

Doctoral thesis

Doctoral theses at NTNU, 2024:214

Leandro Dobre Baptista dos Santos

Third-party involvement in lean supplier development

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of
Philosophiae Doctor
Faculty of Economics and Management
Dept. of Industrial Economics and Technology
Management



Norwegian University of
Science and Technology

Leandro Dobre Baptista dos Santos

Third-party involvement in lean supplier development

Thesis for the Degree of Philosophiae Doctor

Trondheim, June 2024

Norwegian University of Science and Technology
Faculty of Economics and Management
Dept. of Industrial Economics and Technology Management

NTNU

Norwegian University of Science and Technology

Thesis for the Degree of Philosophiae Doctor

Faculty of Economics and Management

Dept. of Industrial Economics and Technology Management

© Leandro Dobre Baptista dos Santos

ISBN 978-82-326-8020-7 (printed ver.)

ISBN 978-82-326-8019-1 (electronic ver.)

ISSN 1503-8181 (printed ver.)

ISSN 2703-8084 (online ver.)

Doctoral theses at NTNU, 2024:214

Printed by NTNU Grafisk senter

Acknowledgments

The work of a doctoral thesis is mainly done alone, in front of a screen. However, many people have helped me with revising the manuscript, giving input with their knowledge, and, of course, with encouragement. I would like to acknowledge some people whose help has been fundamental to getting this work done.

I would like to give many thanks to my supervisors. First, Professor Elsebeth Holmen, my main supervisor, thanks for the patience and time dedicated to helping me shape the thesis. Your profound knowledge has inspired me many times. Secondly, my co-supervisor, Professor Ann-Charlott Pedersen, thank you for your practical approach to the supervision and for your confidence from the beginning that this thesis would become a reality. Thank you both for believing in the success of my return to academia and for your patience with my readaptation. Finally, Post. Doc. Victor Eriksson, thank you for providing me with valuable input toward the end; your inputs and suggestions were fundamental to completing the thesis.

I would like to thank my mother, Roseli, for her encouragement and investment in my education, which has set a good foundation for me to pursue the highest academic degree. Also, thanks to my closest family, who followed me during these years, among many sorrows and joyful moments. Thank you, Flavia, for your love, partnership, patience, resignation, and dedication to me and the kids. Only God knows what we went through together in this period! Thank you, Levi and Melissa, my beloved kids, for your energy, smiles, and astonishing pace of development, helping me believe that it was possible to finish this thesis.

I would also like to thank my colleague and friend, Maren W. Østensen, with whom I have shared offices for more than three years and who went through similar stages doing her thesis by my side. Your dedication and competence have inspired me. Other friends have also helped, such as Kerenina K. Dansholm and Logan R. Vallandingham, who have commented and contributed with their extensive knowledge of English: thank you! I will also mention my friend Leonel de Souza, who has given many wise insights in recent years, and his gift for listening.

I also extend my gratitude to the IMP Group community, who, during conferences and seminars, supported and motivated me to continue this journey.

And finally, I would like to thank you so much, Lord God, for taking care of every detail!

Leandro D. B. dos Santos

Abstract

Developing business relationships with suppliers is crucial to exploit the full potential of lean management. Inspired by mature lean firms, such as Toyota, lean adopters have been employing lean supplier development, a set of initiatives aimed at transferring lean and continuous improvement capabilities to suppliers. Key issues in lean supplier development are collaborative relationships, the use of activities to transfer lean capabilities, and implementation steps. These issues have been discussed in a variety of literature streams, focusing on activity structures used by advanced lean firms to develop single suppliers. Specifically, research has considered the level of dyads or the development of large supply networks and associations. However, lean supplier development also involves relationships with additional suppliers, other suppliers or customers, and other organizations. These third parties, alongside the buying firm, initiate and drive lean supplier development. Against this backdrop, this study explores the involvement of third parties in lean supplier development.

The study underlying this thesis is based on a case study and two literature reviews. Paper 1 reviews the involvement of third parties in the supplier development literature, identifying ways in which they can be involved and discussing the reasons for their involvement. Paper 2 discusses the key elements of lean supply and how they can be interpreted from an industrial marketing and purchasing perspective (i.e., the industrial network approach). Paper 3 explores a case of lean supplier development employed by a firm with evolving lean capabilities, and the role of third parties in the process, comparing their initiative with the Toyota-style supplier network.

The theoretical framing of the thesis is the industrial network approach, which explores relationships in a network context, and regards them as belonging to a broader network as a set of connected relationships. A conceptual model based on the industrial network approach and literature on triads is developed and applied in the analysis, which focuses primarily on the third-party effects, connections, and types of actors, such as an additional buyer, additional supplier, and ancillary organization.

It is found that lean supplier development involves deep supplier relationships, direct and advanced supplier development, and relationship management, with mature lean firms like Toyota providing inspiration. The literature has identified various triads, with third parties involved in different ways regarding their types and connections. The results of the present study show that an additional buyer can contribute positively to the engagement of the focal supplier in lean supplier development. In addition, an additional supplier can share superior capabilities and transfer knowledge to other suppliers, leading to strong(er) network ties. Ancillary organizations provide important teaching, training, and resources in lean supplier development, and those with high levels of lean capabilities play a crucial role in initiatives of buyers that are not yet mature in terms of lean capabilities.

This thesis contributes to lean supplier development research by using a network level of analysis to systematically explore third-party involvement. It expands the current view of the focal buyer as the lean master, and sheds light on the third party as a fundamental role. The study relies on and contributes to the industrial network approach and literature on triads by examining third-party involvement. Finally, this thesis provides some important guiding principles for managers of buyers, suppliers, and third parties involved in lean practices and supplier development.

Sammendrag

Utvikling av forretningsrelasjoner med leverandører er avgjørende for å utnytte det fulle potensialet til lean management. Inspirert av erfarne lean-firmaer, som Toyota, har lean-etterfølgere tatt i bruk lean leverandørutvikling, et sett med initiativer som tar sikte på å overføre lean og kontinuerlig forbedringsevne til leverandører. Sentrale aspekter i utviklingen av lean-leverandører er samarbeidsrelasjoner, bruk av aktiviteter for å videreføre lean-ferdigheter og implementeringstrinn. Disse temaene har blitt diskutert i en rekke litteraturstrømmer, med fokus på aktivitetsstrukturer brukt av avanserte lean-firmaer for å utvikle enkeltleverandører. Forskningen har sett spesifikt på nivået av dyader eller utviklingen av store leverandørs-nettverk og foreninger. Lean leverandørutvikling innebærer imidlertid også relasjoner med flere leverandører, andre leverandører eller kunder og andre organisasjoner. Disse tredjepartene, sammen med innkjøpsfirmaet, initierer og driver lean leverandørutvikling. Med dette bakteppet utforsker denne studien involvering av tredjeparter i utvikling av lean leverandører.

Studien som ligger til grunn for denne oppgaven er basert på en casestudie og to litteraturstudier. Den første artikkelen gjennomgår involvering av tredjeparter i leverandørutviklingslitteraturen, identifiserer måter de kan involveres på og diskuterer årsakene til deres involvering. Den andre artikkelen diskuterer nøkkelementene i lean supply og hvordan de kan tolkes fra den industrielle nettverkstilnærmingen. Den tredje artikkelen utforsker en case med lean-leverandørutvikling gjort av et firma som holder på å utvikle sine lean-ferdigheter, og rollen til tredjeparter i prosessen, og sammenligner deres initiativ med Toyota-stil leverandørnettverket.

Det teoretiske rammeverket til avhandlingen er den industrielle nettverkstilnærmingen, som utforsker relasjoner i en nettverkskontekst, og ser på dem som tilhørende i et bredere nettverk som et sett av sammenhengende relasjoner. En konseptuell modell basert på den industrielle nettverkstilnærmingen og litteratur om triader utvikles og brukes i analysen, som primært fokuserer på tredjepartseffekter, koblinger og typer aktører, som en ekstra kjøper, en ekstra leverandør og en støtteorganisasjon.

Det er funnet at utvikling av lean-leverandører involverer dype leverandørrelasjoner, direkte og avansert leverandørutvikling og relasjonsstyring, med erfarne lean-firmaer som Toyota som inspirasjon. Litteraturen har identifisert ulike triader, med tredjeparter involvert på ulike måter når det gjelder typer og koblinger. Resultatene fra denne studien viser at en ekstra kjøper kan bidra positivt til fokusleverandørens engasjement i lean leverandørutvikling. I tillegg kan en ekstra leverandør dele bedre ferdigheter og overføre kunnskap til andre leverandører, noe som fører til sterke(re) nettverksbånd. Støtteorganisasjoner gir viktig undervisning, opplæring og ressurser i utvikling av lean-leverandører, og de med høye nivåer av lean-ferdigheter spiller en avgjørende rolle i initiativer til kjøpere som ennå ikke er erfarne når det gjelder lean-ferdigheter.

Denne avhandlingen bidrar til forskning på lean leverandørutvikling ved å bruke et nettverksnivå av analyse for å systematisk utforske tredjepartsinvolvering. Det utvider det nåværende synet på den fokale kjøperen som lean mester, og belyser tredjeparten som en grunnleggende rolle. Studien baserer seg på og bidrar til den industrielle nettverkstilnærmingen og litteratur om triader ved å undersøke tredjepartsinvolvering. Til slutt gir denne oppgaven noen viktige veiledende prinsipper til ledere for kjøpere, leverandører og tredjeparter som er involvert i lean-praksis og leverandørutvikling.

Table of Contents

Part I

1	Introduction.....	1
1.1	Personal motivation.....	1
1.2	Problem area: Lean supplier development and third parties	1
1.3	Outline of the thesis.....	3
2	Theoretical basis and framing.....	5
2.1	Lean supplier development	5
2.1.1	Supplier development	5
2.1.2	The spread of lean supplier relationships	6
2.1.3	Implementation of lean and lean supplier development	7
2.1.4	Stages and characteristics of Toyota-style lean supplier development	8
2.2	Industrial networks	10
2.3	Triads in industrial networks	12
2.4	Third parties in supplier development: A conceptual model	16
2.5	Problem discussion and framing of the research questions.....	23
2.5.1	Research question 1	23
2.5.2	Research question 2	24
3	Methodology.....	27
3.1	Research setting and process	27
3.3	Literature review as a method	29
3.3.1	Method in Paper 1.....	30
3.3.2	Method in Paper 2.....	31
3.3.3	Research quality for a literature review design	33
3.4	Case study as a method	34
3.4.1	Method in Paper 3.....	35
3.4.2	Research quality for a case study design	36
4	Summaries of the three appended papers	39
4.1	Summary of Paper 1	39
4.2	Summary of Paper 2	40
4.3	Summary of Paper 3	42
5	Discussion.....	45
5.1	Literature examples of the involvement of third parties	45
5.1.1	Analyzing triads with an additional buyer.....	48
5.1.2	Analyzing triads with an additional supplier.....	56
5.1.3	Analyzing triads with an ancillary organization.....	59

5.2 Third-party involvement in lean supplier development	66
5.2.1 Third parties involved in NSI	66
5.2.2 How various types of third parties can contribute to lean supplier development.....	71
6 Conclusions.....	75
6.1 Addressing the research questions	75
6.1.1 Addressing research question 1	76
6.1.2 Addressing research question 2	79
6.2 Implications for research	82
6.2.1 Implications for research on supplier development considering lean and capabilities	82
6.2.2 Implications for third-party involvement: Industrial network and triads	84
6.3 Managerial implications	85
6.3.1 Implications for focal buyers	85
6.3.2 Implications for focal suppliers	86
6.3.3 Implications for third parties	86
6.4 Suggestions for further research.....	87
References	89

List of Figures

Figure 1. Substance of the firm, relationship (dyad), and network.....	10
Figure 2. A triad: three connected relationships embedded in a business network	12
Figure 3. Four triads that represent different connected relationships.....	13
Figure 4. Serial and unitary triads, adapted from Havila (1996) and Holmen and Pedersen (2000). 14	
Figure 5. Serial triad positive effects	14
Figure 6. Unitary triad effects	15
Figure 7. One-way third-party effect	16
Figure 8. A third party connected via the focal buyer or the focal supplier	17
Figure 9. Third-party types: additional buyer, additional supplier, and ancillary organization	17
Figure 10. Implicit triad, connected via the focal supplier or buyer: Types 1 to 6.....	18
Figure 11. Open triad, connected via the focal supplier or buyer: Types 7 to 12.....	19
Figure 12. Semi-closed triad, connected via the focal supplier or buyer: Types 13 to 18.....	21
Figure 13. Closed triad, connected via the focal supplier or buyer: Types 19 to 24	22
Figure 14. The research design adopted in this study	28
Figure 15. Third-party involvement, the supplier development literature, and lean supply studies..	45
Figure 16. Triad types and third parties connected via the focal supplier and via the focal buyer....	47
Figure 17. Implicit triad with an additional buyer connected via the focal supplier (TT 1-a).....	49
Figure 18. Implicit triad with an additional buyer connected via the focal supplier (TT 1-b)	49
Figure 19. Implicit triad with an additional buyer connected via the focal supplier (TT 1-c).....	50
Figure 20. Open triad with an additional buyer connected via the focal supplier (TT 7).....	50
Figure 21. Semi-closed triad with an additional buyer connected via the focal supplier (TT 13).....	51
Figure 22. Closed triad with an additional buyer connected via the focal supplier (TT 19-a)	52
Figure 23. Closed triad with an additional buyer connected via the focal supplier (TT 19-b)	52
Figure 24. Implicit triad with an additional buyer connected via the focal buyer (TT 4).....	54
Figure 25. Open triad with an additional buyer connected via the focal buyer (TT 10).....	54
Figure 26. Semi-closed triad with an additional buyer connected via the focal buyer (TT 16-a)	55
Figure 27. Semi-closed triad with an additional buyer connected via the focal buyer (TT 16-b)	55
Figure 28. Closed triad with an additional supplier connected via the focal supplier (TT 20).....	57
Figure 29. Semi-closed triad with an additional supplier connected via the focal buyer (TT 17).....	58
Figure 30. Closed triad with an additional supplier connected via the focal buyer (TT 23)	59
Figure 31. Open triad with an ancillary organization connected via the focal supplier (TT 9).....	60
Figure 32. Semi-closed triad with an ancillary organization connected via the focal supplier (TT 15)	61
Figure 33. Closed triad with an ancillary organization connected via the focal supplier (TT 21-a) .	61
Figure 34. Closed triad with an ancillary organization connected via the focal supplier (TT 21-b) .	62
Figure 35. Implicit triad with an ancillary organization connected via the focal buyer (TT 6).....	63
Figure 36. Open triad with an ancillary organization connected via the focal buyer (TT 12).....	63
Figure 37. Semi-closed triad with an ancillary organization connected via the focal buyer (TT 18)	64
Figure 38. Closed triad with an ancillary organization connected via the focal buyer (TT 24)	64
Figure 39. Implicit triad with an additional buyer connected via the focal supplier (TT 1).....	67
Figure 40. Closed triad with an additional supplier connected via KMS (TT 23).....	68
Figure 41. Semi-closed triad with SRM connected via the focal supplier (TT 15)	68
Figure 42. Closed triad with Innovation Norway connected via KMS (TT 24-a)	69
Figure 43. Closed triad with NCE-SE connected via KMS (TT 24-b)	69
Figure 44. Closed triad with Semcon Devotek connected via KMS (TT 24-c).....	70
Figure 45. Closed triad with SRM connected via KMS (TT 24-d).....	70

Figure 46. The conceptual model.....	75
Figure 47. Effect and contributions of an additional buyer connected via the focal supplier	77
Figure 48. Effect and contributions of an additional buyer connected via the focal buyer	77
Figure 49. Effect and contributions of an additional supplier connected via the focal buyer	78
Figure 50. Effect and contributions of an ancillary organization connected via the focal supplier...	78
Figure 51. Effect and contributions of an ancillary organization connected via the focal buyer	79
Figure 52. Effect and contribution of an additional buyer to lean supplier development.....	80
Figure 53. Effect and contribution of an additional supplier to lean supplier development.....	81
Figure 54. Effect and contributions of an ancillary organization in lean supplier development	81
Figure 55. Effect and contributions of an ancillary organization with high levels of lean capabilities	82

List of Tables

Table 1. Classifications of triads.....	15
Table 2. Triad types in supplier development.....	18
Table 3. Main themes in the supplier development literature.....	31
Table 4. Elements of lean supply.....	32
Table 5. Lean supply elements in the IMP framework.....	33
Table 6. Contribution of independent papers to research questions.....	39
Table 7. Twenty-four triad types.....	48
Table 8. Triads with an additional buyer.....	48
Table 9. Involvement of an additional buyer connected via the focal supplier.....	53
Table 10. Involvement of an additional buyer connected via the focal buyer.....	56
Table 11. Triads with an additional supplier.....	56
Table 12. Involvement of an additional supplier connected via the focal supplier.....	57
Table 13. Involvement of an additional supplier connected via the focal buyer.....	59
Table 14. Triads with an ancillary organization.....	60
Table 15. Involvement of an ancillary organization connected via the focal supplier.....	62
Table 16. Involvement of an ancillary organization connected via the focal buyer.....	65
Table 17. Involvement of third parties addressed in extant research.....	66
Table 18. Involvement of an additional buyer in NSI.....	67
Table 19. Involvement of an additional supplier in NSI.....	68
Table 20. Involvement of ancillary organizations in NSI.....	71
Table 21. Third parties in NSI and the corresponding examples in the literature.....	71

Part II

Paper 1

dos Santos, L. D., Holmen, E., & Pedersen, A. C. (2022). *Who develops the suppliers? The role of third parties in bringing about supplier development*. Working Paper, NTNU, Trondheim.

(A previous version was presented at the 30th annual conference of the International Purchasing & Supply Education & Research Association, March 29–April 1, 2021.)

