best practices (=lean practices) within the enterprise was not the end of the road, already back in 90s Toyota understood the importance of suppliers for firm performance and started teaching them. Indeed, as Dyer (2000) explains, Toyota invests \$50 million annually on supplier training, which is 0.03% on annual revenues of \$150 billion, and for every \$1 spent on supplier training, \$100 comes back in profit. However, the task of teaching these best practices was never ending, therefore the disciple of Taiichi Ohno - Fujio Cho developed a simple presentation of these practices – a house (Liker, 2004b). This house is frequently called “the house of lean” or “TPS house” and, initially, had an emphasis on lean tools, such as JIT (just-in-time) and Jidoka (automation with a human touch). Later, focus of lean management was shifted from just lean production to broader picture, to the lean enterprise, when the value-creating lean activities were applied to the whole value chain with the purpose to create value stream (Womack and Jones, 1994). So, there was a need for the enterprise lean house (not just tools lean house), that had “a wider view and emphasized philosophy and approach” (Bicheno and Holweg, 2016)(p. 5), and included such notions as Kaizen (continuous improvement) and respect for people. Lean enterprise was envisioned by Womack and Jones (1994) as “a group of individuals, functions and legally separate but operationally synchronized companies” (p. 92), what, as we understand today, is called lean supply network (Adamides et al., 2008) or lean network (Bortolotti et al., 2016). Also, definition of lean manufacturing (LM) had been changing from 1988 to 2007 (Bhamu and Sangwan, 2014) – from the focus on inventory (definition of Krafcik (1988) and best practices (definition of

Womack et al. (1990) to the focus on waste elimination in entire value stream, entire supply chain network (definition of Shah and Ward (2007)).

In this article, we use the latest version of the lean house (Figure 1) (we added “respect for people”) presented by Liker (2004b) in his bestseller “The Toyota Way: 14 management principles from the world’s greatest manufacturer” that incorporates “tools elements” and “philosophy elements” of Toyota way of lean thinking. Even though, lean house has undergone some modifications, the core principles remain the same. The main lean goals are QCDSM - best quality, lowest cost, short delivery time, best safety and high morale.

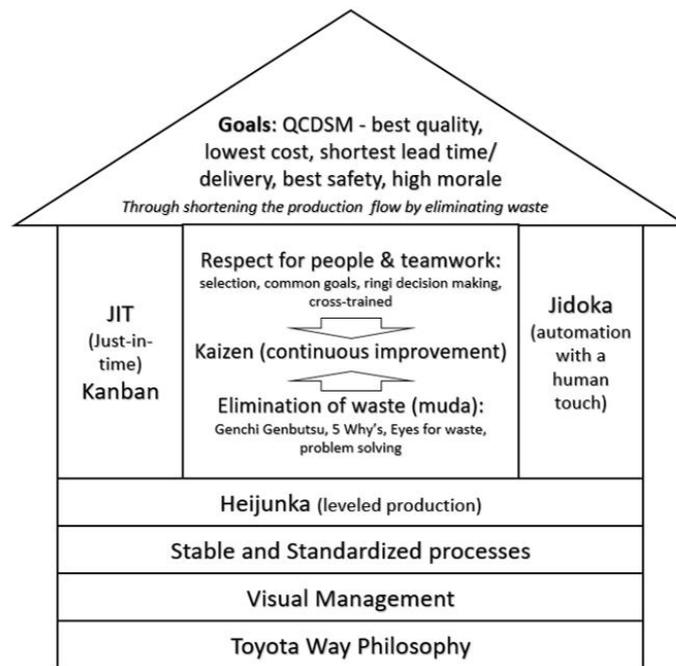


Figure 1. The Toyota Production System, adapted from (Liker, 2004b) (p. 33)

The core idea of lean management or TPS (Toyota Production System), according to Ohno (1988) is to reduce time from the customer order until payment by reducing waste that does not create value for the customer. Ohno (1988) explains in his book: “All we are doing is looking at the timeline... from the moment the customer gives us an order to the point when we collect the cash. And we are reducing that time-line by removing the non-value-added wastes.” (p. ix)

The two outer pillars are JIT and Jidoka. **Just-in-Time (JIT)** “means that, in a flow process, the right parts needed in assembly reach the assembly line at the time they are needed and only in the amount they are needed” (Ohno, 1988)(p. 4), in other words JIT “means removing, as much as possible, the inventory used to buffer operations against problems that may arise in production” (Liker, 2004b)(p. 32). **Kanban** is one method to achieve JIT, it is a Japanese manufacturing system in which the supply of components is regulated through the use of an instruction card sent along the production line.

**Jidoka** “in essence means never letting a defect pass into the next station and freeing people from machines – automation with a human touch” (Liker, 2004b)(p. 32). Liker (2004b) explains the connection between JIT and Jidoka. JIT implies one-piece flow, that the firm makes one unit at a time at the rate of customer demand or takt (German word for meter), at the same time the inventory (buffer) is reduced to minimum, therefore, if a quality defect

problem occurs, it becomes immediately visible. This reinforces Jidoka, which means “never letting a defect pass into the next station”, it means that the workers must resolve problems immediately in order to resume the production. Jidoka principle helps to eliminate overproduction, an important component of production wastes, and prevents the production of defective products.

**Standardized** processes are at the foundation of the Lean House and are considered to be “the basis for continuous improvement (Kaizen)” (Mikvaa et al., 2016)(p. 330). **Kaizen** means continuous improvement and “refers to continuous accumulation of small betterment activities rather than innovative improvement” and is based on three core principles: 1) process orientation, 2) small step improvement, 3) people orientation (Bicheno and Holweg, 2016)(p. 113). **Heijunka** means levelling out the production schedule in both volume and variety, which is necessary to keep the system **stable** and to allow for minimum inventory (Liker, 2004b). We can see in the Figure 1 that **Stability** is one of the foundations of the Lean House.

**Respect for people and teamwork** are the essential elements of the Toyota way, because “Toyota will never sacrifice the safety of their workers for production” (Liker, 2004b)(p. 34). Moreover, people are at the center of the Lean House, because they “must be trained in order to see waste and solve problems”, and problem solving should happen at gemba – at the actual place. **Waste** is **muda** in Japanese. There are eight mudas: 1) defects, 2) overproduction, 3) inventories, 4) extra processing, 5) motion, 6) transport and handling, 7) waiting, 8) underutilized human potential. Gemba means actual place and **Genchi Genbutsu** means “go and see”. Japanese practice, in case of occurred problem, is to go and see to the actual problem place in order to understand and find the solution to that problem, “rather than management by remote control” (Bicheno and Holweg, 2016)(p. 5).

**Liker (2004b) writes that lean house elements reinforce each other, therefore even if only one element of the house is affected by some actions in the lean supply network in a negative way, does it mean that then the whole house can fall apart like a house of cards?** Therefore, in this article, our goal is to understand what happens in the lean supply chain network between network actors, which resources they share, which actions they undertake, in order to understand which elements of the lean house and how can be affected, to trace the chain of changes of one house element by another. Lean House is a practical management tool, therefore we use a supporting theory on networks of Håkansson and Snehota (1995) - ARA-model (web of actors, recourse constellation and activity pattern), that we present and discuss in the next part.

### ARA-Framework and Relational Tightness

The founders and proponents of IMP perspective (International Marketing and Purchasing group) such as Håkansson and Snehota (1995), Ford and Håkansson (2006), Ford et al. (1998) say that firms cannot exist in isolation, therefore they suppose that all firms are embedded in business networks. Håkansson and Snehota (2017) state that “no business is an island” and, contrary to the “picture of “an economy” proposed in textbooks on economics or in management literature, which assume explicitly or imply that the business world consists of companies that are independent and buy and sell in markets defined by a product category”, suggest that, “the business world is characterized by relatedness and limited autonomy among single individual companies” (p. 8). Håkansson and Snehota (2017) explain that “three layers of substances can be identified in inter-organizational business relationships”. The first layer is activities – “a relationship between two businesses can link

activities such as production, R&D, handling and transporting and storing, not just within the two firms but also across the boundaries of several organizations” (p. 10) - the second layer is resources – “tying together and combining resources of the two businesses or resources that can be accessed through two businesses” (p. 10). The third layer is actors – “connections between various individuals, mutual commitments and bonds between the actors” (p. 10).