Paper 2

dos Santos, L. D., Holmen, E., & Pedersen, A. C. (2020). Viewing lean supply from the IMP perspective. *Journal of Business & Industrial Marketing*, 35(1), 172–182.
<https://doi.org/10.1108/JBIM-02-2019-0066>

Paper 3

dos Santos, L. D., Holmen, E., Pedersen, A. C., Mogos, M. F., Lodgaard, E. & Powell, D. (2023). How can a buying company develop a Toyota-style supply network while its lean capabilities are still evolving? *International Journal of Lean Six Sigma*, ahead-of-print.
<https://doi.org/10.1108/IJLSS-11-2021-0191>

Part I

1 Introduction

This thesis deals with the involvement of third parties in lean supplier development. This chapter first outlines the motivation and background of the research. Next, it presents the research focus and problem area, culminating in the aim of the thesis. Finally, the chapter ends with an outline of the thesis.

1.1 Personal motivation

In 2012, I started working as a lean coordinator in a firm assembling air compressors for oil platforms in Norway. The company's purchasing department focused on operational processes, such as order placement and follow-ups. The firm also performed a yearly supplier evaluation and audits as required for quality management certification. However, because the purchasing department carried out its evaluations without much involvement from the other departments, the results did not benefit the company significantly.

The firm has had a lean management program since the mid-2000s, focusing primarily on the standardization of processes in its workshop. My task was to expand the lean program from the workshop to other parts of the firm. At the beginning of 2014, we started using continuous improvement principles in our supplier evaluation, allocating more time to it, and involving other departments, such as the engineering department. These changes improved the evaluations and made them more helpful for the firm. We also performed more supplier audits than in previous years and broadened their scope to assess the suppliers' continuous improvement and lean capabilities. Furthermore, we noted great potential for improving logistic and purchasing processes related to suppliers, albeit we did not explore this potential in detail. In 2016, we started to use lean tools, such as process mapping and performance indicators, to develop suppliers.

The primary lean supplier development initiative was an extended value stream mapping (eVSM) with two suppliers. From the outset, the first supplier was engaged, whereas the other supplier was more skeptical, probably because it had a lower level of lean capabilities. Therefore, we decided to continue with the engaged supplier. Continuing the initiative for several months with this supplier proved fruitful, and together, we mapped key processes and established common buyer–supplier performance indicators.

Unfortunately, because of a crisis in the industry, followed by a loss of essential orders, many of the firm's long-term plans needed to be deprioritized, and lean supplier development was one of them. Its premature discontinuation prompted two main questions: What might the results have been if the initiative had been taken further? Would we have managed to advance the program to involve more suppliers? These questions provided me with a personal motivation to apply to a PhD project about lean management and suppliers, which resulted in this thesis.

1.2 Problem area: Lean supplier development and third parties

Since its origins in the Japanese automotive industry and the Toyota production system (see, e.g., Fujimoto, 1999; Ohno, 1988), lean principles and practices (or simply *lean*) have evolved as a broad management concept aiming to improve business operations and processes (e.g., Shook and Marchwinski, 2014; Womack et al., 1990). Numerous firms have implemented lean practices and principles to achieve operational improvement and cost reductions (Bicheno and Holweg, 2016; Netland and Powell, 2016).

Lean implementation initially focuses on internal processes, but the full potential of lean is achieved when it embraces the supply chain and network (Bortolotti et al., 2016; Jones and Womack, 2016; Lamming, 1993). Exemplary lean firms have been systematic and consistent in transferring their lean capabilities to suppliers (see, e.g., Bicheno and Holweg, 2016; Dyer and Nobeoka, 2000; Hines et al., 2004; Sako, 2004).

Nevertheless, the transfer of lean capabilities to suppliers is demanding and involves the development of business relationships (Harris et al., 2011; Myerson, 2012; Tortorella et al., 2017). Therefore, lean adopters have been inspired by how Toyota Motor Corporation (hereafter, Toyota) has dealt with its suppliers (see, e.g., Dyer and Nobeoka, 2000; Marksberry, 2012; Sako, 2004; Womack et al., 1990). One of the management principles that made Toyota a world-class lean firm is its ability to “find solid partners [i.e., suppliers] and grow together to mutual benefit in the long term” (Liker, 2004, p. 202). To lean adopters (i.e., lean firms), the supply base is fundamental to increasing their performance and is thus considered crucial and seen as the extended enterprise (Dyer, 2000). Consequently, firms searching for performance improvements using lean principles and practices must look beyond internal operations and promote the development of capabilities within suppliers (Bortolotti et al., 2016; Dyer, 2000; Harris et al., 2011). To exploit the full potential of lean, firms must engage in lean supplier development to transfer internal lean capabilities to suppliers (Harris et al., 2011; Hines, 1994; Jones and Womack, 2016; Sako, 2004).

Thus, the implementation of lean in the supply base, or *lean supplier development*, is relevant for firms in many industries and has been partially discussed in supplier development studies (e.g., Hines, 1994; Powell and Coughlan, 2020; Sako, 2004). In studies of Japanese supply systems (e.g., Dyer and Nobeoka, 2000; Hines, 2016; Liker and Choi, 2004), efforts of lean firms with large supply networks have been in focus, with an emphasis on the structures that advanced lean firms use to transfer lean and continuous improvement capabilities to suppliers, such as supplier associations (Hines, 1994; Powell and Coughlan, 2020; Sako, 2004).

In practice, a lean firm can identify and manage internal lean processes, whereas external processes are beyond its formal control (Jasti and Kodali, 2015). The literature has discussed how lean firms can succeed in extending lean to suppliers by developing collaborative relationships, utilizing lean tools, and following particular implementation steps (e.g., Harris et al., 2011; Hines, 1994; Lamming, 1993; Womack and Jones, 2003). Nevertheless, such collaborative relationships require a high degree of involvement of both parties, which is costly (Gadde and Snehota, 2000; Lamming, 1993).

In addition to focusing on how a single firm can develop lean suppliers, research has observed that, as well as a buyer and a single supplier, lean supplier development involves relationships with other parties, hereafter, *third parties* (e.g., Dyer and Nobeoka, 2000; Hines, 1994, 2016; Hoque, 2021; Kito et al., 2014; Marksberry, 2012; Powell and Coughlan, 2021; Sisson and Elshennawy, 2015). In a business relationship, third parties can be connected and may impact the relationship in many ways (Anderson et al., 1994; Dubois et al., 2011). In fact, third parties form part of discussions of how Toyota deals with its suppliers (see, e.g., Hines, 1994; Hines and Rich, 1998; Kito et al., 2014; Marksberry, 2012). More recently, the literature has noted that third parties can contribute to the development of suppliers’ lean capabilities (Hoque, 2021; Powell and Coughlan, 2021; Sisson and Elshennawy, 2015). Likewise, third parties can help the lean firm to overcome its lack of formal control over external lean processes and can support involvement and collaboration in large supplier networks, such as interacting with tier-two and tier-three suppliers (e.g., Dyer and Nobeoka, 2000; Hines, 2016).

In practice, third parties have been central in developing the suppliers of lean firms (see, e.g., Dyer and Nobeoka, 2000; Hines, 2016; Kito et al., 2014; Marksberry, 2012; Powell and Coughlan, 2021). For example, in the early days of Toyota’s supplier association, the local government in Japan

supported the association through involvement in activities such as consultancy among its members (Nishiguchi, 1994; Sako, 2004). Research has explored the central role of third parties in, for example, facilitating innovation and new product development (e.g., Dubois et al., 2011; Lynch and O'Toole, 2006). Nevertheless, to date, third-party involvement has not been a central focus in lean supplier development research and practice, a shortcoming that this thesis aims to address. Against this backdrop, the aim of this study is therefore as follows: *To explore the involvement of third parties in lean supplier development.*

1.3 Outline of the thesis

The remainder of this compilation thesis, which consists of six chapters and three appended papers, is structured as follows. Chapter 2 discusses lean supplier development and triads to understand connections between various actors in industrial networks. It develops a conceptual model based on triads, connectedness, and lean supplier development and also provides a formulation and discussion of the research questions. Chapter 3 describes the research design of the study as a whole and discusses the methods used. Chapter 4 summarizes the three appended papers. Chapter 5 discusses the research questions and how the findings contribute to achieving the aim of the thesis. Chapter 6 presents the conclusions of the thesis, including the theoretical and managerial implications, and ends with avenues for future research.

2 Theoretical basis and framing

This chapter first presents previous research on lean supplier development. It then builds the theoretical basis of the present research, which draws on the industrial network approach and the concept of triads. Next, it presents the conceptual framework based on the role of third parties in lean supplier development that will guide the analysis. The chapter ends by formulating and discussing the research questions of the thesis.

2.1 Lean supplier development

2.1.1 Supplier development

It is well known that most industrial firms must deal with a high level of technological complexity and competition. As observed already in the 1990s, “increasingly global competition is forcing vendors (buying firms) to develop specialized capabilities” (Lascelles and Dale, 1990, p. 46). Thus, many buying firms are highly specialized in what they do, which increases their reliance on outsourcing components and their dependence on suppliers (Araujo et al., 2016). Consequently, the efficient use of a firm’s internal capabilities cannot account for all of its business performance, since what is beyond a firm’s boundaries considerably affects its operations (Dyer, 2000; Håkansson and Snehota, 1995). In addition, many firms “increasingly expect their suppliers to deliver innovative and quality products on time and at a competitive cost” (Handfield et al., 2000, p. 37). As pointed out by Gadde (2010, p. 12), “By joining with suppliers and sharing capabilities with them, the supply side may contribute substantially to performance improvements.”

However, suppliers cannot always meet the capability and performance needs of the buying firm, and several alternatives exist for dealing with underperforming suppliers. For low-margin items and commodities, the buying firm can switch to a new supplier; otherwise, the buyer may choose to bring the production of the required item in-house (Handfield et al., 2000). In addition to in-house production and switching suppliers, the buying firm may undertake supplier development, that is, efforts to develop the performance and capabilities of current suppliers (Wagner, 2006). A commonly used definition of supplier development is “any effort of a firm to increase performance and/or capabilities to meet the firm’s short- and/or long-term supply needs” (Krause, 1997, p. 12). Supplier development efforts have the potential to develop suppliers to fulfill the buying firm’s needs, provided that the suppliers receive the appropriate incentives and support (Handfield et al., 2000; Krause et al., 1998).

Supplier development varies depending on the buying firm’s type of participation in the activities, which can be direct or indirect (Sucky and Durst, 2013; Wagner, 2006). Direct supplier development can include on-site consultation, education and training programs, temporary personnel transfer, inviting the supplier’s personnel to visit the buyer’s operations, or provision of equipment and capital to the supplier (Krause, 1997; Krause and Scannell, 2002). Toyota is a frequently used example of a buying firm that applies a direct, systematic, and standardized way of working with suppliers and builds supplier capabilities that benefit both the suppliers and Toyota in the long run (Dyer and Nobeoka, 2000).

In contrast, indirect supplier development occurs when a buying firm commits no or limited resources to a specific supplier and instead offers incentives for or enforces supplier development (Wagner, 2006). The means of indirect supplier development include assessing suppliers, communicating supplier evaluation results and performance goals, and promising future business (Krause, 1997; Krause et al., 2000). Hence, buying firms use indirect supplier development to

encourage suppliers to improve with less involvement from the buying firm (Aune et al., 2013; Krause et al., 2000).

A buying firm that applies supplier development, directly or indirectly, intends to improve the capabilities of the supplier (Handfield et al., 2000; Krause, 1997; Sako, 2004). The buying firm can replicate capabilities from its organization and pass them on as “a subject [that is] taught” (Sako, 2004, p. 281). Additionally, the ability of the buying firm to develop its suppliers is a capability in itself (Sako, 2004), sometimes referred to as execution capability (Talluri et al., 2010). Thus, the supplier development capability involves two aspects: capabilities to be replicated in the supplier and the execution capability of the buying firm.

The buying firm’s needs, interests, and perspective are central in supplier development. Many studies of supplier development also deal with the efforts of a buying firm in relation to an individual supplier (e.g., Busse et al., 2016; Galt and Dale, 1991; Krause and Ellram, 1997; Wagner, 2006). In other instances, the focus is on supplier development initiatives that involve a portfolio, groups, or associations of suppliers (e.g., Arráiz et al., 2013; Hadfield et al., 2000; Liu et al., 2018; Quayle, 2000). Nevertheless, in general, the supplier’s perspective is considered less frequently (Ahmed and Hendry, 2012; Nagati and Rebolledo, 2013; Rogers et al., 2007).

In addition to the single buyer and supplier perspective, other actors have been identified as contributing to supplier development. For example, some studies point to the involvement of a second buyer that supports a single buying firm in developing supplier, suggesting that it can be advantageous for buyers to cooperate in developing suppliers (e.g., Aune et al., 2013; Friedl and Wagner, 2016; Talluri et al., 2010; Wagner, 2016). Other examples show some complementary suppliers support a buying firm in developing another supplier (e.g., Aune et al., 2013; Dyer and Nobeoka, 2000; Hines, 1994, 2016; Khan and Nicholson, 2014; Zhang et al., 2017). Finally, in addition to the second buyer and complementary suppliers, other third parties can be involved in supplier development. For example, governmental agencies and consultancy firms can initiate, support, or advance supplier development initiatives (e.g., Arráiz et al., 2013; Arroyo-López et al., 2012; Esteves and Barclay, 2011; Liu et al., 2018; Quayle, 2000). The involvement of such third parties in supplier development can bridge institutional voids (Brix-Asala and Seuring, 2020) and trigger the adoption of sustainable supplier development (Sancha et al., 2015).

2.1.2 The spread of lean supplier relationships

With roots in the Japanese automotive industry, lean management was popularized by the International Motor Vehicle Program studies (Womack et al., 1990). Since then, lean principles¹ and practices (Womack and Jones, 1996) have been applied across many functional areas and many different industries, such as construction, retail, and public services (Bicheno and Holweg, 2016; Netland and Powell in Netland and Powell, 2016). From the 1990s, there was a slow but constant spread of Japanese-style supplier relationships and related practices to the Western context (Hines, 1994; Hines and Rich, 1998). Nevertheless, a culture of arm’s-length supplier relationships was considered the standard type of supplier relationship in the American automotive industry in the 1990s (Bicheno and Holweg, 2016; Lamming, 1993).

Japanese lean firms coming to the US in the 1990s became involved in the internal operation of external companies to develop their lean capabilities, despite this being an unusual and unprecedented endeavor (Liker and Choi, 2004; MacDuffie and Helper, 1997). The lean supplier

¹ Womack and Jones (1996) described the five principles of lean as follows: (i) specify the value for the customer; (ii) identify all value chain steps, eliminating steps that do not add value to the product; (iii) create flow in the process; (iv) let demand pull value; (v) repeat all stages to achieve perfect value creation. These principles, however, are not directly applicable in all organizational settings.

development approach adopted by these firms was considered superior to the approaches adopted by US firms, since Japanese firms and their suppliers working in collaborative relationships were quicker to learn lean principles and practices and, thus, to adapt to changes in the market (MacDuffie and Helper, 1997; Womack and Jones, 2003).

Later, inspired by the efforts of Japanese firms, supply chains in the West successfully adopted the lean supplier relationships and development model (Bicheno and Holweg, 2016; Liker and Choi, 2004). Consequently, collaborative relationships are prevalent in the lean context in Japan and in the West, as they are fundamental for the enhancement of suppliers' capabilities (see, e.g., Bicheno and Holweg, 2016; Fujimoto, 1999; Harris et al., 2011; Lamming, 1993; Liker and Choi, 2004). Inspired by Japanese lean firms' approach to developing suppliers, and in order to achieve the benefits that lean has to offer not only to the internal organization but also to the supplier base, many firms that implement lean have also been adopting lean supplier development (Hines et al., 2004).

2.1.3 Implementation of lean and lean supplier development

Soriano-Meier and Forrester (2002) studied the adoption of lean in 36 firms and distinguished three levels of implementation of lean: traditional firms with no lean experience, early-stage lean firms or firms in transition to lean, and advanced lean firms whose lean capabilities have evolved to a mature level. As Womack and Jones (1996) prescribed, it takes a minimum of five years to achieve a mature level of lean capability or complete a lean transformation; the firm will need to remodel its internal organization, as when installing a new business system (Womack and Jones, 2003, p. 269). Thus, the lean implementation focus is initially on the transformation of the internal firm, which leads to "complete transformation of the lean business system" (ibid.).

Many authors have asserted that a firm must first implement lean internally before starting the process of transferring these capabilities to its suppliers (Dolcemascolo, 2006; Harris et al., 2011; Hines et al., 2004; Marksberry, 2012; Tortorella et al., 2017). Harris et al. (2001, p. 41) argued that "the better your internal operations are, the greater the need [and] the success rate you will likely have in your lean supplier development initiatives." Indeed, advanced lean firms are greatly concerned with their supply base (see, e.g., Bicheno and Holweg, 2016; Dyer and Nobeoka, 2000; MacDuffie and Helper, 1997) and have a highly effective system for their development (Harris et al., 2011; Hines, 1994; Hines and Rich, 1998).

The current consensus is that only advanced lean firms can implement lean supplier development. The focus on firms that already possess advanced lean capabilities internally is to be expected since, before transferring a capability to externals, it is necessary to master that capability. Dolcemascolo (2006, p. 8) explained that "in general, lean should be extended after the company has worked through its door-to-door value stream and completed an initial lean implementation." However, efficient lean implementation must account for the development of the supply base as a source of competitive advantage and value creation that outperforms the internal efficiency focus (Fujimoto, 1999; Hines and Rich, 1998; Jones and Womack, 2016). For this reason, firms at the beginning of lean implementation may also be concerned with extending lean to suppliers. Nevertheless, for firms that have not yet arrived at a level of mature lean capabilities themselves, training suppliers in lean capabilities can be particularly challenging (Marksberry, 2012).

As argued previously, the Japanese model of lean supplier relationship and development has inspired firms in the West to successfully implement lean and lean supplier development practices (Bicheno and Holweg, 2016; Hines et al., 2004; Liker and Choi, 2004). These lean supplier development practices, especially those employed by Toyota, include the development of the supply base at the network level, with the aim of transferring lean capabilities to, from, and between suppliers in complex network structures involving many supply tiers (Choi and Liker, 1995; Hines and Rich,

1998; Sako, 2004). These practices “did not appear by happenstance. Rather, Toyota[’s] [...] intent was first to create weak, non-threatening ties that could later be transformed into strong, trusting relationships” (Dyer and Hatch, 2004, p. 61). However, one may speculate whether firms in transition to lean can engage in lean supplier development without themselves having reached a high level of lean maturity or whether they must go through a gradual lean evolution over decades, as observed in the case of Toyota’s supply system and its direct development of lean suppliers and networks.

2.1.4 Stages and characteristics of Toyota-style lean supplier development

Toyota is renowned for the comprehensive direct approach to lean supplier development adopted in its supply base (Dyer and Hatch, 2004; Hines, 2016; Sako, 2004), and its supply system has been studied extensively as a benchmark for high-performance networks (Aoki and Wilhelm, 2017; Dyer and Nobeoka, 2000; Hines, 2016). Observing the evolution of Toyota’s supply system, researchers have identified an evolutionary process of creating a high-performance structure to spread its lean capabilities to the company’s supplier network (Dyer and Nobeoka, 2000; Hines, 1994). As stated by Hines, “this process [...] in the case of Toyota, has taken over 50 years” (Hines, 1994, p. 67).

Stage I – Creating weak network ties

In the late 1930s, Toyota established its initial supplier associations in Japan, and since then, it has organized and reorganized its associations (Hines and Rich, 1998; Nishiguchi, 1994). The Toyota supplier associations in Japan initially aimed to unite its 20 closest suppliers (Nishiguchi, 1994). A similar process occurred when Toyota moved to the US, where there was almost no knowledge sharing in the supplier network (Dyer and Hatch, 1994, p. 361). According to a study by Dyer and Nobeoka (2000), this was Stage I of Toyota’s supply system, which aimed to create weak network ties.

Stage II – Creating strong (dyadic) ties between Toyota and each supplier

In the 1970s, observing the need to strengthen lean production capability, Toyota created a separate consulting division to improve operations management. The consulting division aimed to develop tacit lean production knowledge within Toyota and its supplier network. Therefore, the division initially provided individual assistance and/or on-site consultancy to single suppliers, strengthening their dyadic ties (Dyer and Hatch, 2004; Dyer and Nobeoka, 2000). In the US, Toyota made its production consultants available free of charge, but suppliers had to agree on reciprocal knowledge sharing, and strong ties between Toyota and each supplier were created (Dyer and Hatch, 2004, p. 362). Stage II is thus characterized by strong ties between Toyota and each supplier.

Stage III – Creating strong relationships in the network

After the first two stages, Toyota divided its suppliers into learning teams to support lateral supplier–supplier learning and operational improvement throughout the supply network, a process that defines Stage III (Dyer and Hatch, 2004; Dyer and Nobeoka, 2000; Liker and Choi, 2004). In short, learning teams are a systematic practice that allows for knowledge sharing and learning of tacit knowledge among suppliers in the network. In addition to establishing supplier learning teams, Toyota and other Japanese firms encourage tier-one suppliers to deploy their practices with their own suppliers, creating a multi-tier cascading effect of activities (Hines, 1994, 2016; Hines and Rich, 1998).

Supplier association practices

Other Japanese firms, such as Hitachi, Honda, and Mazda, have also focused on operational integration with suppliers, taking part in their supplier associations and practices (Hines, 1994; Liker, 2004; Liker and Choi, 2004). The Japanese supplier associations are “in essence a collection of a company’s most important suppliers for their own and their customers mutual continual improvement” (Hines, 1994, p. 68). Supplier association practices support the operational integration with direct (tier-one) suppliers and indirect suppliers (i.e., the suppliers’ suppliers) (Hines, 1994, 2016). In addition, supplier association practices aim to manage the transfer of either explicit or tacit knowledge associated with lean capabilities (Dyer and Nobeoka, 2000; MacDuffie and Helper, 1997; Sako, 2004).

To allow the transfer of explicit and tacit lean knowledge, leading lean firms, especially Toyota and its association, have employed a full array of practices in a complex structure for training and transferring lean capabilities to suppliers, creating an identity in the network and support operational integration (Bortolotti et al., 2016; Dyer and Nobeoka, 2000; Sako, 2004). The supplier association practices range from meetings to classroom teaching, individual supplier assistance and joint problem solving, on-site consultancy, study visits, and supplier learning teams (Dyer and Hatch, 2004; Dyer and Nobeoka, 2000; Liker and Choi, 2004; Sako, 2004). It is worth noting that supplier learning teams are the only one of these practices that allows knowledge to be transferred laterally from supplier to supplier.

Supplier learning teams

As mentioned previously, the supplier learning teams present in Toyota are “the most systematic institution for inter[supplier]–supplier sharing and learning of tacit knowledge” (Sako, 2004, p. 301). Thus, these teams support supplier–supplier transfer of tacit lean production knowledge, which creates strong network ties (Dyer and Nobeoka, 2000; Sako, 2004).

Supplier learning teams always involve more than an individual supplier and may include, for example, temporary transfer of personnel among suppliers (Bortolotti et al., 2016; Dyer and Nobeoka, 2000). The teams are comprised of four to 12 suppliers with similar types of components and from nearby geographical areas; the teams rotate in the participant suppliers’ plants, identifying and supporting on-the-job training, problem solving, and production improvement (Dyer and Hatch, 2004; Liker, 2004; Liker and Choi, 2004). Every supplier in the group hosts the learning team for two to three months, meeting once a week to set improvement targets and implement improvement ideas (Dyer and Nobeoka, 2000). Toyota also arranges a yearly learning teams meeting, where each supplier team presents what they have learned and shares their experiences (ibid.).

These teams are organized in Toyota “as sub-networks [...] designed to facilitate the creation of strong ties among suppliers” (Dyer and Nobeoka, 2000, p. 363). Supplier learning teams are noteworthy for their effective inter-firm learning and for being a valuable source of lean production knowledge (Dyer and Hatch, 2004; Liker and Choi, 2004; Suh, 2017). In a survey of Toyota’s suppliers in Japan, learning from other suppliers was found to be the second most valuable benefit of belonging to the Toyota supplier association (second only to facilitated access to information from the customer) (Sako, 1996). Furthermore, the suppliers surveyed accorded equal value to learning jointly with other suppliers and to learning from the buyer (Sako, 1996). This inter-supplier learning takes place mainly in the supplier learning teams. Moreover, in supplier learning teams, each supplier accesses knowledge from the supply base, which is located outside the buyer’s organization. Thus, the supplier learning teams facilitate the transfer of tacit knowledge, which is difficult to codify and requires a specific learning context (Dyer and Hatch, 2004; Dyer and Nobeoka, 2000).

2.2 Industrial networks

As stated earlier, much of the discussion on lean supplier development has focused on single lean firms and single suppliers. In current research on lean supplier development, the initiative of a single firm, namely the lean buying firm, is central. However, a single lean firm will be unable to develop lean suppliers without the support of relationships in the network. Thus, the importance of business relationships in lean supplier development, as well as the network beyond a single relationship, calls for an inter-organizational approach. One such inter-organizational approach is presented in the Industrial Marketing and Purchasing Group research (IMP) tradition: the industrial network approach (Ford et al., 2003; Håkansson and Snehota, 1995, 2017).

The industrial network approach explores relationships in networks on the basis that firms do not exist in isolation since they are connected, directly and indirectly, to others in the network (Ford et al., 2003, 2017; Håkansson and Snehota, 1989). For this reason, the approach emphasizes that “no business is an island” and focuses on business relationships to understand how the relationships and business interactions affect both individual firms and their relationships (e.g., Ford et al., 2011; Håkansson and Snehota, 1995, 2017). One framework presented in the industrial network approach identifies three layers in the substance of a business relationship: activity links, resource ties, and actor bonds (Håkansson and Snehota, 1995). As depicted in Figure 1, a firm possesses three internal features: (1) an activity structure involving, for example, technical, administrative, and commercial activities; (4) an organizational structure, such as functions, departments, and divisions; and (7) a resource collection, consisting of various resource elements, such as technological, material, and knowledge elements. When attention is turned to a business relationship, the activity structure of one firm becomes linked (i.e., activity links, 2) with other firms. Furthermore, parts of the organizational structure of one firm, such as departments, functions, and personnel, become bonded (i.e., actor bonds, 5) to the structure of the other firm. Lastly, the resource collection of one of the firms becomes tied (i.e., resource ties, 8) to the other firm’s collection of resources. The interplay between the layers of substance in the relationship and internal features of a firm is depicted by the arrows in Figure 1. Consequently, as Håkansson and Snehota put it:

The activity links, resource ties and actor bonds in a relationship between two companies affect the activity structures, the collections of resources and the organizational structures of the companies involved. At the same time the activity structures, resource collections and organizational structures of the companies will influence what kinds of links, ties and bonds can develop in a relationship. (1995, p. 42)

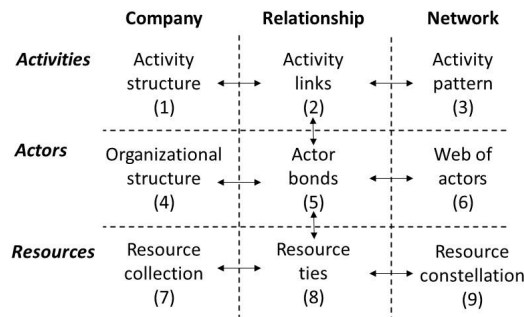


Figure 1. Substance of the firm, relationship (dyad), and network (Håkansson and Snehota, 1995, p. 45)

Because firms do not possess all the resources necessary to produce their services and products internally, they interact with other firms not only in dyadic relationships but also in networks (Gadde et al., 2010; Håkansson and Snehota, 1995). Therefore, the industrial network approach also emphasizes that a relationship is connected, directly and indirectly, to other relationships in the surrounding network (Anderson et al., 1994; Håkansson and Snehota, 1995). In the network, “the effects of a relationship between two companies are not limited to the two companies directly involved and their relationships. Other parties and relationships may be affected” (Håkansson and Snehota, 1995, pp. 44–45). Consequently, the activity links formed in dyads are part of the activity pattern (3) in the network. Moreover, the actor bonds formed in a relationship are a portion of the web of actors (6) in the network. Finally, the resource ties formed in a relationship are an element of the resource constellation (9) in the network.

Each relationship layer is connected to the corresponding layer in the network; “an activity link is but a link in a broader activity pattern spanning several companies, a resource tie is but an element of a broader resource constellation that companies can mobilize, and an actor bond is but a part of a web of actors” (Håkansson and Snehota, 1995, p. 44). Consequently, in addition to the substance dimension, and depending on which parties a relationship is connected to, there are three identifiable functions of business relationships: the single firm function, the dyad function, and the network function (Håkansson and Snehota, 1995). In the function of the single firm, “a relationship has effects on each of the companies, on what it can do internally and in other relationships. These depend on how effects of a relationship can be connected to other internal elements of the company and its other relationships” (ibid., p. 37). As for the function of the dyad, “[a]ctivity links, resource ties and actor bonds in a relationship integrate various elements and thereby some unique outcomes and effects are produced” (ibid., p. 27). Moreover, because the outcomes that dyadic conjunction can produce are unique, the dyad may have a team effect, and “[j]ointly, the two companies can perform activities and utilize resources which none of them could accomplish in isolation” (ibid., p. 37).

Finally, there is the network function of business relationships. Because relationships are “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” (ibid., p. 27). The essence of the network function is that, as relationships arise, “they form a structure of actor bonds, activity links and resource ties where third parties are integrated” (ibid., p. 41). Thus, businesses are always part of networks, connected to several external actors (e.g., suppliers or buyers) that are also connected to other relationships (Anderson et al., 1994; Ford et al., 2011; Gadde et al., 2010).

Although analysis of business relationships can focus on the level of the dyad or the single firm, it is crucial to consider that a dyad, or a single relationship, is never isolated but is connected to other relationships (Anderson et al., 1994). An exclusive focus on the dyad can lead to dyadic reductionism, which is associated with a disregard for the connections in the broader network and impacts management decisions since:

There is a problem of balance with regard to the functions of business relationships. Too much emphasis on the functions for the single actor may become counterproductive, as it may destroy the dyadic team function. Too much emphasis on the dyadic function could also turn out counterproductive; being overly altruistic may be harmful for the self-interest. Disregard for the network functions can produce disastrous effects or mean that a company does not recognize certain development opportunities being offered or constraints which arise. (Håkansson and Snehota, 1995, p. 41)

In summary, how a dyadic relationship affects and is affected by third parties within networks of business relationships is one of the main concerns of the industrial network approach, since “what

is happening in a relationship between two companies does not depend solely on the two parties involved in the relationship but on what is going on in a number of other relationships” (Håkansson and Snehota, 1995, p. 20).

Beyond observing relationships in isolation, the industrial network approach turns attention, in particular, to what takes place within networks of business relationships (Ford et al., 2011; Håkansson and Snehota, 2017). However, extending the analysis to networks requires a conceptualization of relationships as connected, leading to the introduction of the concept of a *triad*, which has been discussed as the smallest network (e.g., Blankenburg and Johanson, 1992; Havila, 1996; Laage-Hellman, 1989; Ritter, 2000; Vedel et al., 2016). A triad expands the vocabulary used to describe business relationships, which is absent from the dyadic framework (Holma, 2009; Vedel et al., 2016), and helps study situations involving more than one relationship, such as when a third party is present.

2.3 Triads in industrial networks

Business networks are seen as a set of connected relationships among various actors (Anderson et al., 1994). Scholars adhering to the industrial network approach have thus studied business networks as sets of connected relationships (Anderson et al., 1994; Håkansson and Snehota, 1995, 2017). A triad consists of three actors with two or three connected relationships. Triads allow for analysis of connected relationships, since they can be considered as a smaller part of a more extensive business network (Håkansson and Gadde 2019), as depicted in Figure 2.

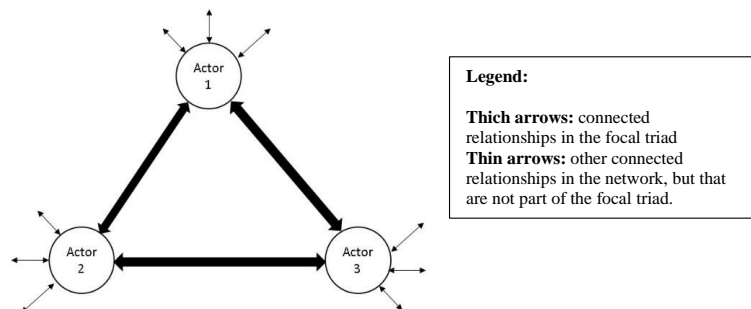


Figure 2. A triad: three connected relationships embedded in a business network

Since 1989, studies adhering to the industrial network approach have been using the concept of triads to understand these connected relationships in networks that span across relationships (Laage-Hellman, 1989). Eriksson (2021) listed over 40 studies that focus on triads inspired by the industrial network approach, ranging from conference papers to dissertations, journal articles, and books. Some of these studies have distinguished different approaches to triads concerning connected relationships that allow for the classification of triads. Considered in what follows are three of these studies, two of which present vital ways of classifying triads (Blankenburg and Johanson, 1992; Havila, 1996) and one of which uses triads to discuss the effects of relationships on other relationships (Ritter, 2000).

Blankenburg and Johanson (1992) suggest a classification of triads based on modes of managing connected relationships. Their classification results from a study of 85 focal buyer–supplier relationships and the effects of relationships connected with a third party, such as a supplementary supplier, a government agency, or a consultant. Their study presents different triads concerning the level of interaction with and impact of third parties on a focal relationship, identifying four different

types of triads to represent ways of managing the connections to third parties: (a) the implicit triad, (b) the open triad, (c) the semi-closed triad, and (d) the closed triad, as depicted in Figure 3.

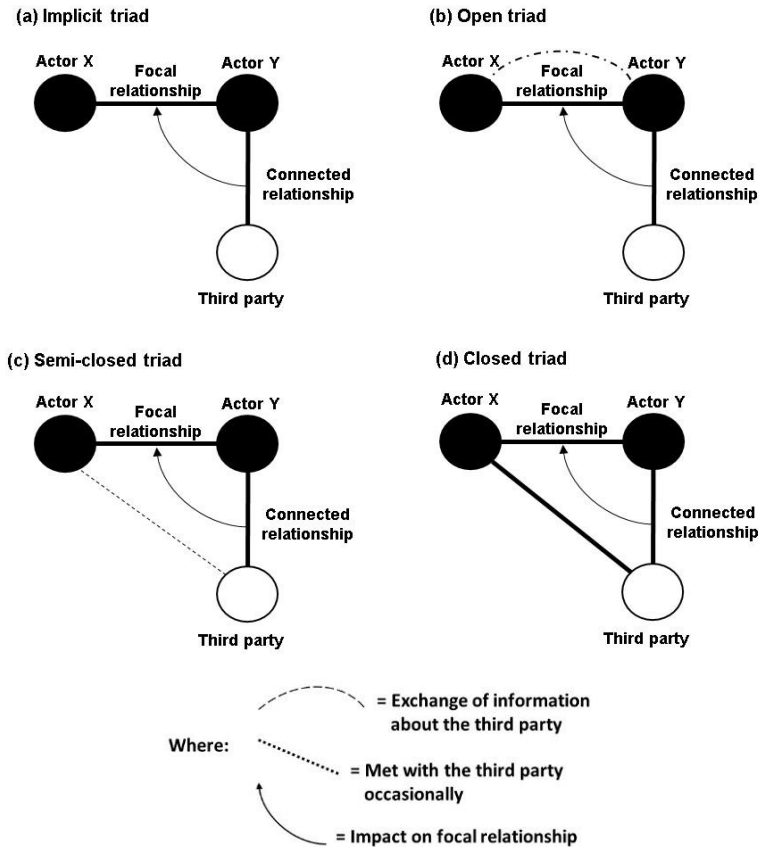


Figure 3. Four triads that represent different connected relationships (Blankenburg and Johanson, 1992, p. 16)

Notably, actor Y always has a relationship with the third party. In the first mode of managing connected relationships, represented by an implicit triad (a), the connected relationship may impact the focal relationship without explicit reference to the third party. In an open triad (b), actors X and Y exchange information about the third party, whereas actor X does not have a direct relationship with the third party. If actor X occasionally interacts with the third party without developing a relationship, this mode represents a semi-closed (c) triad. Finally, in a closed triad (d), the supplier has a relationship with the third party, spending time and effort on managing the relationship.