Activities, resources and actors constitute the ARA-model (Håkansson and Snehota, 1995). This model is a useful analytical tool that can be used for internal analysis of the firm’s business processes – we can explore firm’s activity structure, organizational structure and resource collection. ARA-model can as well be used to analyze the dyadic relationships between two firms – we can explore activity links, actor bonds and resource ties. And, furthermore, the ARA-model can be also applied for analyzing firm’s business network – by studying the activity patterns, web of actors and resource constellation. (Håkansson and Snehota, 1995)(p. 47)

One of the most interesting and rich foundations of IMP network approach is the heterogeneity of resources, which was already presented by Penrose (1959). Håkansson (1993) and Håkansson and Snehota (1994) think that to view resources heterogeneous instead of homogeneous is more valuable, because this reveals new facets of resource value – the value of resource always depends on which other resources it is combined with. For example, resource A when combined with resource B, C or D gives three different values:  $rA + rB = \text{Value 1}$ ,  $rA + rC = \text{Value 2}$ ,  $rA + rD = \text{Value 3}$ . It means that for the firm it is highly important to understand who the other actors in its network are that it has relationships with and what are their resources, because with different actor (and actor’s resources) the final value achieved will be different. Therefore, firms need to focus on the combinations of resources, rather than on the characteristics of the single resource.

As well it should be noted, the authors’ reflections on the notions of interdependency and connectedness (Håkansson and Snehota, 1995). The authors explain that what happens in one relationship between two parties affects, and is affected by what happens in another, due to interconnectedness. Interconnectedness is a term that the authors use, when talking about interdependences of connected relationships. The authors say that “there is more to the interdependence; there are specific connections between a company's relationships” and not all relationships are connected (Håkansson and Snehota, 1995). They describe connectedness or “connected relationships” in the following way: “relationships are connected when a given relationship affects or is affected by what is going on in certain other relationships; what happens in a relationship to a customer can, for example, affect what is happening in the relationship to some other customer; and a change in a relationship that a company has to a supplier of materials may affect positively or negatively a certain customer relationship” (Håkansson and Snehota, 1995) (p. 17). The other firms involved in the connected relationships are often referred to as “third parties”, and effects of a focal relationship on third parties, or vice versa, are referred to as “third-party effects” or “network effects”(Håkansson and Snehota, 1995). From this we understand, that not all actors in the network are connected. Moreover, connectedness or interconnectedness tells us that the actors are connected in the network, but it does not say anything about the type of relationship these actors have.

However, Håkansson and Snehota (1995) are talking about the “**tightness**” of connectedness: “The effects on third parties and from third parties and their relationships on the relationship in any of the three layers of substance depend on how tight the connectedness of relationships

is in the overall network.” (p. 27). They also use the term “**thick**”: “The more effects there are in the three layers in a relationship, the ‘thicker’ and the more complex it will be. Major relationships between companies tend to have complex substance. Still, there is a large variety in their substance, dependent on the existence, type and strength of the activity links, resource ties and actor bonds.” (p. 26)

Håkansson and Snehota (1995) are talking about “tightly linked activities, more or less closely tied resources and of actors with more or less strong bonds” (p. 269) or “tight connection to a competing supplier” (p. 310). Therefore, in the next part, we suggest bringing in the notion of “tightness” of connected relationships, such as **relational tightness**, that can explain the substance of business relationships on three layers of actors, resources and activities. Håkansson and Snehota (1995) also “use the notion of first-, second- and third-order functions of a business relationship in order to distinguish different levels of analysis” (p. 36). Second and third order functions they also call network functions.

Håkansson and Snehota (1995) say actors need to develop “tight” bonds, in order to benefit from their “connected relationship”. For example, Schmitt and Biesebroeck (2013) explain that in order to benefit from “connected relationship” it is not enough to locate close to your supplier, but firms need to develop close relations (tight relations) with suppliers based on trust. They specifically discuss the outsourcing and offshoring practices of the European automotive industry. They explain that producing locally can save costs, but close location is not enough for attracting contacts from foreign clients. They argue, that close location to suppliers is not useful without tight relationships: “without relational proximity, establishing a presence in a co-located supplier park would save on transportation costs, but confer only small additional benefits through proximity to suppliers producing complementary parts” (Schmitt and Biesebroeck, 2013)(p. 2).

Håkansson and Snehota (1995) say, that “in order to make any analysis of a certain relationship between two companies, the nature and strength of these bonds have to be taken into account.” (p. 34). We believe that in order to understand the degree of the strength and depth of business relationships we can use the notion of **relational tightness**. In this study, **relational tightness** is defined as **the degree to which firms have strong actor bonds, share their resources and conduct common activities.**

## PROPOSITION

The main proposition to be supported in this study is the following:

**Main Proposition: Relational tightness in network reinforces the positive relationship between lean practices and firm’s performance.**

On the one hand, this proposition is the extension of the IMP framework and the network literature. The notion “relational tightness”, “tightness of business relationships” or “tightness of connected relations” is the degree to which firms have strong actor bonds, share their resources and conduct common activities. On the other hand, it is an extension of the lean network literature, as relational tightness here as well is a broader concept that notably make it possible for knowledge transfer (a key attribute for successful lean networks such as Toyota’s) to occur, but not only, as it also covers transfer and mutualization of other types of resources. Using the ARA-model, we know that it also implies and relies on relational tightness at the actors, activities and resources layers, which is often a given in a lean supply network context, but still an important dimension for the final firm’s success.

## ANALYSIS

The analysis is divided into three steps based on the three components of the network level of ARA-model: Web of Actors, Resource Constellations and Activity Pattern. We have collected and analyzed academic articles of the champions of lean management such as Toyota, Honda, Nissan and other firms. We analyze these studies and reveal the principles of strong actor bonds for lean network, network resources and activity links between network actors that can enhance firms' leanness.

### Web of actors

According to Håkansson and Snehota (1995) one of the layers of substance of business relationships is actor bonds. In this study we are interested in the secondary (network) functions of business relationships, therefore we look at "the nature and strength of these bonds" in the overall web of actors in order to understand the "tightness" or "thickness" of these bonds in a network (p. 34). And whether and how this "tightness" or "thickness" of the actor bonds in the network is crucial for lean firm performance. In this first part of the analysis, we will support the following proposition:

**Sub-proposition a: Relational tightness between network actors reinforces the positive relationship between lean practices and firm's performance.**

**Relational tightness** between network actors is, firstly, expressed through **trust**. Trust is a key enabler for the exchange of knowledge and information between actors, as well as allowing better coordination and cooperation. MacDuffie and Helper (2007) discussed the advantages of "collaboration with trust" for lean champions such as Toyota and Honda. They explain that in Japan Toyota and Honda used to practice "direct supplier development activities", such as "supplier-to-supplier working groups, called Jishuken in Japan" (p. 438). However, in US "supplier development has been a slower and more difficult process", mainly due to distrust from US suppliers side. US supplier did not trust Toyota and Honda to the degree that would allow them visiting their factories or other suppliers to come to their factories to learn. MacDuffie and Helper (2007) noted, in direct alignment with the lean concepts of Genchi Genbutsu (Go and See) and Kaizen (Continuous improvement), that "Toyota's VP for purchasing Koichiro Noguchi said in 1992: Many US suppliers do not understand our way of doing business. They do not want us to visit their plants and they are unwilling to share the information we require. This makes it very difficult for us to work with them effectively; we also can't help them improve" (p. 438). Referring again to the lean house problem solving should happen at gemba – at the actual place, where trained personnel should "go and see" (Genchi Genbutsu) what happened in order to understand the problem, and physical access to the supplier's facilities is impossible without trust.

Furthermore, MacDuffie and Helper (2007) asserted about "collaborative problem-solving" that "Many of the savings achieved since the [Toyota CCC21] programme's launch in 2000 have come from teams of Toyota engineers working with suppliers on design issues, in particular the reduction of part counts and production variants. Toyota once had thirty-five different versions of the interior assist grip installed above each door. After a joint investigation by a CCC21 team and suppliers, now only three grip styles cover all of Toyota's ninety models" (p. 441), demonstrating the competitive advantage **trust** represents to achieve low-cost and high quality products, a pursuit symbolized by the lean concept Jidoka. Jidoka principle is not just confined to use within machines through automation, it eliminates overproduction, an important component of production wastes, and prevents the production

of defective products. The example of MacDuffie and Helper (2007) shows how “collaborating problem-solving” based on trust helped to avoid overproduction (Jidoka).