Havila (1996) also presents a classification of triads, focused on the changing role of intermediate actors in international business relationships. In this classification, the intermediating actor is considered a focal actor in a network and is always located between two other actors. Therefore, the analysis context in which an actor intermediates between two other actors is a (business relationship) triad (Havila, 1996). Based on the analysis of the changing role of the intermediating actor, the study conceptualizes two different types of triads. First, serial triads have two dyads connected directly through the focal (intermediary) actor (ibid.). Second, there are unitary, or group-

like triads where all three actors frequently interact (ibid.). Serial and unitary triads are depicted in Figure 4.

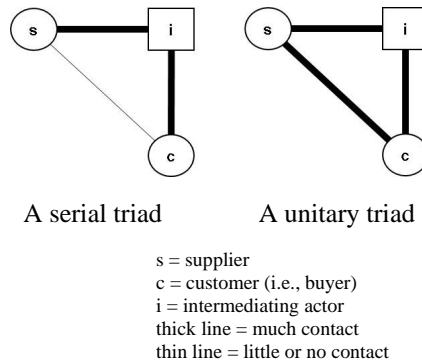


Figure 4. Serial and unitary triads, adapted from Havila (1996) and Holmen and Pedersen (2000)

Havila (1996) goes on to analyze the role of the intermediating actor and relate different roles to the changes in serial and unitary triads. Thus, the study aims to present how the changing role of the intermediating actor generates different business relationship triads that change over time. Notably, the connected relationships are not discussed explicitly, as the focus is on the changing role of the intermediating actor.

Ritter (2000) further develops the effects of relationships on other relationships, drawing on Havila’s (1996) triad classification (serial and unitary triads). Prior to presenting the framework, Ritter distinguishes the impact of one relationship (x) on another relationship (y), categorizing the impact as positive (+) or negative (–), because “an inter-organizational relationship can hinder, weaken, strengthen, or enforce another relationship” (p. 321). Furthermore, because of the interconnectedness between two connected relationships, there can be an effect of (x) on (y) and of (y) on (x), which are two possible effects at the same time. On the basis of these characteristics, this study presents the possible effect of connected relationships in serial triads, identifying effects between two relationships connected via one focal actor, as depicted in Figure 5.

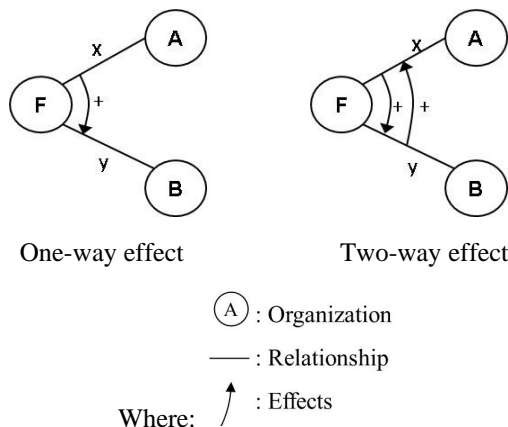


Figure 5. Serial triad positive effects, adapted from Ritter (2000)

Figure 5 shows two serial triads where a focal actor (F) has a relationship with actor A (relationship x) and a relationship with actor B (relationship y) simultaneously. In the triad to the left, relationship x affects relationship y positively. For example, a relationship between the focal actor and a supplier (firm A) strengthens the focal actor's relationship with another supplier (firm B). In the triad to the right, the relationships affect each other positively, for example, when actors A and B are part of developing a new product for the focal actor. Ritter (2000) also identifies the effects of two inter-organizational relationships on a third relationship using unitary triads, as depicted in Figure 6.

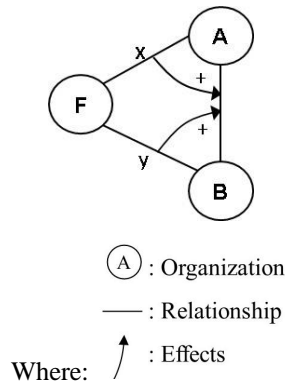


Figure 6. Unitary triad effects, adapted from Ritter (2000)

Figure 6 shows the relationship that a focal actor has with actor A and with actor B, impacting the relationship between actors A and B. For example, the focal actor introduces two of its suppliers to each other and asks them to develop a new component or technical solution jointly.

The three studies discussed above present triad classifications based on characteristics such as the structure of the triads, actors, and relationships, as well as the effect of connected relationships. Table 1 summarizes these characteristics.

Table 1. Classifications of triads

Study	Triads' classification	Effect of connected relationships
Blankenburg and Johanson (1992)	Implicit, open, semi-closed, and closed	One-way effect
Havila (1996)	Serial and unitary	Not explicitly discussed
Ritter (2000)	Serial and unitary	One- or two-way effects

Some of the concepts discussed above are also used in analyses of the involvement of third parties in supplier development according to the different types of triads. The following section presents a conceptual model for that purpose.

2.4 Third parties in supplier development: A conceptual model

This section presents a conceptual model that captures different possibilities of involvement of third parties in supplier development, based on the concept of triads within the industrial network approach. The conceptual model takes inspiration from Blankenburg and Johanson (1992) and the four triad types that represent different connected relationships: implicit triads, open triads, semi-closed triads, and closed triads, used here to analyze the effects of third parties' connections on the focal relationship.

Feature 1 – Third-party (one-way) effect

The model's first feature is related to the way the connected relationship is analyzed. Aune et al. (2013) point out that most research on supplier development has studied the endeavors of a buyer to develop the performance and/or capabilities of a supplier, within the context of their existing dyadic relationship. In this view, also adopted in this thesis, supplier development is part of a focal buyer-supplier relationship.

Furthermore, the aim of this thesis is to explore the involvement of the third party in supplier development. Such involvement can have effects in two directions. However, the model does not consider the effects that the supplier development in a focal relationship has on a third-party relationship. Rather, the model only considers the effects of a third-party relationship on the supplier development occurring in the focal relationship, i.e., one-way effects. Consequently, only effects from the third-party connected relationship to the supplier development occurring in the focal relationship are considered, as depicted in Figure 7.

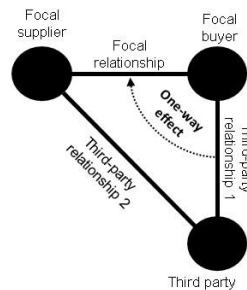


Figure 7. One-way third-party effect

It is possible for both third-party relationships (1 and 2 in Figure 7) to affect the focal relationship concurrently, for example when two buying firms (one being the focal buyer and the other being the third party) cooperate on a common aim in supplier development. In this conceptual model, however, the focus is on one effect at a time (in Figure 7, third-party relationship 1). The reasons for this focus are twofold. First, taking the effects of two third-party relationships into consideration for each triad would not allow the triad classification of Blankenburg and Johanson (1992) to be applied. Second, to the best of the author's knowledge, there is no discussion in the literature of two buyers cooperating in developing lean, shared suppliers.

Feature 2 – Third-party connection

The model's second feature is that third parties can connect to the focal relationship via either the (focal) buyer or the (focal) supplier, which is a possibility previously discussed by Aune et al.

(2013). Figure 8 depicts the possible third-party connections via either the focal buyer or the focal supplier.

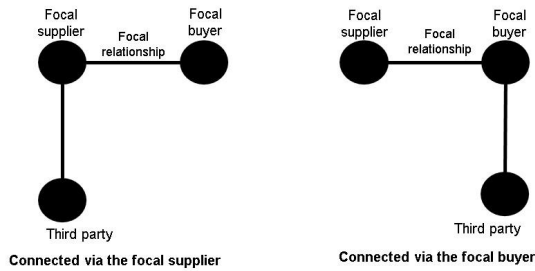


Figure 8. A third party connected via the focal buyer or the focal supplier

Feature 3 – Third-party types

The model’s third and last feature is related to which types of organizations are considered third parties. According to Anderson et al. (1994), third parties can be suppliers, buyers or auxiliary organizations such as consultants, governmental agencies, and trade unions. Consequently, a triad involves a focal buyer-supplier relationship connected to either an additional supplier, an additional buyer, or an ancillary organization, as shown in Figure 9.

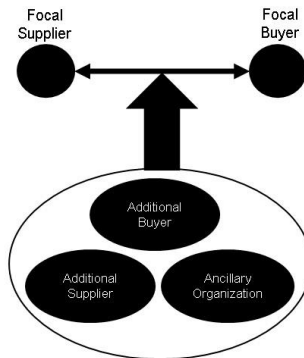


Figure 9. Third-party types: additional buyer, additional supplier, and ancillary organization

The category “additional buyer” comprises several types. An additional buyer can be connected to the focal relationship either via the focal buyer and/or via the focal supplier. The different types may be discerned using the concept of tiers. First, when the additional buyer is connected only via the focal buyer, the additional buyer is the buyer’s customer and is two tiers down from the supplier. Second, when the additional buyer is connected only via the focal supplier, the additional buyer is at the same tier as the focal buyer. Third, when the additional buyer is connected to both the focal supplier and the focal buyer, it can be either on the same tier as the focal buyer or two tiers down from the supplier.

In a similar vein, the category “additional supplier” comprises several types. An additional supplier can be connected to the focal relationship either via the focal buyer and/or via the focal supplier. First, if the additional supplier is connected only via the focal supplier, the additional supplier is the focal buyer’s sub-supplier, two tiers up from the buyer, and one tier from the focal supplier. Second, if the additional supplier is connected only via the focal buyer, the additional supplier is another direct supplier to the focal buyer and thus at the same tier as the focal supplier.

Third, when the additional supplier is connected to both the focal supplier and the focal buyer, it can be either on the same tier as the focal supplier or two tiers up from the buyer.

Finally, what Anderson et al. (1994) refer to as ancillary firms include any organization that is a third party to the focal dyad but is neither a buyer nor a supplier. Since ancillary organizations include governmental and non-governmental organizations, which are not necessarily private firms, such as governmental agencies, research institutes, and trade unions, the most accurate term to describe these, and the term that will be used here, is ancillary organizations.

Table 2 summarizes the 24 possible triads that represent types of involvement of third parties in supplier development.

Table 2. Triad types in supplier development

Third-party types	Connected via	Type of third party		
		Additional buyer – I	Additional supplier – II	Ancillary organization – III
Implicit triad	Focal supplier	1	2	3
	Focal buyer	4	5	6
Open triad	Focal supplier	7	8	9
	Focal buyer	10	11	12
Semi-closed triad	Focal supplier	13	14	15
	Focal buyer	16	17	18
Closed triad	Focal supplier	19	20	21
	Focal buyer	22	23	24

Taking Table 2 as a starting point, the conceptual model will now be illustrated with examples of each triad type. In an implicit triad, the third party is connected via the focal supplier or buyer. A common characteristic in the implicit triad is that the third party is not explicitly referred to in the focal relationship but affects the focal relationship. The implicit triad is depicted in Figure 10.

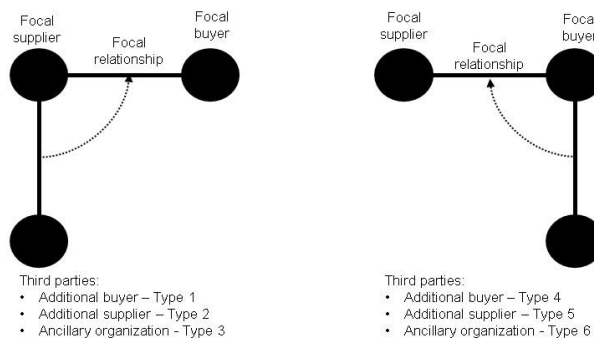


Figure 10. Implicit triad, connected via the focal supplier or buyer: Types 1 to 6

The first example illustrates the relationship between the focal supplier and an additional buyer. The additional buyer contributes to the supplier development in the focal relationship, for example, by promoting supplier development activities with the focal supplier at a given time. Later, the experience with the additional buyer increases the ability of the focal supplier to engage in the supplier development activities of the focal buyer.

The second example illustrates the relationship between the focal supplier and an additional supplier. The additional buyer is not referred to explicitly in the focal relationship but affects it. In this case, the relationship of the supplier with its own supplier, or a sub-supplier for the focal buyer, affects the supplier development in the focal relationship. For example, the focal supplier may have employed supplier development activities with the sub-supplier in the past, which may increase the firm's ability to engage in further activities. In addition, if the focal supplier can conduct supplier development activities with its own supplier, it is likely to be more comfortable participating in such activities.

The third example illustrates the relationship between the focal supplier and an ancillary organization. The ancillary organization is not explicitly referred to in the focal relationship but affects it. For example, an ancillary organization, such as a consultant firm, educates the focal supplier about supplier development, thereby increasing the chances of the focal supplier thriving. Later, when the supplier development in the focal relationship occurs, the ancillary organization is not referred to in the focal relationship but affects the supplier development.

The fourth example illustrates the relationship between the focal buyer and the additional buyer. The additional buyer is not referred to explicitly in the focal relationship but affects it. In this case, the relationship of the focal buyer with its own buyer affects the supplier development in the focal relationship. For example, the buyer on a higher relationship tier may have previously employed supplier development activities with the focal buyer. These previous activities can increase the ability of the focal buyer to conduct its own supplier development program later.

The fifth example illustrates the relationship of the focal buyer with an additional supplier. The additional supplier contributes to the supplier development in the focal relationship, for example, by being an exemplary supplier. The additional supplier inspires the focal buyer in relation to how other suppliers could work, thereby affecting the supplier development in the focal relationship, even though the additional supplier is not referred to explicitly in the focal relationship.

The sixth example illustrates the relationship between the focal buyer and an ancillary organization. The ancillary organization is not referred to explicitly in the focal relationship but affects it. For example, an ancillary organization, such as a government agency, offers incentives to the focal buyer to develop suppliers. Later, this ancillary organization is not referred to in the focal relationship but affects the supplier development.

In an open triad, the third party is also connected via the focal supplier or buyer. A common characteristic in the open triad is that the third party relates directly only to one of the focal firms, while the focal firms exchange information about the third party. The open triad is depicted in Figure 11.

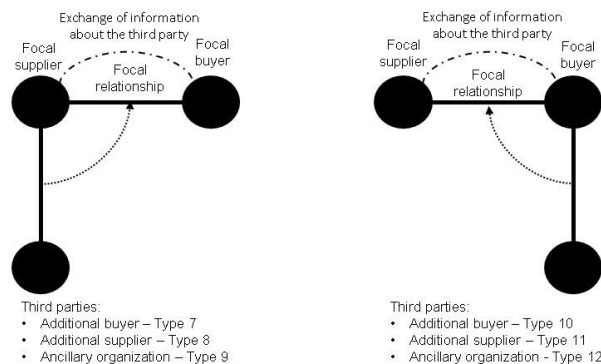


Figure 11. Open triad, connected via the focal supplier or buyer: Types 7 to 12

The seventh example illustrates the relationship between the focal supplier and an additional buyer about whom the focal firms exchange information. For example, the additional buyer promotes supplier development activities with the focal supplier, which thus becomes experienced in participating in supplier development. Later, the focal supplier engages in supplier development with the focal buyer, and information about how the additional buyer conducted supplier development is exchanged.

The eighth example illustrates the relationship between the focal supplier and an additional supplier about whom the focal firms exchange information. In this case, the relationship of the focal supplier with its own supplier, which is a sub-supplier of the focal buyer, affects the supplier development in the focal relationship. For example, the focal firms exchange information about best practices and improvements acquired through the relationship between the focal supplier and the additional supplier, thereby affecting the focal relationship.

The ninth example illustrates the relationship between a focal supplier and an ancillary organization about whom the focal firms exchange information. For example, an ancillary organization, such as a non-governmental organization, offers training to the focal supplier on specific capabilities (e.g., sustainable development). Later, the focal firms exchange information about the ancillary organization and the training, which affects the supplier development in the focal relationship.

The tenth example illustrates the relationship between a focal buyer and an additional buyer about whom the focal firms exchange information. In this case, the buyer on the upper tier is an additional buyer, affecting the supplier development in the focal relationship. For example, the higher-tier buyer invites the focal buyer to visit its operations. Afterward, the focal buyer uses lessons learned and information acquired during that visit to develop the focal suppliers.

The eleventh example illustrates the relationship between the focal buyer and an additional supplier. For example, the additional supplier has improved the on-time delivery level. Later, the focal buyer shares information with the focal supplier on how the additional supplier achieves high on-time delivery levels, which affects supplier development.

The twelfth example illustrates the relationship between the focal buyer and an ancillary organization about which the focal firms exchange information. For example, a financial organization provides capital for supplier development. Later, a focal buyer uses this capital, making supplier development with a focal supplier viable. In addition, in supplier development, information about the financial organization is exchanged between the focal firms without the direct involvement of the ancillary organization.

In a semi-closed triad, the third party is also connected via the focal supplier or buyer. A characteristic of the semi-closed triad is that the third party interacts only occasionally with one of the focal firms but affects the focal relationship. The semi-closed triad is depicted in Figure 12.