Also, Lee and Jo (2007) write about the importance of **trust and mutual agreement** for lean management. Their example is about how **distrust between the third party (in their case – labour union) and firm’s management** can negatively affect leanness of the firm: *“In the mid 1990s, Hyundai management failed to implement performance based HRM plans, modelled on the career and compensation system of Toyota, due to opposition from the labour union, which preferred an egalitarian system of wage determination and job promotion (Lee 1997). The labour union also has interfered with management’s policy to promote workplace innovation and flexible job rotation, thereby resulting in rigid and Kaizen-free working practices on the shop floor. In fact, the labour union forced management to reduce the items of TQC from 30 to 10, and to use an increasing number of irregularly-contracted workers in the early 2000s....Given the degree of mutual distrust between the militant labour union and Hyundai management, management has been unable to promote any systemic flexibility in terms of labour utilization and workplace innovation, aided by the performance-based HRM schemes, which are a key part of and a prerequisite for TPS, thereby moving further towards an engineer-led production model.”* (p. 3675)

MacDuffie and Helper (2007), also mention the power of **shared experiences** with suppliers for lean performance and success. They note that *“Japanese automakers frequently brought their suppliers with them to the USA, often finding this easier than to train US firms in the techniques of lean production, in the 1980s over 300 Japanese auto suppliers came to the USA”* (p. 428). As we know from the example of Toyota’s expansion to US, it takes time to build close relations with local suppliers and to transfer them into lean. Shared experience with known suppliers becomes then an asset firms can use to achieve quicker results and leanness in new markets.

Pheng and Chuan (2001) in their study of precast concrete components manufacturing emphasize the need for **long-term relationships** to better implement JIT: *“Too many suppliers will cause management to have less time with each supplier for liaising, expediting orders, feedback and coordination efforts. JIT therefore emphasizes the need to reduce the pool of suppliers, and eventually work toward a single supply source. This requires the forging of long-term business relationships founded on mutual trust and benefits. The single supplier, with assured business over the long term, will then be more willing to invest in machinery and automation to improve productivity and reduce costs.”* (p. 495)

**“Tight” business relationships** can also be developed through **club membership**: *“Toyota supplier: Because they are members of our supplier association, we do what we can to help them out. We help each other because it makes us all better off.”*(Dyer and Nobeoka, 2000) (p. 354). When they belong to the same club or association, suppliers are more keen and likely to share with each other their ideas and best lean practices, thus lifting the lean performance of the network and enabling a faster rate of improvement (Kaizen).

Finally, **networking** also provides a competitive advantage to firms: *“Networking (networking activities with customers and suppliers) companies did more in-house training and teamwork than non-networking suppliers.”* (Perez and Sanchez, 2002)(p. 271) Training and teamwork are two key components of the lean enterprise, especially regarding its cornerstone: Kaizen. Also, Håkansson et al. (1999) prove in their study that the “networking increases learning... and there is a much greater probability for a supplier to learn in a business relationship when it is connected to a number of the buyer’s other supplier

relationships”, because, for example, group discussion can be more advantageous (multidimensional and multifaceted) than the dyadic discussion (p. 450).

Also, Hong and Kim (2012), described an example of Hyundai **networking with its suppliers and subcontractors, which** secures the stability of the supply of parts, what is crucial for success of shipbuilding companies: “*Shipbuilding requires a network of suppliers and subcontractors, and the network is important for the collaborative relationship as well as for the supply of parts...The strengths of Korean shipbuilding industries depend on the steady support from the network of small and medium-sized shipbuilders as critical providers of components parts.*” (p. 456)

Another interesting example, about the web of actors is the **networking with your lean competitor’s suppliers**, was described by Lee and Jo (2007): “*While building the FBL, Hyundai contracted for technical consulting from Yamashita Machinery, which had designed and supplied the main buck system of the body-building line for Toyota, and had devised the Toyota-imitated ‘one buck system’ along with its own invention of the ‘windmill jig system’.*” (p. 3670). Networking with your lean competitor’s suppliers can enable lean learning, therefore, faster introduction into lean.

### Resource constellation

In this second part of the analysis, we will support the following proposition:

**Sub-proposition b: Relational tightness enabling the use of network resources reinforces the positive relationship between lean practices and firm’s performance.**

**Relational tightness** can be achieved using network resources, for example, through **knowledge transfer**. Knowledge (resource) sharing about lean practices and processes between the firm and its suppliers is what creates lean enterprise (Womack and Jones, 1994). Synonym of mutuality is reciprocity, and reciprocity is a motivator for knowledge sharing, for example, Schultz (2001) states that “collecting new knowledge intensifies vertical flows of knowledge, that codifying knowledge facilitates horizontal, and that combining old knowledge mainly affects horizontal flows” (p. 661), in other words, when actors exchange knowledge this further stimulates a reciprocal flow of knowledge between them. Dyer and Hatch (2006) write that “*Toyota’s competitive advantage – it is a relational advantage secured through knowledge sharing within its supplier network...In a sample of US automotive suppliers selling to both Toyota and US automakers, we found that greater knowledge sharing on the part of Toyota resulted in a faster rate of learning within the suppliers’ manufacturing operations devoted to Toyota...In 2003 Toyota’s net profit was larger than the combined profits of GM, Ford and DaimlerChrysler. Moreover, according to JD Power’s Initial Quality Studies, Toyota’s vehicle had roughly 40% fewer defects than those same competitors.*” (p. 701-702). From this last example we also see that knowledge transfer between suppliers resulted in lower defects rate (Jidoka).

**Employee exchange (shukko** in Japanese) in the supply lean network is a fastrack to knowledge sharing and communication easing, it helps to avoid mistakes and be more successful in lean implementation and beyond. **Relational tightness** is the degree to which actors are bound by relations. Employee exchange between firms binds actors and creates close personal relationships. According to Lincoln et al. (1998), who studied organizational learning and purchase-supply relations in Japan in the Hitachi, Matsushita, and Toyota firms, *shukko* contributed to organizational knowledge creation in these three firms and their

supplier, thus improving lean performance of the network. Lincoln et al. (1998) writes: “An important element of the process whereby one Japanese firm in a purchase supply exchange becomes intimately familiar with the requirements and workings of another is *shukko*—the assignment of employees to relatively long-term stints on the shop or office floor of a customer or supplier” (p. 245). “When the product is a large industrial system the employee may stay 3-6 months, as was the case with JR. Nuclear and electrical power systems may transfer them for as long as two years. When a Hitachi employee is *shukko*’d to another company, he has to understand the precise meanings of that field so small mistakes can be avoided.” Lincoln et al. (1998)(p. 246). We can also say that employee exchange allows firms to quickly adjust their workforce, and thus helps to balance the workforce at the network level (*Heijunka*). In order to further level the production, the supplier needs to understand what the customer wants – employee exchange allows understanding the client faster. For example, Dyer and Nobeoka (2000) found “that 11% of the suppliers’ directors were former employees of Toyota. Overall, Toyota transfers approximately 120-130 individuals per year to other firms in the value chain, most of whom go to suppliers. Some of the transfers are permanents, some temporarily. When we visited Kojima Press, we found that the assistant plant manager was a Toyota engineer on leave from Toyota for a 2-3 years assignment. He said: “I am here to apply what I have learned at Toyota to help the plant manager run more efficient plant. Also by working at the supplier I can understand the supplier’s perspective and what problems they experience.” (p. 357)

Another way of **shukko** was presented by Netland (2014), when he described how Elkem, Hydro, Jotun and Volvo were **rotating people among their plants**. «In cases where the same best practices are valid for several plants in a production network, a shared corporate system has clear benefits. Elkem, Hydro, Jotun and Volvo provide examples of how the implementation of XPSs can be developed, launched and managed in the networks: they have all set up corporate XPS offices, appointed XPS coordinators and teams in all plants, developed audit schemes and shared practices between plants by means of both codified standards and by rotating people among plants.» (Netland, 2014, p. 129)