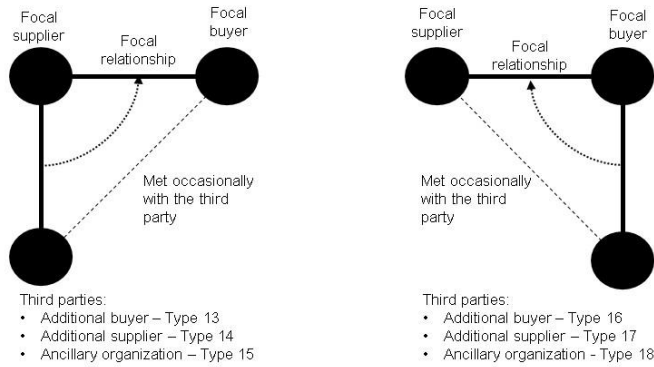


Figure 12. Semi-closed triad, connected via the focal supplier or buyer: Types 13 to 18

The thirteenth example illustrates the relationship between the focal supplier and an additional buyer who occasionally meets the focal buyer. The additional buyer has an established relationship with the focal supplier but interacts only occasionally with the focal buyer. For example, the focal buyer and the additional buyer meet at the yearly customers’ meeting but have not established a relationship outside of that meeting.

The fourteenth example illustrates the relationship between the focal supplier and an additional supplier that meets the focal buyer occasionally. The additional supplier has an established relationship with the focal supplier but interacts only occasionally with the focal buyer. For example, a supplier of the focal supplier develops a new component, which has the potential to increase the quality of the focal supplier’s product. The additional supplier occasionally meets the focal buyer, for example, during a test of the functionalities of the new component.

The fifteenth example illustrates the relationship between a focal supplier and an ancillary organization that meets the focal buyer occasionally. The ancillary organization has an established relationship with the focal suppliers and occasionally interacts with the focal buyer. For example, a law office helps the focal supplier win a lawsuit, which allows the focal supplier to take on more business from the focal buyer. The focal buyer performs supplier development activities with the focal supplier because of the increased business but meets the law office only occasionally.

The sixteenth example illustrates the relationship between the focal buyer and an additional buyer who occasionally meets the focal supplier. The additional buyer has an established relationship with the focal buyer but interacts only occasionally with the focal supplier. In this case, the additional buyer is a buying firm of the focal buyer and thus mainly interacts with the focal buyer. In addition, the additional buyer affects the supplier development in the focal relationship, for example, by training the focal buyer in capabilities that impact the supplier development.

The seventeenth example illustrates the relationship between the focal buyer and an additional supplier who occasionally meets the focal supplier. The additional supplier has an established relationship with the focal buyer but interacts only occasionally with the focal supplier. For example, the focal supplier and the additional supplier meet at the focal buyer’s suppliers’ meeting, but they have not established a relationship. However, the focal buyer reduces the purchasing amount from the additional supplier and, at the same time, increases the deliverance of the focal supplier. This rebalancing of supply increases the importance of the focal supplier and affects supplier development in the focal relationship.

The eighteenth example illustrates the relationship between the focal buyer and an ancillary organization that meets the focal supplier occasionally. The ancillary organization has an established relationship with the focal buyer and interacts with the focal supplier occasionally. For example, a

consultant firm helps the focal buyer expand the business to new areas, allowing the focal buyer to take on more business with the focal supplier. Because of the increase in business with the focal supplier, the focal buyer performs supplier development activities with the focal supplier, but the focal supplier meets the consultant firm only occasionally.

In a closed triad, the third party is also connected via the focal supplier or buyer. A characteristic of the closed triad is that the third party has a direct relationship with both focal firms. The closed triad is depicted in Figure 13.

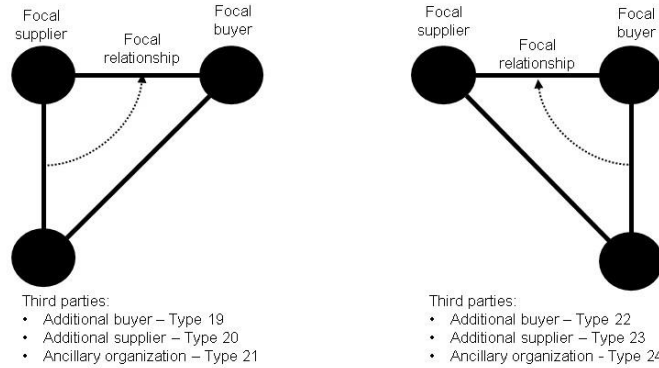


Figure 13. Closed triad, connected via the focal supplier or buyer: Types 19 to 24

The nineteenth example illustrates the relationship between the focal supplier and an additional buyer who also has a relationship with the focal buyer. Although the additional buyer has a relationship with the focal buyer, the relationship with the focal supplier is the one that affects the supplier development in the focal relationship. For example, an additional buyer evaluates and communicates the results to the focal supplier. The evaluation helps the focal supplier cut product costs, which impacts the supplier development in the focal relationship.

The twentieth example illustrates the relationship between the focal supplier and an additional supplier that also has a relationship with the focal buyer. Although the additional supplier has a relationship with the focal buyer, the relationship with the focal supplier is the one that affects the supplier development in the focal relationship. In this case, the relationship between the two suppliers impacts supplier development in the focal relationship. For example, in a joint training program, the focal supplier learns new production techniques with the additional supplier.

The twenty-first example illustrates the relationship between the focal supplier and an ancillary organization that also has a relationship with the focal buyer. Although the ancillary organization has a relationship with the focal buyer, the relationship with the focal supplier is the one that affects the supplier development in the focal relationship. For example, a governmental agency provides capital to the focal supplier for investment in production. The investment increases the production capacity of the focal supplier, reducing costs; consequently, the focal buyer increases its purchasing from the focal supplier. However, some quality problems arise, and the focal buyer performs supplier development activities with the focal supplier to improve the quality.

The twenty-second example illustrates the relationship between the focal buyer and an additional buyer who also has a relationship with the focal supplier. Although the additional buyer has a relationship with the focal supplier, the relationship with the focal buyer is the one that affects the supplier development in the focal relationship. For example, the additional buyer shares the results of an evaluation of the focal supplier with the focal buyer, which affects the supplier development in the focal relationship.

The twenty-third example illustrates the relationship between the focal buyer and an additional supplier that also has a relationship with the focal supplier. Although the additional supplier has a relationship with the focal suppliers, the relationship with the focal buyer affects the supplier development in the focal relationship. For example, the focal buyer learns new techniques with the additional supplier, which inspires the supplier development activities in the focal relationship.

The twenty-fourth example illustrates the relationship between the focal buyer and an ancillary organization that also has a relationship with the focal supplier. Although the ancillary organization has a relationship with the focal supplier, the relationship with the focal buyer is the one that affects the supplier development. For example, a governmental agency provides capital to the focal buyer for investment in supplier development. As a result, the focal buyer performs supplier development activities with the focal supplier, which also has a relationship with the governmental agency.

The 24 third-party effects in supplier development have now been discussed conceptually (Dubois et al., 2023). The conceptual model combines four triad types, three third-party groups, and two ways of connecting the focal relationship. Examples of how these triad types could occur have been given, showing that the concept of triads can reduce the complexity of the network phenomenon (Håkansson and Gadde, 2019; Vedel et al., 2016). In Chapter 5, this conceptualization will be used with feature 3 (third-party effect). In accordance with Ritter (2000, p. 319), a one-way third-party effect can have three results: the third-party relationship can have no effect (i.e., a neutral effect), an overall positive effect, or an overall negative effect on another relationship. These three effects will be used to discuss the involvement of third parties in the literature and in an empirical case of supplier development.

2.5 Problem discussion and framing of the research questions

2.5.1 Research question 1

The first research question stems from exploring the literature and finding that lean supplier development has been dealt with in different literature streams. The attempt to explore lean supply studies in Paper 2 demonstrates the need to explore lean supplier development further in its own right. Lean supplier development consists of an array of initiatives to support knowledge transfer and sharing (Dyer and Hatch, 2004; Hines and Rich, 1998; Potter and Wilhelm, 2020; Sako, 2004) that aim to bring the supply network to a stage of strong network ties (Dyer and Nobeoka, 2000; Marksberry, 2012; Powell and Coughlan, 2020; Suh, 2017). Moreover, many lean firms have a high level of outsourcing (Fujimoto, 1999; Hines, 1994; Hines and Rich, 1998; Shimokawa and Fujimoto, 2008; Torvatn et al., 2016) and are greatly concerned with the operational integration and the development of their supply base (Bicheno and Holweg, 2016; Hines, 2016; Martínez-Jurado and Moyano-Fuentes, 2014). Accordingly, lean firms have employed lean supplier development to transfer lean and continuous improvement capabilities to suppliers (Hines, 1994; Powell and Coughlan, 2020; Sako, 2004).

However, the transfer of lean capabilities is loaded with tacit knowledge and difficult to replicate (Dyer and Nobeoka, 2000; Sako, 2004). Inspired by Japanese-style supplier relationships, lean firms relate to a limited number of suppliers with whom they work in collaborative relationships to develop lean capabilities (e.g., Bicheno and Holweg, 2016; Hartley and Jones, 1997; Iwao and Kato, 2019; Sako, 2004). Although it is challenging to maintain such collaborative relationships with suppliers, lean firms throughout the world and in many industries have found that the benefits outweigh the challenges (Harris et al., 2011; Jones and Womack, 2016).

Furthermore, lean supplier development practices, especially those employed by Toyota, include the development of the supply base on a complex network structure (Dyer and Nobeoka, 2000; Hines, 2016; Marksberry, 2012; Suh, 2017). Inspired by how Toyota developed its supply base, lean firms initiate supplier development by working with a key supplier (Bicheno and Holweg, 2016; Harris et al., 2011; Lamming, 1993) and employing an array of activities for operational integration (Aoki and Lennerfors, 2013; Dyer and Nobeoka, 2000; Hines and Rich, 1998; Potter and Wilhelm, 2020; Powell and Coughlan, 2020).

Although different fields of study attend to lean supplier development and correlated concepts, such as supply chain management, operations management, and supply management, there are few academic articles with lean and supplier development in the title (e.g., Hoque, 2021; Powell and Coughlan, 2020). Other studies have paid attention to lean supplier development issues without using the exact term “lean supplier development.” Nevertheless, the focus has either been on a single buyer–single supplier relationship (i.e., dyad) (e.g., Bicheno and Holweg, 2016; Lamming, 1993; Liker and Choi, 2004; MacDuffie and Helper, 1997; Myerson, 2009) or on the development of large supply networks and associations (e.g., Bortolotti et al., 2016; Dyer and Nobeoka, 2000; Hines, 1994; Marksberry, 2012; Potter and Wilhelm, 2020; Sako, 2004). Consequently, the involvement of third parties in lean supplier development has received little attention. These considerations lead to the first research question:

RQ1: How is the involvement of third parties in lean supplier development addressed in extant research?

2.5.2 Research question 2

In lean supplier development, relationships in the network are also important since the array of activities and stages of development involves actors other than the buyer–supplier dyad. Indeed, in some recent studies, there is evidence of third parties contributing to lean supplier development (Hoque, 2021; Powell and Coughlan, 2021; Sisson and Elshennawy, 2015). However, apart from some discussion of lateral supplier–supplier learning in supplier learning teams (Dyer and Hatch, 2004; Liker and Choi, 2004; Suh, 2017) and of governmental support in the early days of the Toyota supplier association (e.g., Nishiguchi, 1994; Sako, 2004), the literature has focused on a single actor or on a dyadic view. Nevertheless, third parties, such as other suppliers (Dyer and Nobeoka, 2000; Sako, 2004; Suh, 2017) and governmental agencies (Fujimoto, 1999; Sako, 2004) are initiating and driving lean supplier development.

Most studies of the application of lean with suppliers affirm, implicitly or explicitly, that buying firms themselves have lean capabilities that are well-developed (Chiarini and Brunetti, 2019; Hines et al., 2004; Prajogo et al., 2016; Tortorella et al., 2017; Womack and Jones, 2003). As a result, research has focused on such firms, especially Toyota (e.g., Aoki and Wilhelm, 2017; Dyer and Nobeoka, 2000; Hines, 2016; Potter and Wilhelm, 2020). Nevertheless, there is relatively little knowledge about how firms engage in lean supplier development at the beginning of their lean implementation journey (i.e., in the transition to lean). These considerations lead to the second research question:

RQ2: How can various types of third parties contribute to lean supplier development?

Achieving the purpose of the thesis, namely, *to explore the involvement of third parties in lean supplier development*, requires a tool for analyzing third-party involvement. For this reason, the thesis develops a conceptual model built on triads to address RQ1 and RQ2.

3 Methodology

This chapter outlines the study's methodology. It starts with an overview of the research setting, followed by an explanation of the research design and approach. Next, the methods, data collection, and data analysis for the studies appended in this thesis are described and discussed. Finally, the quality of the research in light of the methodological choices is considered.

3.1 Research setting and process

The research underpinning this thesis was part of the *Lean Management* research project, which was organized as a multidisciplinary consortium with partners from academia and industry and concluded in 2020. The Norwegian Research Council funded the project within its BIA program.²

The project included several partners from the industry and research community interested in lean management as a strategy to increase the competitiveness of the Norwegian industry. One of the companies, and the starting point for the study reported in this thesis, is a firm offering various solutions within the maritime industry. The firm, Kongsberg Maritime, provides complex technological solutions, such as robots, vessels, and information systems for the maritime and offshore industry, especially for firms operating under extreme conditions. Kongsberg Maritime consists of several divisions, and its subsea division (henceforth KMS) initiated and developed a supplier development initiative that won the 2017 Norwegian Lean prize. The empirical context of the study reported in this thesis is the supplier development initiative developed by KMS.

The research process started in June 2017. At the start of the project, the scope was not clearly defined beyond the idea of lean management in relation to suppliers, but the working experience within lean and the questions arising from that experience served as a starting point (see Section 1.1). The empirical context also provided some directions. Given previous experiences and the empirical context of the study, it was deemed necessary to dig deeper into theories related to supplier relationships in a lean supply context. Thus, Paper 2, which focuses on lean supply, was the first to be completed. However, lean supply studies did not adequately capture the focal phenomenon of this thesis, namely lean supplier development, as they mainly addressed aspects related to individual firms and paid very little attention to third-party involvement. As such, the supplier development literature supplemented the study reported in this thesis, and Papers 1 and 3 focus on lean supplier development.

In response to readjustment and learning during the process, the focus was sharpened to supplier development in a lean setting, or, to use the terms in this thesis, lean supplier development, which aligns empirically and theoretically with the phenomenon under study. In addition, the cover paper of this thesis goes beyond a mere summary of the three appended papers. Based on the knowledge gained during the work reported in the three appended papers, the cover paper also presents a conceptual framework based on the literature around triads within the industrial network approach (Dubois et al., 2023).

3.2 Research strategy and design

This thesis deals with the involvement of third parties in lean supplier development. To capture this involvement, a dual research strategy comprising literature review studies and an in-depth case study was needed (Bryman, 2016; Maxwell, 2012; Snyder, 2019). First, an analysis of the literature on (1) lean supply and (2) supplier development was conducted to delineate the knowledge present in each research area (Bryman, 2016; Tranfield et al., 2003). Literature reviews not only

² Brukerstyrt innovasjonsarena in Norwegian, and User-Driven Innovation Arena in English.

provide a foundation for advancing a subject beyond previous findings but also generate relevant research agendas and allow the construction of additional models and taxonomies (Post et al., 2020), in this thesis supporting the elaboration of theory in lean supplier development. In addition, a revelatory in-depth qualitative case study (Yin, 2018) was conducted to capture lean supplier development in a context involving a buying firm (KMS), six of its key suppliers, and several third parties, where KMS is in transition of becoming lean, meaning that the firm is in the early stages of acquiring lean capabilities. Qualitative research revolves around providing insights into a problem, in this case, how third parties influence lean supplier development, highlighting issues such as how to develop lean capabilities when the lean maturity is low and providing possible explanations of the underlying mechanisms (Flick, 2014).

A qualitative approach was also selected because the investigation is concerned with questions of “how” and “why” rather than “how many.” Precisely because a qualitative approach has the potential to reveal complexities and discover underlying meanings rather than frequencies (Easton, 1995; Miles et al., 2014), one widely used research design in the study of business and management is the case study, a strategy often used to study business and management (Eisenhardt and Graebner, 2007) and in particular to study actors in industrial networks (Easton, 2010).

In what follows, some principles of research design are discussed, and the design adopted in this thesis is summarized. Bryman (2016) argued that the starting point of any research is the research questions, which should guide the design, case selection, sampling, data collection, analysis, and presentation of the data and subsequent results. In contrast, Maxwell (2012) argued that, instead of the research questions guiding these decisions, there is an interactive process whereby the first design element, the research question(s), is matched with four more design elements, namely aim, framework, methods, and research quality. The design of the present study is set out in Figure 14.

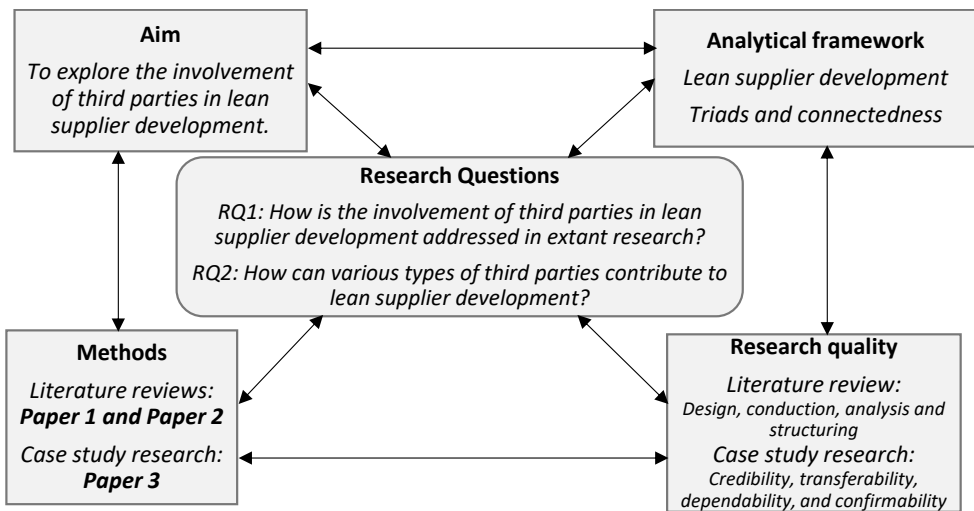


Figure 14. The research design adopted in this study

Aim: Inspired by previous industry experience and the theoretical background in lean management and supply chains, this thesis initially looked at business relationships in a lean supply context. As the research evolved within the context of a firm employing lean supplier development with several suppliers and other parties, the aim became to explore the involvement of third parties in lean supplier development.

Research questions: The purpose of the research impacts the research strategy and the framing of adequate research questions (Bryman, 2016). First, the study of the two bodies of work utilized in this thesis, namely (1) supplier development and (2) lean supply, presents challenges since most studies in supplier development have focused on the dyadic view (Aune et al., 2013; Friedl and Wagner, 2016), paying limited attention to the involvement of third parties. The lean supply studies also include significant variety and generality, which requires research and adaptation to specific contexts (Netland and Powell, 2017; Shah and Ward, 2007; Ugochukwu et al., 2012). Thus, a broader theoretical understanding of these two streams was needed. RQ1 is related to the involvement of third parties in lean supplier development addressed in extant research; this led to theoretical advancements necessary to continue exploring the topic empirically. Thus, RQ2 is an empirical question about how various types of third parties can contribute to lean supplier development. It concerns the lean supplier development initiative of a firm transitioning to lean while concurrently developing lean capabilities in its suppliers.

Methods: RQ1, which focuses on extant literature, required a careful review of the literature, and the methods employed for this purpose are discussed in Section 3.3. Since RQ2 is a “how” question about a contemporary phenomenon over which the researcher has no control, it required a case study research design (Bryman, 2016; Yin, 2018), the details of which are discussed in Section 3.4.

Analytical framework: In this cover paper, the analytical framework is developed in Chapter 2, based on the lean supplier development characteristics and its array of initiatives to support lean knowledge transfer and sharing (Bortolotti et al., 2016; Sako, 2004) and to create strong relationship ties in the supply network (Dyer and Hatch, 2004; Dyer and Nobeoka, 2000). A conceptual model based on connectedness is developed and applied. The model applies the triad typology presented by Blankenburg and Johanson (1992) and analyzes third-party connections (Aune et al., 2013), third-party effects (Ritter, 2000), and various types of third party (Anderson et al., 1994).

Research quality: There are critical issues to be addressed in each phase of any literature review (Snyder, 2019; Tranfield et al., 2003), and they are discussed in relation to the studies in Section 3.3.3 of the thesis. In case study research, the quality of research must be appraised in relation to its trustworthiness (Lincoln and Guba, 1985), as discussed in Section 3.4.2.

3.3 Literature review as a method

The first method employed in this thesis is the literature review, which is a crucial process that allows the researcher to delineate the knowledge present in a research area (Bryman, 2016; Snyder, 2019; Tranfield et al., 2003). By analyzing a body of work, a literature review also helps to identify advancements and new paths for a theoretical understanding of the research phenomena (Bryman, 2016; Post et al., 2020).

The different approaches to conducting a literature review can be divided broadly into systematic, narrative, and integrative approaches (Snyder, 2019). The systematic approach is based on a reproducible process for collecting data that fits pre-specified inclusion criteria to answer a particular research question (Tranfield et al., 2003). A narrative review is used to address bodies of research in which it is not possible to review every single relevant work (Snyder, 2019). Unlike in the systematic approach, the data collection strategy in a narrative review does not adopt pre-specified criteria but depends instead on the researchers’ judgment and is thus more subject to bias (Snyder, 2019; Tranfield et al., 2003). An integrative review is useful for combining perspectives and insights from different fields or research traditions, with the aim of assessing, critiquing, and synthesizing the literature and enabling new theoretical frameworks and perspectives to emerge (Snyder, 2019). In

this approach, data collection requires a more creative process to combine different perspectives and streams of research (ibid.)

Literature review studies, especially narrative ones, have been criticized for lacking thoroughness and specific methodology, for being susceptible to researcher biases, and for lacking rigor, leading to questions about their quality and reliability (Snyder, 2019; Tranfield et al., 2003). For researchers to ensure the quality and reliability of literature reviews, issues must be addressed in each of the four phases of the review (Snyder, 2019; Tranfield et al., 2003):

1. Planning and designing the review
2. Conducting the review
3. Analyzing the results
4. Writing and reporting the results.

In phase 1, the choice of an adequate approach, a methodology search strategy definition, and an assessment of the need for the review in relation to previous accounts in the research field must be carried out (ibid.). In phase 2, issues related to the search process, such as identifying and selecting studies, criteria for study quality access, data extraction, and synthesis, must be addressed (Tranfield et al., 2003). In phase 3, the data abstraction and analysis methods must be in accordance with the overall purpose of the review and accurately described (Snyder, 2019). Finally, in phase 4, the organization of the review results, the accurate description of the process, the usefulness of the results, and directions for further research must be accounted for (ibid.)

3.3.1 Method in Paper 1

In Paper 1, “Who develops the suppliers? The role of third parties in bringing about supplier development,” a literature review aims to address explicitly and systematically the issue of third-party involvement in supplier development. Snyder (2019) reminds us that systematic reviews synthesize research findings efficiently, allowing the researcher to proceed in a transparent and reproducible way. Thus, a review approach inspired by the systematic method was chosen in Paper 1.

The review was conducted in the following four-stage process: (1) data collection, (2) sorting documents, (3) thematic selection, and (4) classification (Denyer and Tranfield, 2009; Tranfield et al., 2003). To collect data (stage 1) from recent, relevant, and highly cited publications, a search was conducted using the most extensive literature collections—Scopus and Web of Science (Chadegani et al., 2013). The search in these collections combined resulted in only 89 documents, which was considered insufficient to review the subject thoroughly. Thus, a new search was conducted in Google Scholar (GS), which offers broader coverage of documents (Martín-Martín et al., 2018). The combined search in Scopus, Web of Science, and GS resulted in 439 documents. The search terms used were third-party(ies), network(s), triad(s), third actor(s), and supplier development.

Of the 439 documents, many were irrelevant for the review. Thus, a sorting process (stage 2) was initiated by establishing and fine-tuning exclusion criteria (details of the process can be found in the discussion of research quality in Section 3.3.3):

- A. Documents that were not cited, were once cited, or were more than three years old were excluded. This stage excluded 218 documents.
- B. Documents from non-peer-reviewed academic journal publications were excluded to avoid low-quality research and to limit the review to academic journal publications. This stage excluded 28 documents.
- C. Papers not dealing with the supplier development phenomenon, such as those focusing on marketing relationships, quality management, supplier selection, and new product development, were excluded. This stage excluded 72 documents.

D. Papers that did not address (or minimally addressed) network aspects were excluded. Although they dealt with supplier development, these papers did not present discussions related to the aim of the study (or did so only minimally). Among the excluded papers were those investigating the risk and decision processes in dyadic supplier development and those exclusively investigating success factors in buyer-centered supplier development. In this stage, 59 documents were excluded.

In addition, after reading the remaining documents, three relevant papers were found by snowballing the reference lists, and these were added to the final sample of 65 papers for analysis.

To identify the recurrent themes (thematic selection) in this literature sample (stage 3), the 65 papers underwent a word count of their abstracts using qualitative data analysis software (NVivo). The word count was conducted by grouping words with the same root (e.g., “improve,” “improvement”) and eliminating words that are not considered literature themes (e.g., terms such as “supply” and “model” in relation to the method or the research object). This counting and grouping process resulted in a thematic classification (stage 4), in which seven main themes were established (Table 3).

Table 3. Main themes in the supplier development literature

Theme	
A	Performance/improvement
B	Supplier development activities, practices, and programs
D	Capability and knowledge management
E	Supplier development for sustainability
F	Direct and indirect supplier development
G	Supplier development in a small and medium firm context
H	Supply chain and relationships

The papers were then subjected to a general analysis, focusing on their publication period, methods employed, and publication outlets. Finally, after an in-depth reading, looking for how the papers were conceptualized, they were categorized into (I) papers that addressed supplier development as a dyadic phenomenon and (II) papers that addressed it as a triadic or network phenomenon (i.e., connected dyads). The analysis investigated the differences in characteristics and themes addressed in these categories, which were then cross-examined against the seven main themes of the thematic classification. Finally, an analysis of the trends and differences among the prevalence of the themes for each category led to an alternative model for third-party involvement in supplier development and a corresponding research agenda.

3.3.2 Method in Paper 2

Paper 2, “Viewing lean supply from the IMP perspective,” discusses how the variety and generality in lean supply studies lead to its key concepts being adapted to different purposes and, thus, to its concepts appearing opaque. The planning of the study identified the need for a review in relation to previous accounts in the research field. As four previous literature reviews on the topic were found, the literature on lean supply was not reviewed directly; rather, these four studies were presented and compared to identify key characteristics and elements of lean supply. Of the four, two (Martínez-Jurado and Moyano-Fuentes, 2014; Ugochukwu et al., 2012) examined characteristics of lean supply chains based on extant literature, and the other two (Jasti and Kodali, 2015; Shah and Ward, 2007) developed a conceptual model based on extant literature and empirical research.

The first study, the seminal work by Shah and Ward (2007), reviewed the extant literature to capture and validate key elements of lean production, including and highlighting the supplier base system; the study presents four relevant factors for lean supply discussions. In the second study, Ugochukwu et al. (2012) presented a comprehensive review of 40 articles on lean in the supply chain and identified eight lean supply chain characteristics using structured content analysis. In the third study, Martínez-Jurado and Moyano-Fuentes (2014) reviewed studies combining literature on lean management and supply chain management and, on the basis of 14 articles, compared and discussed 11 characteristics that distinguish lean supply from traditional supply chains. In the fourth article, Jasti and Kodali (2015) created a lean supply framework with nine pillars based on the literature and experts' opinions.

Through comparison and analysis of the four factors presented by Shah and Ward (2007), the eight lean supply characteristics presented by Ugochukwu et al. (2012), the 11 characteristics that distinguish lean supply from traditional supply chains (Martínez-Jurado and Moyano-Fuentes, 2014), and the nine pillars of Jasti and Kodali (2012)'s framework, a lean supply model was discussed. The four previous literature reviews on lean supply were analyzed, and key lean supply concepts were identified, compared, and, in some cases, combined. The process yielded 12 elements of lean supply (see Table 4).

Table 4. Elements of lean supply

Element	
1	Delivery practices
2	Problem solving and improvement
3	Supply chain type
4	Product development with supplier
5	Customer focus
6	Supplier quality assurance
7	Communication and information sharing
8	Relationship type
9	Relationship horizon
10	Supply base type
11	Supplier selection
12	Supplier development and support

This paper also draws on the IMP perspective (i.e., the industrial network approach), using it as a lens to interpret the key elements of lean supply. In order to achieve that, the basic concepts of the perspective are used (Håkansson and Snehota, 1995); in addition, other relevant literature about this perspective (e.g., Gadde et al., 2010; Håkansson et al., 2009) is used as input for presenting the key concepts. First, two levels of analysis of business relationships are discussed: a single business relationship level (i.e., a dyad) versus the extended network of relationships level. The primary elements of a relationship (actors, resources, and activities), which form actor bonds, resource ties, and activity links on a dyad (the ARA model), are then discussed.

For the analysis, the fundamental concepts (the dyad- vs. network-level analysis and the ARA model) were juxtaposed with lean supply elements. This juxtaposition was applied to each of the 12 lean supply elements; two examples can be found in Table 5 (for the entire table, see Paper 2). In Table 5, an empty cell indicates no correspondence to the concepts, a cell with a lower-case "x" indicates minor correspondence to the concepts, and a cell with an upper-case "X" indicates significant correspondence to the concepts.

Table 5. Lean supply elements in the IMP framework

Element	Main discussion	Dyads	Networks	Activities	Resources	Actors
LS1 – Delivery practices: Lean production and logistics	JIT systems, pull production	X	X	X		x
...						
LS4 – Supplier involvement in product development	Product design	X		x	X	x

Subsequently, each key element of lean supply was discussed in relation to the two IMP frameworks: (1) dyad vs. network level and (2) the ARA model, observing the presence of the elements in relation to the said frameworks.

In sum, through a meta-analysis of the current theory on lean supply, Paper 2 presents a novel conceptual classification of the key elements. Juxtaposing the IMP core concepts with the lean supply elements indicates how lean supply can be expanded and gives direction to future research.

3.3.3 Research quality for a literature review design

In this section, the research quality aspects for Papers 1 and 2 are discussed in relation to their designs.

Paper 1: “Who develops the suppliers? The role of third parties in bringing about supplier development”

In the initial phase of the literature review (phase 1; i.e., planning and designing), the search strategy in this paper—based on the search terms, database, and exclusion criteria adopted—was employed to ensure that the subject of interest is adequately captured in the body of literature (Tranfield, 2003).

In the review itself (phase 2), the criteria for selecting studies were based on quality parameters, database selection, and exclusion criteria. Nevertheless, few articles were found during the first search round in the databases initially chosen (Scopus and Web of Science). Thus, a new search was conducted using Google Scholar (GS), which increased the sample of documents and articles that met the criteria to 439 in total, making it possible to perform a more comprehensive analysis of the body of work.

Nevertheless, GS has been criticized for lacking a reliable tool for extracting documents (Martín-Martín et al., 2018). As a countermeasure for this deficiency, the software Publish or Perish, which has an embedded search function for the GS, was utilized for reliable document extraction (Adler and Harzing, 2009).

In phase 3, prior to the analysis, all abstracts were skim-read, and it was noted that not all documents dealt with the subject of supplier development; thus, they were unrelated to the overall purpose of the review (Snyder, 2019). Criteria were thereby established (Meline, 2006) based on important parameters to exclude unrelated documents. Following this exclusion, 65 articles remained to be analyzed.

For the data analysis, the words in the abstracts of the 65 articles were counted to ensure that the most important themes of the literature were captured (Post et al., 2020). NVivo software was used to perform the word count, wherein words with the same root words were grouped, and a final word count report was delivered. After excluding words that cannot be considered themes (such as

“suppliers,” “develop,” “method,” and “model”), the top words in the count were established as the seven main themes of the literature.

Finally, in phase 4, the papers were read and analyzed based on a search for discussions related to third-party involvement. During this process, papers were categorized into (1) those dealing with supplier development primarily as a dyadic phenomenon and (2) those addressing supplier development also as a network phenomenon (including third parties). This categorization and analysis allowed for the presentation of an alternative model for third-party involvement and a research agenda, which are meaningful ways of synthesizing the wealth of information obtained from the review (Post et al., 2020).

Paper 2: “Viewing lean supply from the IMP perspective”

The literature review in Paper 2 can be seen as an integrative review (Torraco, 2005), as the aim of the paper is to reconceptualize lean supply through an alternative perspective (Snyder, 2019). In planning the review (phase 1), it was noted that much had been written on the lean supply topic; the field can thus be considered mature. The first studies date back to the 1990s (e.g., Lamming, 1993; Womack et al., 1990). However, apart from a few studies (e.g., Hines, 1994; Lamming, 1993), business relationships in networks have not been used as a central concept in lean supply studies. Thus, using the IMP concept as a research lens, with its focus on business relationships and networks (Ford et al., 2003; Håkansson and Snehota, 1995), there was clear potential to expand the view of lean supply.

In the review (phase 2), the lean supply body of work was not reviewed directly but meta-analyzed (Snyder, 2019). Four papers reviewing the lean supply literature were utilized: Jasti and Kodali (2015), Martínez-Jurado and Moyano-Fuentes (2014), Shah and Ward (2007), and Ugochukwu et al. (2012).

In phase 3, while abstracting and analyzing the four literature reviews, some discrepancies were found in the characteristics of lean supply they presented. Nevertheless, it proved possible to integrate those characteristics into a single view that reconceptualizes and expands the current theoretical foundation (Snyder, 2019).

In phase 4, when reporting the results, it was crucial to synthesize the abundance of information and insights gained in the review in an engaging, comprehensible, and helpful way (Post et al., 2020). Thus, the analysis led to a reconceptualization of the key elements of lean supply and, by discussing those elements in light of the key concepts of the IMP perspective, suggested a research agenda.

3.4 Case study as a method

The case study research method investigates a small number of social entities or situations using multiple sources of evidence (Easton, 2010; Yin, 2018). Case study research has a distinct advantage over other methods when a “how” or “why” question is raised about a contemporary phenomenon over which the researcher has little control (Yin, 2018). However, it has been criticized for being too context-embedded (Flyvbjerg, 2006) and for its apparent inability to generalize (Yin, 2018). However, the context-specificity of this type of research should be seen as a strength since it allows for the expansion and generalization of theories through the exploration of the variability of complex factors in a controlled (bounded) context (Dubois and Gadde, 2002; Ketokivi and Choi, 2014; Yin, 2018). This thesis raises “how” questions about a contemporary phenomenon, a lean supplier development case initiative, over which the researcher has no control. Accordingly, the case

study method was chosen since it is suitable for empirically exploring such an initiative and its underlying mechanisms.

3.4.1 Method in Paper 3

Case selection. The case was selected for its relevance to the theme and its viability as a research object. First, sufficient access to the companies and people involved in the potential case is an important factor in case selection (Yin, 2018). Here, the focal buyer in the lean supplier development case initiative, KMS, was part of the *Lean Management* research project; thus, sufficient access to the initiative was granted through the project. Moreover, the selected case presented a unique opportunity to investigate the Network for Supplier Innovation (NSI), the first Norwegian supplier association based on lean principles, which was established in 2014 by KMS (Powell and Coughlan, 2020). Like other firms aiming to develop lean in their supply network, KMS drew inspiration from how Toyota developed its supply network (Dyer and Hatch, 2004). Nevertheless, unlike in the case of Toyota, the focal buyer was, at the beginning of the initiative, a buying firm transitioning to lean (Soriano-Meier and Forrester, 2002) and in the early stages of acquiring lean capabilities. Thus, the case choice can be considered an information-oriented selection (Flyvbjerg, 2006) that contains elements that are “revelatory,” “unique,” and “critical instances” (Bryman, 2016). This choice also allowed for the exploration of how a buying firm transitioning to lean can concurrently develop lean suppliers in a network and create an expectation of what the study can reveal about this typical situation (Yin, 2018).