Another example of lean knowledge (resource) sharing is **technical personnel from one supplier visits another supplier** with the purpose of helping with equipment installation and product launch MacDuffie and Helper (1997) wrote how: “When Honda began to build cars in 1982, they asked Capitol to take on some important console parts for the Accord. At first, the tooling was supplied from Japan. Honda also arranged for Capitol to establish “a technical collaboration agreement” with their supplier of the same part in Japan. This firm Marioko, began to send technical personnel to Capitol to help with equipment installation and product launch.” (p. 125)

MacDuffie and Helper (2007) write about **phenomena similar to shukko**, but what is called in Japanese **kyogyo** – “**collaborative division of labor**”: “Akira Takeishi (2003) and his colleagues argue that Japanese OEM-supplier relations must move into a new fourth phase, after three previous phases that emphasized cost, quality and engineering input for individual components respectively. The newest phase emphasizes horizontal coordination with suppliers of other components for improved design, greater system integrity, and more innovation at both component and system levels, as well as exploration of more modular design principles.....The Japanese word **kyogyo** is used to describe this phase; it means “collaborative division of labour”. OEMs have shown a willingness to turn more design responsibilities over to suppliers who can manage these horizontal collaborations most successfully, certain examples of **kyogyo** are well publicized in Japan, e.g. an instrumental panel console for a new Lexus model that resulted from the self-initiated collaboration of

*Sumitomo Denko (an electronics firm) and Toyota Gosei (a plastics firm) and that achieved sizeable improvements in terms of lighter weight, lower parts count, and lower overall cost.”* (p. 437) This example shows that due to collaborative division of labour (human resources) the firms were able to reduce muda (waste) – reduced costs, lighter weight.

**Consulting services** is another way to provide knowledge and human resources to lean network and contribute to development of **tightness of business relationships** between actors. Dyer and Nobeoka (2000) say that “*consulting teams at Toyota and Honda have been effective at transferring knowledge to suppliers and improving their productivity and quality. OMCD – Toyota Operations Management Consulting Group in Japan has proved on-site knowledge transfers at suppliers’ plants since 1977, while the US consulting group (the Toyota Supplier Support Center) has provided assistance to US suppliers since 1992. These consultants (roughly 60 in Japan and 20 in the USA) are experienced Toyota personnel with in-depth knowledge of the principles and practices of the Toyota Production System.*” (p. 704-705). Dyer and Nobeoka (2000) report that “*US automotive suppliers have made significant reductions in inventories as well as increases in output per labor hour after 2 years of interaction with the Toyota Consultants*” (p. 704-705). We see that thanks to consultants firms were able to reduce inventories. Also together with consultants, firms can find the perfect level of inventories that is needed for Heijunka: “*A small inventory of finished goods is often necessary to protect a suppliers’ level production schedule from being jerked around by sudden spikes in demand. It may seem wasteful, but by living with the waste of some finished goods inventory, you can eliminate far more waste in your entire production process and your supply chain, if you keep your production level*” Liker (2004a) (p. 121). Finally, similarly to what was discussed regarding employee exchange, but even more rapidly, consulting services increase the firm’s workforce to resolve for example complex and time-sensitive situations in production.

**Relational tightness** can also be linked to the **sharing of “hard” and “soft” resources**, such as facilities, equipment, software, etc. used for manufacturing, testing, logistics, or other purposes. Chen (2003) in his study of how Taiwanese firms use network resources studied a supplier to IBM, HP, Philips and Viewsonic. Chen (2003) explains that Falcon and IBM decided to share soft and hard resources: “*Falcon signed a strategic alliance agreement with IBM, its biggest client, in 1999, whereby the two partners agreed to cross-license computer-related technologies and to share production capacities*” (p. 1121). Such sharing of production capacities of the network actors relates to elimination of wastes/muda (7 wastes). Thanks to such sharing we can save space, time and money while ensuring optimal coordination through efficient, standardized and centralized communication.

A truly lean enterprise would succeed from the points of view of end users, for example benefit from **customer input** as a result of supplier-consumer interaction. Blokland et al. (2007) explain how Dell started to sell its own product ‘Intel inside’ by capitalizing on the strength of the supplier-consumer interaction. Such interaction lifts up the effectiveness of lean value chain network, and is the realization of a type of lean “Kanban” user driven computer manufacturing approach. Blokland et al. (2007) explain that “*The value is being added by the firm on demand of the end-customer, through interaction with suppliers and the (end)-customers. Hewlett Packard is ‘making the computer personal again’. Dell interacts on one side closely with the consumer, facilitating build-to-order sales, with the ‘purely you’ commercials and on the other side Dell capitalizes on the strength of the supplier-consumer interaction to sell its own product; ‘Intel inside’. The joint efforts of the consumer and the firm – the firm’s extended network and consumer communities together – are co-creating value through personalised experiences that are unique to each individual consumer*

(Pralhad and Ramaswamy, 2004)” (p. 6). In this case, the resource being used and shared across the network upstream in the value chain is the specific customer need and manufacturing request.

**Using the retired employees of your lean competitor to build your plant** is another way to provide knowledge and human resources to lean network and contribute to development of **tightness of business relationships** between actors. *“In the late 1990s, Hyundai management built a green-field plant (in Asan), simulating Toyota’s Kyushu Miyata plant. Designing this new plant, Hyundai utilized a group of retired Toyota engineers to reproduce the manufacturing layout and facilities of the Miyata plant. The Asan plant, which started its operations in 1996, was almost identical to the Miyata plant in its layout of production processes. Like the Toyota green-field plant, for instance, the Asan plant consisted of a set of segmented assembly lines, with inter-line buffers (about three vehicle units), and it improved the working environment by automating production facilities using an ergonomic design.”* (Lee and Jo, 2007)(p. 3671)

### Activity pattern

In this third part of the analysis, we will support the following proposition:

**Sub-proposition c: Relational tightness achieved through common activities reinforces the positive relationship between lean practices and firm’s performance.**

**“Tight” or “thick” business relationships** between network actors can be achieved through common activities, such as **collaborative work** between lean network actors. Collaborative work of lean network actors (teamwork in lean house) leads to better process understanding, therefore saves time (muda, one of the seven wastes – motion, searching for missing information). Lincoln et al. (1998) write about Hitachi’s Omika plant’s (a Hitachi division producing complex computer control systems custom-built for such large corporate customers as Japan Rail and Tokyo Power) mutual exchange and openness with its suppliers: *“We ask our suppliers to come to our factory and start working together with us as early in the development process as possible. The suppliers also don’t mind us visiting their plants. This kind of mutual exchange and openness about information works to enhance flexibility. Early participation on the part of the supplier enables them to understand where they are positioned within the entire process. Furthermore, by working with us on a regular basis, they learn how to bring in precisely what we are looking for, even if we only show them a rough sketch. When we reach this point, our designers can simply concentrate on work requiring creative thinking.”* (p. 243-244). For example, collaborative design with suppliers helps to avoid mistakes, solve problems faster, save costs (muda), achieve higher quality (Jidoka) and identify innovative solutions (Kaizen).

**Relational tightness** between network actors can be achieved through common activities, such as **supplier-to-supplier activities**. MacDuffie and Helper (2007) write about **jishuken – supplier-to-supplier working groups, or as they also say “direct supplier development activities”**, which help suppliers to reduce muda (waste) such as costs, lead times, improve product quality: *“Within overseas operations, Toyota and Honda continue to strengthen their local supply chains in terms of systematic production capabilities to reduce cost, improve quality, increase logistical accuracy, and shorten lead times, often through **direct supplier development activities** that began in the 1990s and continue to the present day. Slower to*

*develop have been supplier-to-supplier working groups, called **Jishuken** in Japan; these are considered to be a better method of supplier development in terms of sustainability, since the direct supplier assistance by the OEM (=original equipment manufacturer) often produces too much dependency.” (p. 438)*

**Relational tightness** between network actors can be achieved through interaction between **suppliers with common activities** in lean network that learn from each other and therefore improve. This type of learning from the actor with similar activity is the way firms can do continuous improvements (Kaizen). Dyer and Nobeoka (2000) in their study of Toyota’s knowledge-sharing network write about one interesting example of how two suppliers both doing painting activity interacted and one learnt from the other: *“Last year we were able to reduce our paint costs by 30 %. This was possible due to a suggestion to lower the pressure on the paint sprayer and adjust the spray trajectory, thereby wasting less paint... We find more things that are useful visiting other suppliers’ plants versus Toyota’s plants. Suppliers’ operations are more similar to ours.”*(p. 356). Another example of how one supplier learnt from the other with the same activity and improved its changeover time: *“As a supplier executive at Lucas Body Systems stated, “Toyota told us to work on cutting our changeover time from 2 hours to 30 minutes. I told them it was impossible. Then they sent me to visit a Japanese supplier in our same business that had changeover times of 15 minutes. I never would have believed it if I hadn’t seen it with my own eyes. My boss still doesn’t believe it.”* (Dyer and Nobeoka, 2000)(p. 355)

If each actor in the lean network is involved in activity at which it is best, then the network will function more effectively. In case of lean network we are talking about **best activity for a given supplier**. Therefore, supplier can choose to focus on just one component divesting itself of all other businesses, to yield higher network performance, for example: *“Supplier companies often made dramatic changes in response to Nissan’s new policy; for example, one long-time supplier of brake systems chose to focus on just one group of components, divesting itself of all other businesses and hence moving from a first-tier to a second-tier position in Nissan’s supply chain”* (MacDuffie and Helper, 2007)(p. 439)

In order for **supplier customer logistics** to function well, without errors and delays, the stability of customer orders and the flow of communication are important. Lean customer logistics corresponds to JIT in the lean house, and comes from the simple realization that supplier and customer must work together and build their relationship to achieve better results. For example, Dyer and Hatch (2006) write that *“Previous research suggests that the ability of a firm to effectively implement the “Toyota Production System” (e.g. Kanban, Heijunka, JIT) depends on the stability of its customer orders and the inter-organizational processes which pull inventory through the value chain (Womack, Jones and Roos, 1990; Helper and Sako, 1995). If customer orders fluctuate widely or if key interorganizational processes are not in place, a supplier may be unable to minimize inventory safety stocks if it is going to provide just-in-time deliveries. The point is that a firm’s internal routines or production capability, may to some extent, be contingent on the interorganizational routines which constitute the network “context” linking the firm’s production system to the systems of its customers and suppliers.”* (p. 704)

**Relational tightness** between network actors can be achieved through **lean network assessment activity** through which managers can evaluate the lean work, identify errors, understand where and what needs to be corrected; assessed firms can learn from each other and therefore improve: *“Today, the business units and plants engaging in the VPS (Volvo Production System) typically go through an annual or bi-annual VPS assessment, and most*

*plants in the global network have been assessed twice since 2007” (Netland and Aspelund, 2013)(p. 1522).*

Finally, **relational tightness** can be achieved through the organization of **meetings**, workshops, conferences, events, travels, etc. between lean network actors. Regular meetings are the lowest level type of activity but are still key for network members to communicate exchange, discuss problems, identify solutions, and together progress step by step towards higher lean and firm performance. Dyer and Nobeoka (2000) write “*Toyota’s kyohokai has general meetings every other month (e.g., general assembly, top management meetings) that are designed to allow for high-level communication within the network with regard to production plans, policies, market trends, etc. Thus, these meetings primarily facilitate the sharing of explicit knowledge among members. More frequent interaction occurs within the association’s topic committees (cost, quality, safety, etc.)...The ‘topic’ committees on cost, quality, safety, and general affairs are designed to facilitate knowledge sharing on topics that are critical to all members in the network...The “regular committee” picks a theme for the year (e.g. the 1994 theme was “Eliminating supplier design defects”) and meets 6 times each year to share knowledge with regard to that particular theme.*” (p. 353)

## RESULTS

The analysis has shown that our main proposition (**relational tightness in network reinforces the positive relationship between lean practices and firm’s performance**) stands on 31 legs of arguments (web of actors - 9 arguments, resource constellation – 13 arguments, activity pattern – 9 arguments), summarized in the Table 1 presented in appendix “Summary table of analysis”. Also in Table 2 (see appendix), we present the “pattern” of the arguments that were found from the reviewed articles for three layers of substance of business relations: actors, resources and activities. Furthermore, we saw that each component of the ARA-model on the network level has a role to play and is essential to take into consideration in order to maximize firm leanness and performance.

### Results: the web of actors

Our proposition about the web of actors was that *relational tightness between network actors reinforces the positive relationship between lean practices and firm’s performance*. In the Table 1, there is the column with the “key words” such as **trust, shared experience, long-term relationships, club membership, networking, networking with suppliers and subcontractors, networking with your competitor’s suppliers. The concept of relational tightness in the web of actors layer of substance of business relationships is defined by these key words.** *When we reviewed chosen 16 articles and found relevant examples about either web of actors or resources constellations of the lean firms, we have thought about the main idea of that example and called it in Table 1 with the key word, for example, “trust” or “club membership”.* Our results show that **on the actor side**, one must strive to create the close or “tight” relationships with network partners, based on trust, shared experience, long-term engagement and regular face-to-face interactions (networking) at professional clubs or events with customers, suppliers, third parties and even competitors and competitors’ network actors. According to Håkansson and Snehota (1995) “as a business relationship develops, actors become connected...bonds between actors are established which affect how the actors perceive, evaluate and treat each other” (p. 26). Also, Håkansson et al. (1999) note the importance of the connected relationships in the web of actors for the learning opportunities: “there is a much greater probability for a supplier to learn in a business relationship when it is connected to a number of the buyer’s other supplier relationships” (p.

450). Our results show that strong bonds (based on trust, etc...) in the web of actors provide firms lean learning opportunities. We think it is important to look at these “bonds”, how “thick” they are, in order to understand to which degree actors are connected. We propose to call the degree of connection “**relational tightness**”, which we explain with the “**key words**” concepts (table 1). We think that relational tightness in the web of actors can enhance the opportunities for lean management offered in business relationships in the actor and activity dimensions.

### Results: resource constellation

Our proposition about the resource constellation was that *relational tightness enabling the use of network resources reinforces the positive relationship between lean practices and firm's performance*. In the Table 1, you can see the column with the “key words” such as **knowledge transfer, employee exchange, kyugyo - collaborative division of labour, rotating people among plants, change teams, consulting services, sharing “hard” and “soft” resources, customer input**. The concept of relational tightness in resource constellation layer of substance of business relationships is defined by these key words. Our results show that **on the resource side**, one must successfully access the rich and tremendous pool of network resources, containing knowledge, expertise, employees, consulting resources or other types of resources such as for example equipment, facilities or software. We must pay attention to the fact that IMP approach to resources is based on the idea of resource heterogeneity and it differs from economists Coase (1937) that tend to focus on “economizing on scarce resources” and “control of resources” (Håkansson and Snehota, 1995)(p. 134). The main idea of IMP proponents is that firms need to focus not on a single resource, but on the combinations of resources, because each resource in combination with other resources creates different value. We can see the proof for this idea also in the lean literature, when lean champions like Toyota, Nissan and Chrysler combine their human resources on the network level and also share “soft” and “hard” resources also on the network level. They carefully choose actors with which to combine resource in order to achieve the highest lean value out of this combination. For example, Toyota's new supplier with minimum lean knowledge visits Toyota's another supplier, which is experienced and lean knowledgeable. The result of this resource combination is the development of second lean supplier (new knowledgeable lean resource). This idea is also supported by Håkansson and Snehota (1995) who say that “relationships are not only a way to acquire resources but also a way to develop resources” (p. 182). Lean literature shows (see table 1) that such combination of network resources is crucial for successful lean implementation.

### Results: activity pattern

Our proposition about the activity pattern was that *relational tightness achieved through common activities reinforces the positive relationship between lean practices and firm's performance*. In the Table 1, you can see the column with the “key words” such as **collaborative work, jishuken – supplier-to-supplier working groups, suppliers with common activities, best activity for a given supplier, supplier customer logistics, meetings, team work, visits, lean network assessment**. The concept of relational tightness in activity pattern layer of substance of business relationships is defined by these key words. Our results show that **on the activities side**, one must learn to closely collaborate on the right projects and products with its network partners, sometimes also for activities beyond the factory floor such as meetings or gatherings. One must learn to focus on its best activity. Moreover, one must learn and do lean learning activities, such as visits, and

collaboration in the network with the third parties (network function), for example supplier collaborates with another supplier to the same firm, or even with the other supplier's subcontractor; or the focal firm collaborates with its lean competitors' former supplier. This facilitates the learning and lean knowledge sharing, and consequently improves lean firm performance. And, consequently, improves leanness for all the actors in the network. Moreover, lean controlling activities, such as annual lean network assessment also help to keep the overall lean network level stable and find the points in the three layers (actors, resources and activities) of substance of business relationships that need improvements.