Data collection. The primary data were collected through semi-structured interviews with NSI participants, the buying firm, suppliers, and third parties. A main round of interviews was conducted in 2017 with representatives of all the participant suppliers, and the person interviewed was the point of contact for the initiative, CEOs, purchasing managers, and lean coordinators. The interview guide contained initial questions regarding background information about the firm and the informant, and a section addressing the supplier’s motivation to participate in the program, their work on developing lean capabilities, and their experience with the activities, individually and with other firms. As a result, it was possible to conduct two interviews with three of the six suppliers, yielding a total of nine interviews and ensuring that we captured different perspectives on the same themes. With the agreement of the interviewees, the interviews were recorded and transcribed. The interview transcripts were presented to the interviewees to check whether their opinions had been captured accurately.

The researchers also participated in NSI internal meetings, workshops, and seminars, where notes were taken in direct observation. Company documentation, such as documentation for the lean program, technical data, and consultation reports, was consulted. Finally, the researchers participated in the Lean Forum annual meetings in 2017, when, primarily due to its efforts in NSI, KMS received the Lean Forum Norway Company award.

Data analysis. Data from the observations and interview transcripts were used to determine the level of lean knowledge of the participant firms. Later, the interview data were also used to describe NSI and its activities, with the support of documents and direct observation of NSI activities. Regarding the effects of NSI, the interview data captured the effect of activities, such as learning outcomes, relevance to the firm context, and time impact. The available data were transcribed and explained to make sense of the supplier’s opinions on each effect. Lastly, data from the NSI documents and notes taken were used to evaluate NSI’s performance.

3.4.2 Research quality for a case study design

Given the nature of the research addressed in this thesis, it was deemed relevant to employ a single in-depth study of a lean supplier development initiative that was based on “thick” qualitative data, offering insights into the nature of the phenomena (Dubois and Gadde, 2014; Easton, 2010). One typical research quality criterion used to assess such qualitative research is trustworthiness, the umbrella term for what Lincoln and Guba (1985) framed as credibility, transferability, dependability, and confirmability.

Credibility

Credibility relates to demonstrating the truth of a study’s findings (Lincoln and Guba, 1985), which entails linking the presented findings with reality. In the case study in this thesis, the following triangulation strategies were adopted to ensure credibility.

1. The case was based on data collected from various sources; although semi-structured interviews and observations provided primary data, the thesis also utilized secondary sources (e.g., analyses of documents and data on supplier performance). Thus, it was possible to perform triangulation of the data sources, a process that provides additional opportunities for verifying the trust of the empirical material, thereby increasing the credibility of the data (Eisenhardt, 1989; Yin, 2018).
2. In addition to data triangulation, informant triangulation is an essential tool to verify that the people interviewed have a uniform view of the phenomena (Kvale, 1997). Thus, to achieve data saturation (Fusch and Ness, 2015), semi-structured interviews were planned with at least two suppliers’ representatives. However, owing to unforeseen restrictions, only one representative was interviewed in two supplier firms.

Gathering data from the suppliers’ representatives made it possible to capture the suppliers’ perspective on the case, in addition to that of the buying firm (KMS). Interviews were carried out by teams of two researchers and were recorded, transcribed, and checked for understanding and confidentiality, which is essential to suppliers confidently sharing their views.

To ensure increased credibility of the interpretation, the semi-structured interviews, which are the primary data source in the study, were transcribed (Widodo, 2014). After transcription, the supplier interviewees read the transcripts, and the results were presented to informants and discussed with firm representatives several times to check their credibility (Mero-Jaffe, 2011).

Transferability

Transferability captures how a study can make general claims. However, instead of transferability being framed in terms of generalizing across contexts no matter what, it should be understood as the ability to transfer and use theoretical knowledge to make sense of another context, taking into account its intricacies (Polit and Beck, 2010).

The impossibility of making statistical generalizations has been one of the main criticisms leveled at case study research (Yin, 2018). Nevertheless, theoretical generalization is also crucial in advancing a topic (e.g., Dubois and Gadde, 2002, 2014). The value of case study research rests on the possibility of exploring the variability of complex factors that, by the example of a specific context, can contribute to expanding an existing theory (ibid.), which aligns with the aim of this thesis.

Given the complexity of the context of the study, the exact conditions present during the lean supplier development initiative in the empirical case cannot be repeated. Thus, although it would be impossible to replicate this study *ipsis litteris*, the knowledge gained, and lessons learned can inspire future research to approach similar phenomena in light of its findings.

Dependability

Dependability is the stability of data over time and across conditions (Lincoln and Guba, 1985). It also refers to the possibility of tracking and repeating the research process (Bryman, 2016). Hence, the essential parts of the research process were described to ensure transparency regarding how the overall research in this study evolved (see Section 3.1 and Section 3.4.1).

In this thesis, the empirical data are context-dependent, the collection conditions cannot be repeated, and it would be virtually impossible to replicate this study verbatim. Nevertheless, researchers working with the same assumptions, methods, and timescales may find underlying mechanisms similar to those identified in this thesis. Thus, future research within similar contexts can enlighten, validate, and expand the current study.

Confirmability

Confirmability is the extent to which empirical findings are based on the participants' ideas, not on the biases of the researchers (Halldorsson and Aastrup, 2003). It is also concerned with consistency in the use of concepts and their connection to the analysis. In addition, the data analyzed should be grounded in actual events and not in the researcher's values or other personal biases (Bryman, 2016).

To ensure confirmability, the data collected in the interviews were tabulated prior to analysis, which reduces the risk of interference from researcher bias. Also, the findings can be tracked to raw data (for example, to the interview transcripts, which are archived and retrievable). Finally, the expansion and redirection in relation to data and theory ensure that although the a priori theoretical concepts influenced the research, they were not applied unreflectively. This is particularly relevant to two main driving forces in this thesis: (1) the change of research focus from lean supply to lean supplier development, and (2) the addition in this cover paper of the conceptual model based on the concept of triads.

4 Summaries of the three appended papers

This chapter presents a summary of the three independent papers and their main conclusions.

- Paper 1: “Who develops the suppliers? The role of third parties in bringing about supplier development”
 - Presented at the 30th annual conference of the International Purchasing & Supply Education & Research Association (IPSEERA).
- Paper 2: “Viewing lean supply from the IMP perspective”
 - Published in the *Journal of Business and Industrial Marketing*
- Paper 3: “How can a buying company develop a Toyota-style supply network while its lean capabilities are still evolving?”
 - Published in the *International Journal of Lean and Six Sigma*

These three papers are the basis for the thesis, and each makes an individual contribution to the two research questions, as depicted in Table 6.

Table 6. Contribution of independent papers to research questions

Research question	Paper 1	Paper 2	Paper 3
a) How is the involvement of third parties in lean supplier development addressed in extant research?	X	X	
b) How can various types of third parties contribute to lean supplier development?	X		X

4.1 Summary of Paper 1

Firms operate at high levels of specialization, and, because of outsourcing, a firm’s purchasing spend can amount to more than half its turnover, making the firm increasingly dependent on suppliers. The appreciation that a firm’s supply side is vital for its performance has led to increasing attention on how to manage the supply side by, for example, reconsidering make-or-buy decisions, switching suppliers, or engaging in supplier development efforts.

Supplier development revolves around a buying firm’s efforts to improve its suppliers’ capabilities and performance. Buying firms usually engage in supplier development with suppliers whose capabilities and performance do not currently fulfill their needs but could do so with the right incentives and support, so that the supplier becomes a viable supplier in the short and long term. Accordingly, supplier development focuses mainly on the efforts of a single buying firm to develop a single supplier or set of suppliers in parallel isolation, which leads to a dyadic conceptualization of supplier development.

To date, most research on supplier development has adopted the perspective of the buying firm, while the supplier’s perspective and its engagement in supplier development have received less, albeit increasing, attention. Recent debates focusing on supplier development point to the fact that supplier development efforts involve more than a single buying firm and its supplier(s); the involvement of third parties has been mentioned as one area that should be explored further. However, although the purchasing and supply management literature has paid more attention to third parties,

few studies have explicitly or systematically addressed third-party involvement in supplier development.

Paper 1 addresses this gap by exploring how third-party involvement in supplier development has been captured in the supplier development literature. It first deals with the main differences between studies that use a dyadic level of analysis and those that use a triadic or network level. It then explicates (1) the types of third parties involved in supplier development and (2) how they are involved. Finally, it discusses why third parties are involved in supplier development. The inquiry is carried out through a critical review of the literature, based on a search in Scopus, Web of Science, and GS resulting in 439 documents. Reviewing those 439 documents and applying exclusion criteria yields a final sample of 65 articles for analysis. The articles are grouped into classes based on the themes highlighted in their abstracts. In addition, each paper is categorized according to whether it adopts (1) a dyadic or (2) a triadic or network focus on supplier development.

The results show that seven main themes are discussed in the supplier development literature, with some themes being more central to papers with a dyadic focus and others more central to papers with a triadic or network focus. For example, the “performance” theme is dominant in studies with a dyadic focus, whereas the “business relationship” theme is dominant in studies focusing on triads or networks. In addition, “knowledge sharing” and “capability development” are more prevalent in papers with a triadic or network focus.

The results also reveal some triadic supplier development efforts where another buyer, a complementary supplier, or a third party of another type, such as a governmental or non-governmental organization, or a consultancy firm, supplements the focal buyer–supplier dyad. Based on a discussion of the involvement of these third parties, the study outlines six different ways in which a third party can be involved in supplier development, according to two dimensions. The first dimension is a type of involvement that is similar to direct or indirect supplier development, namely, third-party involvement through encouragement or engagement in supplier development. The second dimension relates to which of the focal firms the third party mainly interacts with: the focal supplier, the focal buyer, or both. On the basis of the results of the review, we discuss four reasons buying firms may have for involving third parties in supplier development: (1) their need for complementary capabilities or capacity, (2) a lack of resources, (3) their supply chain position, and (4) their efforts in developing social sustainability.

The findings contribute to the literature by detailing why buying firms engaged in supplier development may benefit from third-party involvement. For example, the involvement of a third party may supplement the capabilities and capacity of the buying firm, since the capabilities of the supplier that the buying firm wishes to develop are not always available in its internal organization. We then show how managers in buying firms, supplier firms, and other organizations acting as third parties to supplier development efforts may benefit from reflecting on the different modes of involvement when engaging in supplier development. Finally, we encourage further studies that aim to capture third-party involvement empirically and conceptually. For example, given the emergence of supplier development studies that focus on sustainability, we encourage empirical studies and conceptual development in settings where sustainability and third-party involvement are at the center of supplier development efforts.

4.2 Summary of Paper 2

Lean management has grown steadily and is now a widely accepted management practice focusing on improvement principles and practices. Although a lean implementation traditionally starts within a firm, it has been emphasized that lean management should be extended to suppliers in

order, for example, to cope with uncertainty in the supply chain. As a result, the literature that explores the extended lean concept is growing and combines various elements related to lean and supply chain management, often called lean supply. Lean supply focuses on process and production enhancement and continuous improvement beyond the boundaries of a focal firm. Thus, it is necessary to capture how firms interact and how business relationships develop beyond the boundaries of a focal firm. The IMP research tradition offers perspectives to capture inter-organizational phenomena such as lean supply. A central tenet within IMP is that business relationships, not individual firms, are the primary unit of analysis. What lies beyond a firm's boundary affects its operations considerably and is, in parallel, a source of efficiency improvements.

Thus, Paper 2 explores and discusses key elements of lean supply in light of the IMP approach. Notably, it deals with specifying the key elements of lean supply and how to interpret those elements from an IMP perspective to expand the lean supply view. To address the study's aim, elements of the lean supply literature and concepts within the IMP research tradition are reviewed. First, by analyzing the literature on lean supply, especially literature reviews, the paper identifies and discusses the characteristics and key elements of lean supply. Based on these characteristics and key elements, a lean supply model is developed, comprising 12 central elements. The key concepts within the IMP research tradition are then presented and used as a base for analyzing each of the 12 lean supply elements. Specifically, the ARA model is used to capture activities, resources, and actors, and it is fused with two business relationship levels: the dyadic and network levels.

The results show that lean supply focuses primarily on the activity layer of the relationship and pays less attention to the resource and actor layers. Emphasizing and delving into these other two layers would, therefore, strengthen the lean supply discussion. In addition, lean supply relates primarily to developing an individual supplier or many suppliers concurrently, where supplier relationships are either unitary or comprise many disconnected dyads (multi-dyad). However, lean supply also deals with the network level when discussing the relationship of lean firms with non-tier-one suppliers, such as when these firms perform problem-solving activities with tier-two suppliers. Additionally, the network level is present in lean supply discussions of using the eVSM tool, which analyzes a value stream of products in more than one relationship tier and thus involves not only dyadic relationships but also connections among tier-one suppliers.

The findings contribute to theory by detailing key elements of lean supply and by showing how relationships and networks play a pivotal role in lean supply. Furthermore, they demonstrate the importance of further developing the network level in lean supply since the extant discussion mainly revolves around different elements primarily related to the dyadic level. Consequently, less consideration has been given to the network level, which includes third parties. Taking a network perspective may also enable a better understanding of the possibilities for improving efficiency in extended supply chains and networks.

The findings contribute to managerial practice by detailing and widening the scope of companies aiming to develop lean supply and its practices. First, many lean firms focus on lean tools, practices, and activities in single relationships, which could usefully be supplemented with consideration of the resource and actor layers, especially at a network level. More specifically, when a buying firm deals with continuous improvement in the supply chain, it may consider whether actors at the supplier's network level should be accounted for when selecting and/or developing suppliers. Second, careful consideration of actor layer concepts such as trust, expectations, and commitment could benefit the development of lean supply. For example, the supplier's efforts toward lean operations led by the customer may depend on the extent to which the supplier trusts the buying firm's intentions and competence, but also on the supplier's expectations regarding the future development of the relationship in the broader context of its own and the buying firm's networks.

4.3 Summary of Paper 3

Increased specialization and dependence on competent suppliers have led buying firms to consider developing their suppliers and supplier networks. Two approaches to supplier development can be distinguished. The direct approach revolves around a buying firm's active involvement through organization of the learning context and dedication of human and/or capital resources to develop specific suppliers. In contrast, the indirect, more passive approach revolves around the buying firm setting targets and encouraging and incentivizing suppliers to improve. For example, Toyota is renowned for its comprehensive direct approach to developing suppliers' lean capabilities for single suppliers and its supply network. For a comprehensive lean transformation, buying firms must also extend their internal lean efforts to the supply chain or network. However, most studies on lean implementation in supplier systems assume implicitly, state directly, or show empirically that buying firms (1) develop their internal lean capabilities and (2) transfer their lean knowledge and practices to their suppliers.

Since most research on lean development has an internal focus, there is a need for more studies that capture how lean can be spread to suppliers. Accordingly, this study explores how a buying firm can create a Toyota-style supplier network (TSN) while its own lean capabilities are still developing. It first considers how a firm can design a TSN-style initiative with an appropriate mix of activities. Second, it deals with how a firm can select an appropriate mix of suppliers for a TSN-style initiative and relate them to each other and to suppliers outside the initiative. Finally, it focuses on how a firm can identify and involve an appropriate mix of third parties who can take on the role of lean master and support a TSN-style initiative. Through a single qualitative case study, the paper explores the Network for Supplier Innovation (NSI) initiative, which aims to develop a Toyota-style supply network. The initiative involves six of the buyer's strategic suppliers and four third parties. The case outlines the buying firm's efforts to develop lean in its supplier network at the same time as it develops lean internally.

The results show that initiatives of firms whose lean capabilities are still evolving can succeed in developing internal lean in parallel with external lean in their supplier network in a relatively short period compared to the mature lean capabilities of Toyota. Like Toyota, NSI provided various activities that enabled explicit and tacit lean knowledge sharing, and it allowed the creation of weak network relationships and strong (dyadic) relationships. To a lesser extent than in Toyota, NSI also allowed the creation of weak network relationships. Nevertheless, initiatives such as NSI's require a different approach than Toyota's. Firms developing lean supplier development initiatives when their own lean capabilities are still evolving should reflect carefully on how they adapt elements from the Toyota approach into their setting.

The results also show that the involvement of third parties is crucial to the success of lean firms' initiatives, and the paper discusses several reasons why this involvement can be effective when organizing and dividing responsibilities in such initiatives. Buying firms with evolving lean capabilities can develop lean suppliers and networks and improve lean capabilities and performance. However, certain aspects must be considered when adapting to each buyer's context, including (1) the stage of involvement of the supplier-buyer relationships and (2) the handling of competitive and collaborative elements. To ensure the continuity of such efforts, it is essential that buying firms assess compatibility with the strategic priorities and anchoring in the organization of the participant suppliers, including top management, in and across the organization.

The findings contribute to the literature by showing that buying firms do not need to wait until they have developed mature lean capabilities internally to develop their supplier networks; they can start developing suppliers while their own lean capabilities are still evolving. Moreover, it is essential

for the buying firm to choose an appropriate mix of suppliers and to design the content, frequency, and sequence of a mix of knowledge-sharing activities, as well as to involve a mix of third parties with capabilities to carry out activities adapted to the suppliers and to the buying firm's particular operations. To build on the results of this study, future work should adopt a longitudinal approach to investigate the evolutionary aspects of a buying firm's development of its lean supplier network. In addition, further studies on lean consultation and masters could seek to capture the vital interplay in the buyer–supplier–third-party context whereby the third party can facilitate the parallel development of lean capabilities in a buying firm and its supplier network.