Dyer and Nobeoka (2000) found that Toyota has created and managed “a highly interconnected strong tie network”, it means Toyota had **relational tightness** in its network, and “established a variety of institutionalized routines that facilitate multidirectional knowledge flow among suppliers” (p. 345). These routines are network activities such as supplier visits another supplier with common activities, learns and improves; or another activity – stability of the customer orders, sub-contractor-supplier-customer logistics activity. Dyer and Nobeoka (2000) describe that the success of Toyota was achieved by a well-executed “evolutionary process” whose final phase was “to strengthen multilateral ties among members and develop “sub-networks” for knowledge sharing within the larger network” (p. 716). For successful implementation of lean practices Dyer and Nobeoka (2000) highlighted the need of strong ties between the core firm and its suppliers but as well between suppliers themselves. These findings support corresponding findings in the IMP literature by Håkansson and Snehota (1995): “**Activities of a sub-supplier** can affect those of a supplier which will in turn have effects on those of a buying company which in turn is reflected in those of its customers” (p. 29). The authors highlighted the level of interconnectedness which characterizes successful functioning networks, especially in the case of third-parties such as other suppliers. The conscious exploitation of these “third-party effects” also called “network effects” contributed to Toyota's competitive advantage against US car manufacturers. We think that Toyota and other discussed lean champions were able to achieve and properly utilize these “network effects” thanks to developed **relational tightness in their network on the three layers of substance of business relationships – actors, resources and activities**. **Relational tightness in the network** can then be measured by the extent to which the firm best exploits each dimension of the ARA-model, which as demonstrated through the lean lens can directly be correlated to the firm performance.

We think that **relational tightness** with network actors can be the source of firm's future competitive advantage, for example relational tightness can enhance leanness which can create competitive advantage. Also Gadde and Snehota (2000) say that “the type of relationships firms develop to suppliers will be the main source of future competitive advantage” (p. 309). Trust on the network level is a source of competitive advantage. MacDuffie and Helper (1997) in their study of supply chain management at Toyota, Honda and Nissan explain that trustworthy relationships with suppliers is a source of competitive advantage. They interviewed Rick Mayo (Honda's engineer who directs BP for Honda) who says: “We view self-reliance in suppliers as a means to achieve long-term competitiveness” (p. 146). MacDuffie and Helper (1997) provide examples of improved firm performance thanks to BP and supplier relations based on trust: “Honda reported productivity increases averaging 50% at the 53 Honda suppliers participating in BP as of 1994, and seven firms interviewed for a report of BP reported productivity gains 25% and quality gains 66%” (p. 124). Also, Dyer and Nobeoka (2000) say that dynamic learning capability extended beyond firm boundaries creates competitive advantage. Network resources can also be the source of competitive advantage, however, according to Ma (2000) “competitive advantage does not

equate to superior performance”, because firms need to know how to properly utilize these resources, so this utilization can result in the improved firm performance.

## THEORETICAL IMPLICATIONS AND CONCLUSION

Traditionally, large Japanese industrial conglomerates, such as Toyota and Nissan, followed Japanese Keiretsu style of business relationships – buying shares of their suppliers, and obtaining more control on their suppliers over the years. Also, “suppliers CEOs were routinely appointed from among the ranks of senior Nissan executives approaching retirement” (MacDuffie and Helper, 1997)(p. 438). This approach, where a company owns part of its supply chain, is called vertical integration.

It has since then “fallen out of favour, due in part to the advantages to long-term relationships with separate supplier companies demonstrated by Japanese companies. If parts are single or dual-sourced, suppliers may be able to achieve substantial economies of scale. The customer can help the supplier with technical assistance, while not bearing full investment costs, and can still benefit from any supplier improvement” (p. 120). This change was also noted by Hong and Kim (2012)(p. 454), who described how in Korea, conglomerates were disbanded to become instead a network of firms.

The organizational structure of these large conglomerates and their supplier base shifted therefore from vertical integration (including buying of supplier shares) to vertically-linked alliances or partnerships (no buying of shares), with the constitution of a supplier network.

In this study of the lean management literature, we further highlighted the significance of the network point of view and network utilization to increase company leanness and as a result overall performance. We used the concept of **relational tightness** to describe the degree to which two given firms experience closeness and interconnectedness on the three levels of the ARA-model: actors, resources and activities. Our analysis has shown that **relational tightness** to the network reinforces the positive relationship between lean practices and firm’s performance, or that in other words the higher **relational tightness a company achieves with its network**, the higher potential this company has in applying lean practices to enhance its operative performance.

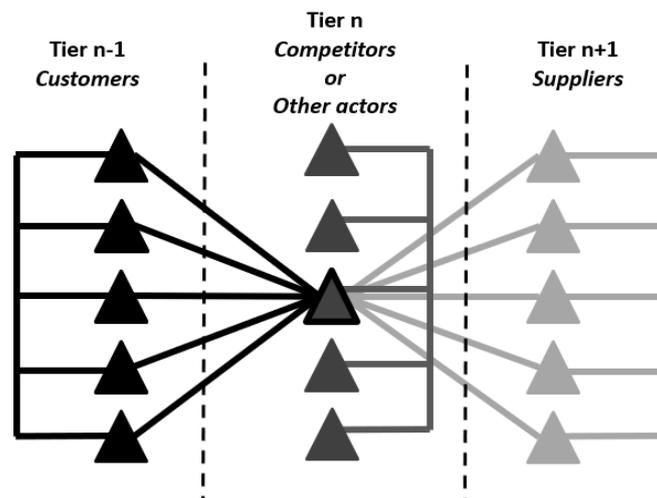
This implies that, in alignment with the IMP perspective, the firm’s network, rather than the firm, has become the relevant unit of analysis. One firm’s lean implementation and performance potential highly depends on its network, as one needs **relational tightness** and alignment to be truly lean and competitive. This is best illustrated by the actions of Japanese manufacturers in the 1980s who “brought their suppliers with them to the USA” (MacDuffie and Helper, 1997) to retain in the transition and establishment phase, while local US suppliers were getting trained, their highest standards of work and remain competitive against local US manufacturers.

Another theoretical result from our study is that the advantage provided by **relational tightness** for lean performance is valid from any firm’s perspective. We believe that any single firm implementing lean practices would benefit from **relational tightness**, and should work on establishing **relational tightness** within its network to maximize its lean return. Lean management is a topic which operates beyond the boundaries of the single firm and is best expressed at network level, as in the case of Toyota.

This shift of focus from the core firm, real driving force in the network, to any firm, independently of its role in the network, is supported by the “third network paradox” related

to “control in networks” and defined by Hakansson and Ford (2002). The two authors indeed write that “the more successful a single company is in forcing its thinking onto the network, the more it and those around it are likely to encounter long-term problems. Moreover, they explain that “network is a “fabric whose component strands are knotted, twisted or otherwise fastened to form an open mesh” – a structure without one center of gravity where components are connected in an open mesh” (Håkansson and Snehota, 1995)(p. 269).

The trend towards less control and integration, which we saw started with moving away from vertical integration of Japanese firms, continues towards growingly distributed networks. This new network structure targets the highest flexibility and innovativeness to reach as desired a higher competitiveness. Single firms have a role to play both as center of their own network and as a member of other firms’ networks, with an adequate balance to avoid missing opportunities in the long term. Under this new paradigm, which is as well one of relevance since most firms are not the driving force in their network, it becomes of interest to present a new network model which puts the single firm at its center and highlights the importance of **relational tightness in three layers of substance (actors, resources and activities) of business relationships** for leanness, competitiveness and operational performance. This new model is illustrated below on Figure 3.



**Figure 3. Relational tightness in the network from the perspective of the single firm**

Generally, any firm essentially operates in the middle of three levels. One level (Tier n-1) is the level of its customers; another level (Tier n) where the firm resides is also the level of its competitors or other actors; and the other level (Tier n+1) is the level of its suppliers. The relations displayed by lines on Figure 3 are those that in the interest of the single firm must exhibit **relational tightness between the actors in the network**.

Relying on our results, we can **conclude** that for **successful lean firm performance**, **relational tightness in the web of actors** (tight actors bonds based on trust, actors in the same club, etc.), **in the management of network resources** (tight resource combinations, human resources, “soft” and “hard” resources) and **in the organization of network activities** (tight lean network activities – meetings, visits, collaborative work, assessment activity) is necessary not only between the focal firm and its customers and suppliers, but also **on the network level** (network function, secondary function level) – between customers of the focal firm, between suppliers of the focal firm, between focal firm and its competitors and other actors.

## APPENDIX

Table 1. Summary table of analysis

<b>Leg</b>	<b>ARA</b>	<b>Lean</b>	<b>Key word</b>	<b>Article</b>	<b>Argument</b>
A1	Web of actors	Kaizen & Genchi Genbutsu	Trust	McDuffie & Helper 2007	Trust is key element for allowing access to plant (go and see) necessary for finding the cause of issues and solving them, towards continuous improvement
A2	Web of actors	Jidoka	Trust	McDuffie & Helper 2007	Trust enables collaborative problem-solving, a pursuit symbolized by the lean concept Jidoka
A3	Web of actors	Lean	Trust	Lee and Jo (2007)	Distrust with third party (labour union) can negatively affect the leanness of the firm. Trust and mutual agreement (this is example of distrust with third party (labor union) and firm's management
A4	Web of actors	Lean	Shared experience	McDuffie & Helper 2007	Lean takes time to establish right, and one would prefer using known partners over new ones to ensure faster return and firm performance
A5	Web of actors	JIT	Long-term relat.	Pheng & Chuan 2001	Long term business relationships founded on mutual trust and benefits key for success of JIT
A6	Web of actors	Kaizen	Club membership	Dyer and Nobeoka 2000	Club membership (strong actor link) allows for suppliers helping out each other towards continuous improvement, lifting the whole network
A7	Web of actors	Kaizen	Networking	Perez & Sanchez 2002	Networking companies - active in the network - are proven to perform more in-house training and be better at teamwork, two key components of lean success
A8	Web of actors	Lean	Networking with suppliers and subcontractors	Hong and Kim (2012)	Networking with suppliers and subcontractors secures the stability of the supply parts. Stability is the fundament of leanness.
A9	Web of actors	Lean	Networking with your competitor's suppliers	Lee and Jo (2007)	Networking with your lean competitor's suppliers enables lean learning, faster introduction to lean
B1	Resource constellation	Lean & Jidoka	Knowledge transfer	Dyer & Hatch 2006	Knowledge (resource) sharing is a key part of Toyota's definition of lean and increases firm performance. Moreover, knowledge transfer between suppliers resulted in lower defects rate.
B2	Resource constellation	Lean & Heijunka	Employee exchange (shukko)	Lincoln et al. 1998 Dyer & Nobeoka 2000	Employee exchange as a fastrack to knowledge sharing and communication easing, to avoid mistakes and be more successful in lean implementation and beyond
B3	Resource constellation	Lean & Heijunka	Employee exchange (shukko)	Dyer and Nobeoka 2000	Employee exchange as a fastrack to knowledge sharing and communication easing, to avoid mistakes and be more successful in lean implementation and beyond (11% of suppliers directors are former employees of Toyota)

B4	Resource constellation	Lean	Employee exchange (shukko)	MacDuffie and Helper (1997)	Technical personnel from one supplier visits another supplier – fastrack to knowledge sharing and communication easing, to avoid mistakes and be more successful in lean implementation and beyond
B5	Resource constellation	Lean	Employee exchange (shukko)	MacDuffie and Helper (1997)	Honda sent people to “live” at Capitol supplier for 9 months - fastrack to knowledge sharing and communication easing, to avoid mistakes and be more successful in lean implementation
B6	Resource constellation	Lean	Kyugyo – “collaborative division of labor”	MacDuffie and Helper (2007)	Kyugyo – “collaborative division of labor” - fastrack to knowledge sharing and communication easing, to avoid mistakes and be more successful in lean implementation
B7	Resource constellation	Lean	Rotating people among plants (type of shukko)	Netland (2014)	Rotating people among plants – one of the examples about how XPS can be developed, launched and managed in the networks
B8	Resource constellation	Lean	Change teams as a part of network events	Boscari et al. (2016)	Change teams comprised of change agents in charge of the transferring lean to the subsidiaries
B9	Resource constellation	Lean & Heijunka	Consulting services	Dyer & Hatch 2006	Consultants is another way to provide knowledge to your network
B10	Resource constellation	Heijunka	Sharing «hard» & «soft» resources	Chen (2003)	Sharing of “hard” and “soft” resources, such as logistics services, manufacturing equipment, testing facilities, software can help to
B11	Resource constellation	Kaizen	Customer input	Beelaerts van Blokland et al., 2007	A truly lean enterprise would succeed from the points of view of end users, for example benefit from supplier-consumer interaction
B12	Resource constellation	Lean	Using retired employees of your rival	Lee and Jo (2007)	Using retired employees of your lean competitor to build your plant can result in quicker lean learning, faster introduction to lean
B13	Resource constellation	Lean	Knowledge acquisition	Hong and Kim (2012)	Information network between the headquarter and branch offices enable firm to acquire the lean knowledge (e.g. about technology and also markets). Knowledge acquisition and marketing through firm’s lean information network
C1	Activity pattern	Kaizen & Muda	Collaborative work	Linkoln et al., 1998 McDuffie & Helper 1997	Collaborative work, for example collaborative design with suppliers helps to avoid mistakes, solve problems faster, save costs
C2	Activity pattern	Lean	Jishuken – supplier-to-supplier working groups	MacDuffie and Helper (2007)	Jishuken – supplier-to-supplier working groups - fastrack to knowledge sharing and communication easing, to avoid mistakes and be more successful in lean implementation

C3	Activity pattern	Kaizen	Suppliers with common activities	Dyer & Nobeoka 2000	Supplier visits another supplier, learns and improves
C4	Activity pattern	Lean	Best activity for a given supplier	McDuffie & Helper 2007 Choi and Hong 2002	Supplier can choose to focus on just one component divesting itself of all other businesses
C5	Activity pattern	JIT	Supplier customer logistics	Dyer & Nobeoka 2000 Dyer and Hatch 2006	Stability of customer orders is necessary for successful lean implementation
C6	Activity pattern	Kaizen & muda	Meetings	Dyer and Nobeoka 2000	Network actors were regularly meeting, discussing problems, findings solutions, etc.
C7	Activity pattern	Lean	Team work	Boscari et al. (2016)	Team work enables faster and more effective lean implementation
C8	Activity pattern	Lean	Lean learning activities – visits	Inkpen (2005)	Visits of experts from other lean plants results in better leanness (learning from former advisors, from firm's alumni, network of former advisors)
C9	Activity pattern	Lean	MNE lean network assessment	Netland and Aspelund (2013)	Lean network assessment activity enhances leanness

Table 2. The pattern of important keywords/notions for lean management in three layers of substance of business relationships on the network level – web of actors, resource constellations and activity pattern

Article	Web of actors	Resource constellation	Activity pattern
McDuffie & Helper (1997)		X (employee exchange - shukko)	X (collaborative work)
McDuffie & Helper (2007)	X (trust)  X (shared experiences)	X (collaborative division of labour - kyugyo) X (supplier-to-supplier working groups - jishuken)	X (best activity for a given supplier)
Pheng & Chuan (2001)	X (long-term relationship)		
Dyer and Nobeoka (2000)	X (club membership)	X (employee exchange - shukko)	X (suppliers with common activities) X (supplier-customer logistics) X (meetings)
Dyer & Hatch (2006)		X (knowledge transfer) X (consulting services)	X (supplier- customer logistics)
Perez & Sanchez (2002)	X (networking)		
Hong and Kim (2012)	X (networking with suppliers and subcontractors)	X (knowledge acquisition and marketing)	
Lee and Jo (2007)	X (trust with third party – labour union) X (networking with your competitor’s suppliers)	X (using retired employees of your competitor to build your plant)	
Boscari et al. (2016)		X (change teams as a part of network events)	X (teamwork)
Lincoln et al. (1998)		X (employee exchange - shukko)	X (collaborative work)
Chen (2003)		X (sharing of “hard” and “soft” resources)	
Blokland et al. (2007)		X (customer input)	
Inkpen (2005)			X (lean learning activities - visits)
Netland and Aspelund (2013)			X (MNE annual lean network assessment)
Netland (2014)		X (rotating people among plants)	
Choi and Hong (2002)			X (best activity for a given supplier)

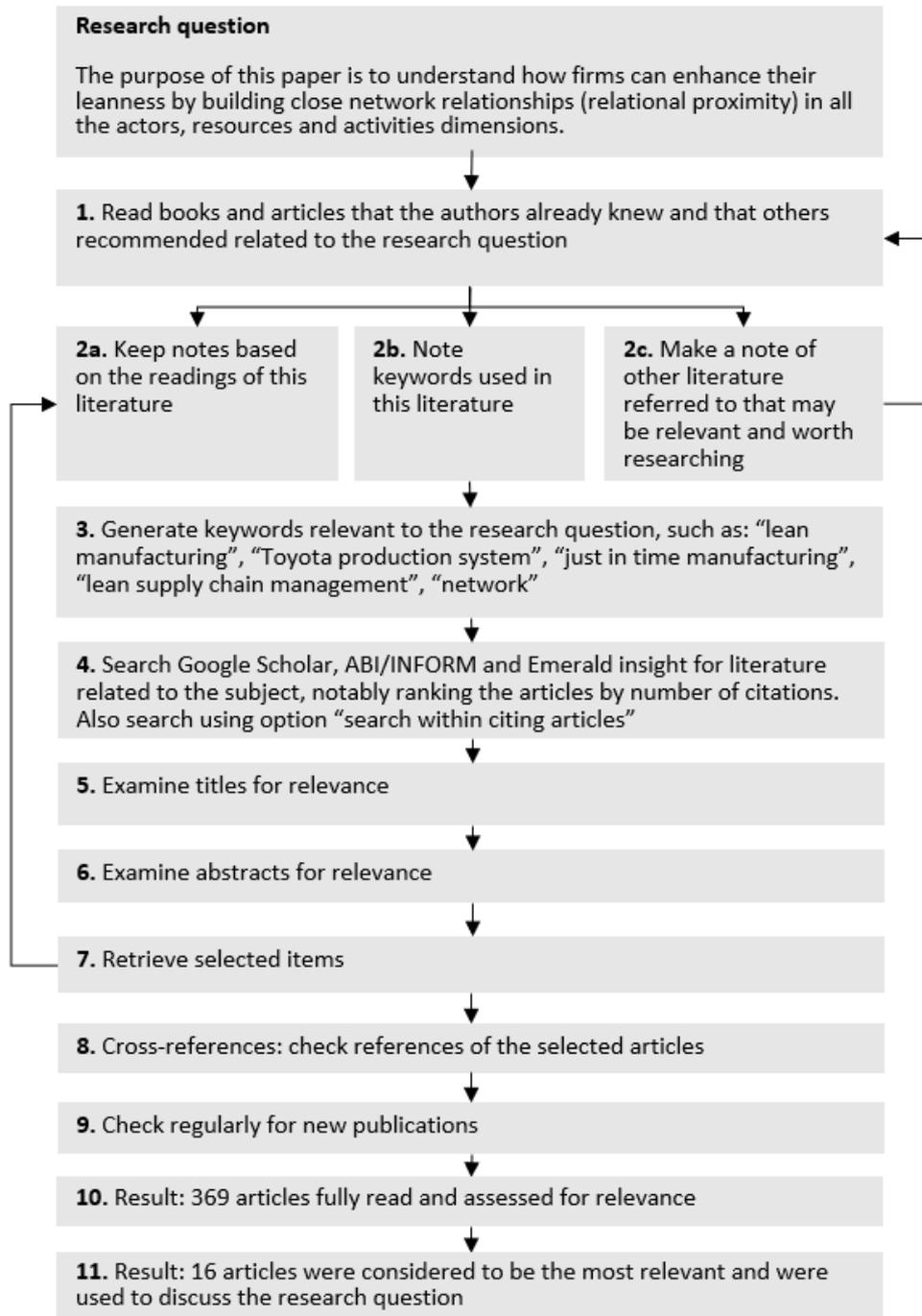


Figure 2. Literature search algorithm

Table 3. The list of reviewed articles with short description

N	Author/year	Short description
1.	McDuffie & Helper (2007)	research about collaboration with and without trust: case studies of supply chain management at Toyota, Honda and Nissan
2.	McDuffie & Helper (1997)	case study of three Honda's suppliers, about creating lean suppliers: Capitol Plastics, Progressive Industries, Tower Automotive
3.	Pheng & Chuan (2001)	study about just-in-time management of precast concrete

		components, survey of forty construction sites in Singapore that use precast concrete
4.	Dyer and Nobeoka (2000)	case study: how Toyota created and managed a high-performance knowledge-sharing network
5.	Dyer & Hatch (2006)	study about relation-specific capabilities and barriers to knowledge transfers, how to create advantage through network relationships, interviews and survey of sample of US automotive suppliers selling to both Toyota and US automakers
6.	Perez & Sanchez (2002)	study about lean production and technology networks in the Spanish automotive supplier industry, survey of an assembly plant of Opel-GM and 53 automotive suppliers
7.	Hong and Kim (2012)	study about Business Network Excellence model in Korean firms, such as Samsung, LG, Hyundai
8.	Lee and Jo (2007)	study about mutation of TPS: how Hyundai adopted TPS (Toyota Production System) and developed its own HPS (Hyundai Production System)
9.	Boscari et al. (2016)	case study of implementation of lean production in multinational Italian corporations (firms' made names Heating, Ventilation, Air Conditioning Refrigeration)
10.	Lincoln et al. (1998)	study about organizational learning and purchase-supply relations in Japan: Hitachi, Matsushita, and Toyota compared
11.	Chen (2003)	study about network resources for internationalization: the case of Taiwan's ten electronics firms, the main firm is Falcon (made name) that serves as a contract manufacturer for branded computer system makers such as IBM, HP, Philips, Viewsonic, etc.
12.	Blokland et al. (2007)	study about how the leanness of a company can be quantified in the context of the lean value network system; financial data of companies from various industries has been analyzed and compared to the configuration of their value chain
13.	Inkpen (2005)	the case study about knowledge transfer – how General Motors was learning from their partner NUMMI and adopting lean manufacturing
14.	Netland and Aspelund (2013)	a resource-based view on the Volvo production system
15.	Netland (2014)	study about the production improvement programmes XPSs (evolved from TPS) of four Scandinavian multinationals: Elkem, Hydro, Jotun and Volvo
16.	Choi and Hong (2002)	study about the structure of supply networks: three cases of supply networks of Honda, Acura, and DaimlerChrysler

Table 4. The list of reviewed articles and their main research firms

Article	Main firm(s) studied in the network
McDuffie & Helper (1997)	Toyota, Honda and Nissan
McDuffie & Helper (2007)	three Honda's suppliers: Capitol Plastics, Progressive Industries, Tower Automotive
Pheng & Chuan (2001)	40 construction sites in Singapore that use precast concrete
Dyer and Nobeoka (2000)	Toyota
Dyer & Hatch (2006)	of US automotive suppliers selling to both Toyota and US automakers
Perez & Sanchez (2002)	assembly plant of Opel-GM and 53 automotive suppliers
Hong and Kim (2012)	Korean firms: Samsung, LG, Hyundai
Lee and Jo (2007)	Hyundai
Boscari et al. (2016)	multinational Italian corporations (firms' made names Heating, Ventilation, Air Conditioning Refrigeration)
Lincoln et al. (1998)	Hitachi, Matsushita, Toyota
Chen (2003)	Taiwan's ten electronics firms, the main firm is Falcon (made name) that is a contract manufacturer for IBM, HP, Philips, Viewsonic, etc.

Blokland et al. (2007)	financial data from car and aircraft manufacturers, and the airline industry
Inkpen (2005)	GM and Nummi
Netland and Aspelund (2013)	Volvo
Netland (2014)	Scandinavian multinationals: Elkem, Hydro, Jotun and Volvo
Choi and Hong (2002)	Honda, Acura, and DaimlerChrysler

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