5 Discussion

This chapter discusses and responds to the two research questions of the thesis:

- a) How is the involvement of third parties in lean supplier development addressed in extant research?
- b) How can various types of third parties contribute to lean supplier development?

To take account of third-party involvement, different triads will be identified in the literature (Section 5.1) and in NSI's supplier development case initiative (Section 5.2) involving a buyer in transition to lean.

As discussed in Chapter 2, the third-party relationship can have no effect (i.e., a neutral effect) on the focal relationship, an overall positive effect on the focal relationship, or an overall negative effect on the focal relationship (Ritter, 2000). Thus, the following sections will discuss which third party is present for each triad (an additional buyer, an additional supplier, or an ancillary organization), and which effect the third party has on supplier development (neutral, positive, or negative).

Defined as the effort of a buyer to develop the capabilities of a current supplier, supplier development has been commonly regarded as the transfer of capabilities from a buyer to suppliers (e.g., Handfield et al., 2000; Krause, 1997; Wagner, 2006). For example, lean internal capabilities have been replicated in suppliers by mature lean firms (Hartley and Jones, 1997; Sako, 2004). Nevertheless, if capabilities are lacking in the buying firm, third parties may assist in the development of supplier capabilities (Brix-Asala et al., 2020; Liu et al., 2018; Rodríguez et al., 2016). In such a case, the third party, which has a higher level of specific capability than the buying firm, is the one that is transferring its capabilities to the suppliers. Thus, the following analysis will also address the question of who has the higher level of capabilities and, thus, of who is transferring its capabilities in each triad: the focal buyer or the third party.

5.1 Literature examples of the involvement of third parties

This section analyzes the literature to answer the first research question. It should be noted that few discussions in the lean supply literature are specifically about the involvement of third parties, whereas there is much more discussion in the supplier development literature, as depicted in Figure 15.

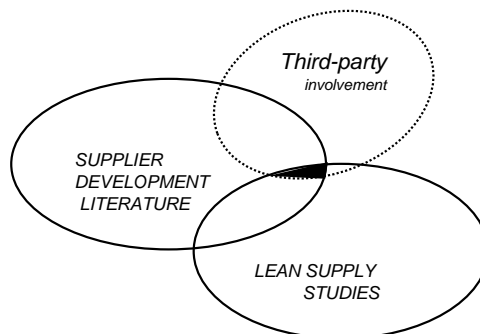


Figure 15. Third-party involvement, the supplier development literature, and lean supply studies³

³ The sizes of the circles are not intended to reflect actual proportions but to represent differences in the presence of discussions.

Accordingly, this section draws mainly on the supplier development literature (on which Paper 1 and parts of Paper 3 are based) but also includes reports found in lean supply studies (on which Paper 2 and parts of Paper 3 are based).

The theoretically deduced set of types discussed in Section 3.4 is based on four triad types: implicit, open, semi-closed, and closed (Blankenburg and Johanson, 1992). The set is also based on the distinction between third parties that connect via the focal supplier and those that connect via the focal buyer, as in Figure 16.

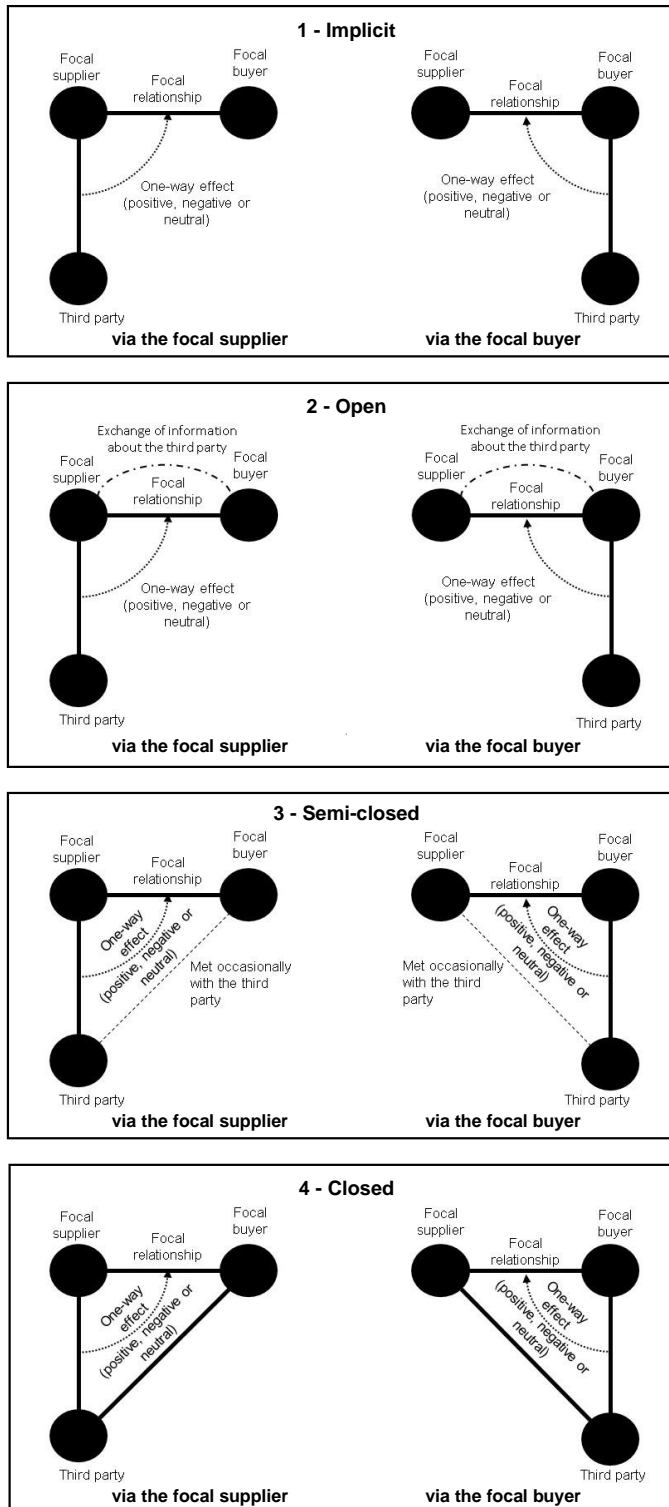


Figure 16. Triad types and third parties connected via the focal supplier and via the focal buyer

To allow comparison among different types of triads, three sections are presented, each focusing on a type of third party (I, II, or III), as shown in Table 7.

Table 7. Twenty-four triad types

Triad type	Connected via	Type of third party		
		Additional buyer – I	Additional supplier – II	Ancillary organization – III
Implicit triad	Focal supplier	1	2	3
	Focal buyer	4	5	6
Open triad	Focal supplier	7	8	9
	Focal buyer	10	11	12
Semi-closed triad	Focal supplier	13	14	15
	Focal buyer	16	17	18
Closed triad	Focal supplier	19	20	21
	Focal buyer	22	23	24

Thus, the type of third party changes between additional buyers, additional suppliers, or ancillary organizations, which results in 24 triad types. The next section will discuss the different types in turn.

5.1.1 Analyzing triads with an additional buyer

Table 8 shows the triad types with an additional buyer.

Table 8. Triads with an additional buyer

Triad type	Connected via	Additional buyer – I
Implicit triad	Focal supplier	1
	Focal buyer	4
Open triad	Focal supplier	7
	Focal buyer	10
Semi-closed triad	Focal supplier	13
	Focal buyer	16
Closed triad	Focal supplier	19
	Focal buyer	22

Involvement of an additional buyer connected via the focal supplier

Triad type 1-a. Dyer and Nobeoka (2000) present a focal buyer and an additional buyer offering consultation to a focal supplier, initially free of charge but conditional on a future price reduction. In this example, the additional buyer requires the focal supplier to reduce prices directly after the completion of the consultation, while the focal buyer does not ask for a price reduction immediately. The authors claim that the focal supplier is more willing to receive assistance from the focal buyer because the time to implement the lessons learned in the consultation before price reduction makes the approach of the focal buyer more beneficial (Dyer and Nobeoka, 2000). The additional buyer and focal buyer do not have a direct relationship, which is characteristic of an implicit triad.

In this implicit triad, the focal buyer has higher supplier development capabilities than the additional buyer, since its approach is more effective. This is the case because the supplier perceives the approach of the focal buyer as more beneficial, leading to a higher potential to thrive than in the approach of the additional buyer. Thus, the comparison between the less beneficial approach of the additional buyer and the more beneficial approach of the focal buyer has a positive effect on this supplier development, as depicted in Figure 17.

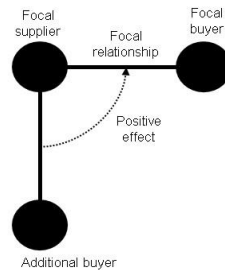


Figure 17. Implicit triad with an additional buyer connected via the focal supplier (TT 1-a)

Triad type 1-b. Another type 1 triad can be identified in Dyer and Nobeoka (2000). In this case, the buyer demanding an immediate price reduction is the focal buyer, and the buyer who does not ask for an immediate price reduction is the additional buyer. Thus, the focal supplier considers the approach of the focal buyer as less beneficial (Dyer and Nobeoka, 2000). The approach of the focal buyer also has a less effective capability transfer since it does not allow the focal supplier enough time to implement the lessons learned in the supplier development (ibid.). In this example, the additional buyer and the focal supplier do not have a direct relationship, which is characteristic of an implicit triad.

In this implicit triad, since the approach of the additional buyer is more effective in capability transfer, the additional buyer has higher supplier development capabilities than the focal buyer. Moreover, the experience of the focal supplier with the superior approach of the additional buyer negatively affects supplier development, as depicted in Figure 18.

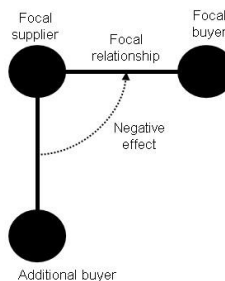


Figure 18. Implicit triad with an additional buyer connected via the focal supplier (TT 1-b)

Triad type 1-c. Liker and Choi (2004) note that in the American automobile market in the 1990s, buyers commonly had relationships based on price competition among suppliers, whereas Japanese automakers, newcomers to the American market at that time, were working on close relationships with suppliers. The close relationships included the involvement of the buyer in the supplier's operations, as a way to support improvement (Liker and Choi, 2004). Thus, the suppliers experiencing close and supportive relationships with the Japanese automakers considered the relationships based on pressure for price competition employed by the American automaker to be less

beneficial (ibid.). This example represents an implicit triad, because the American and the Japanese automakers do not have a direct relationship.

In this implicit triad, since the approach of the focal buyer (the Japanese automaker) is more beneficial to the focal supplier, the focal buyer has higher supplier development capabilities than the additional buyer (the American automaker). Moreover, the supplier's experience of the pressure for price competition with the additional buyer positively affects the relationship with the focal buyer and its supplier development approach, as depicted in Figure 19.

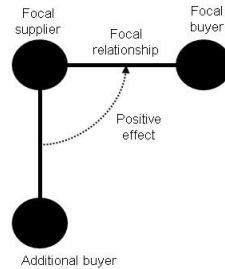


Figure 19. Implicit triad with an additional buyer connected via the focal supplier (TT 1-c)

Triad type 7. Aune et al. (2013) discuss a focal buyer who relies on an additional buyer to engage in supplier development on its behalf. The focal buyer has emphasized the need for the focal supplier to develop a specific capability (production of ex-classified products), which has influenced the supplier development (Aune et al., 2013). As such, the focal supplier, knowing of an additional buyer who has high levels of this specific capability, interacts with and absorbs the capabilities of the additional buyer. The interaction of the focal supplier with the additional buyer is to the benefit of the focal buyer without the focal buyer being involved (ibid.). Although the focal supplier exchanges information about the additional buyer with the focal buyer, the additional buyer and the focal buyer have no direct relationship, which is characteristic of an open triad.

In this open triad, the additional buyer, with capability superiority, is the one that transfers the capabilities to the focal supplier, and thus the one that affects the supplier development positively. However, the condition is that the focal buyer gives up control over the supplier development process (Aune et al., 2013). Giving up too much control of the process might lead to opportunistic behavior by the additional buyer, which in turn would negatively affect supplier development, as depicted in Figure 20.

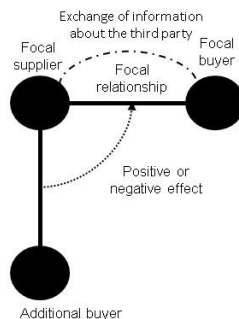


Figure 20. Open triad with an additional buyer connected via the focal supplier (TT 7)

Triad type 13. Friedl and Wagner (2016) present an analytical model of supplier development cooperation where a focal buyer and an additional buyer eventually meet to consider cooperation.

The focal supplier exchanges information about the additional buyer with the focal buyer, but the additional buyer and the focal buyer have no direct relationship. This model is based on the investment costs and possible savings a focal buyer may have in supplier development carried out in cooperation with an additional buyer or independently (Friedl and Wagner, 2016). The study does not consider the levels of capability of the buyers involved, but focuses instead on the level of investment in the supplier development of each buyer as the key success factor in supplier development. Through the application of the analytical model, the study concludes that the cooperation of two buyers results in a lower overall investment, compared with single-buyer applied supplier development (ibid).

In the case that the focal buyer and the additional buyer cooperate, they meet only for the purposes of supplier development, which represents a semi-closed triad. In this semi-closed triad, the cooperation results in lower overall investment in supplier development. Thus, the presence of the additional buyer negatively affects the supplier development, as depicted in Figure 21.

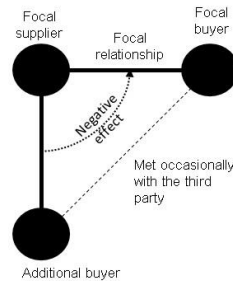


Figure 21. Semi-closed triad with an additional buyer connected via the focal supplier (TT 13)

Triad type 19-a⁴. Aune et al. (2013) discuss supplier development efforts where a focal buyer has had a relationship for many years with an additional buyer and knows of areas where the additional buyer has superior capabilities. The focal buyer, trusting that its interests are being taken care of, requests that the additional buyer transfer its capabilities to the focal supplier (ibid). All parties (the focal buyer, the additional buyer, and the focal supplier) have direct relationships, which is characteristic of a closed triad.

In this closed triad, the additional buyer, with capability superiority, is the one that transfers the capabilities to the focal supplier and, thus, the one that affects the supplier development positively. The authors claim that in such cases the focal buyer expects the additional buyer to engage with the focal supplier in a manner that augments the supplier development in the focal relationship (Aune et al., 2013). However, if the additional buyer engages with the focal supplier in a manner that is harmful to the focal buyer’s supplier development efforts, there will be a negative effect on the focal relationship, as depicted in Figure 22.

⁴ Different examples of the same type are indicated by different letters (-a. -b. -c. ...)

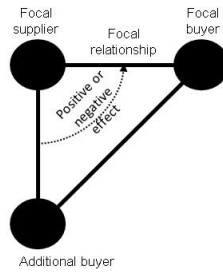


Figure 22. Closed triad with an additional buyer connected via the focal supplier (TT 19-a)

Triad type 19-b. Like Friedl and Wagner (2016), Talluri et al. (2010) present an optimization model of a focal buyer that cooperates with an additional buyer on supplier development and identify conditions in which such cooperation is beneficial. Their model is based on the premise that the additional buyer is more capable in developing a supplier than the focal buyer (ibid.). The model also assumes that all the parties interact and thus have direct relationships, which is characteristic of a closed triad. In this closed triad, the focal buyer engages with the additional buyer with superior capabilities to transfer them to a focal supplier, which affects the supplier development positively. The study also mentions that opportunistic behavior by the additional buyer, to control the focal relationship could have negative effects on supplier development, as depicted in Figure 23.

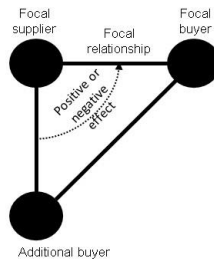


Figure 23. Closed triad with an additional buyer connected via the focal supplier (TT 19-b)

Summary: Additional buyer connected via the focal supplier

The above discussion of how the literature has presented contributions of an additional buyer connected via the supplier is summarized in Table 9.

Table 9. Involvement of an additional buyer connected via the focal supplier

Triad type	Reference	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 1-a	Dyer and Nobeoka (2000)	Applying a less beneficial approach to supplier development	Positive	Focal buyer
TT 1-b	Dyer and Nobeoka (2000)	Applying a more beneficial approach to supplier development	Negative	Third party
TT 1-c	Liker and Choi (2004)	Applying a less beneficial approach to supplier development	Positive	Focal buyer
TT 7	Aune et al. (2013)	Transferring its capabilities to the supplier	Positive or negative	Third party
TT 13	Friedl and Wagner (2016)	Cooperating with the focal buyer	Negative	Not discussed
TT 19-a	Aune et al. (2013)	Transferring its capabilities to the supplier	Positive or negative	Third party
TT 19-b	Talluri et al. (2010).	Transferring its capabilities to the supplier	Positive or negative	Third party

The additional buyer connected via the focal supplier is involved in supplier development by sometimes applying more beneficial and sometimes less beneficial approaches to supplier development, transferring its capabilities to the supplier, and cooperating with the focal buyer. In two instances, the capability level of the additional buyer is lower than that of the focal buyer but impacts the supplier development positively. In other cases, namely triad type 1-b, the additional buyer with a higher level of capabilities affects the supplier development negatively, since the supplier derives more benefits from the approach of the additional buyer than from the approach of the focal buyer. In types 7, 19-a, and 19-b, in addition to positive effects, there can also be negative effects of the additional buyer, because the additional buyer may not consider the interests of the focal buyer in supplier development.

Involvement of an additional buyer connected via the focal buyer

Triad type 4. Hines (1994) discusses the supply base of leading Japanese firms, such as Hitachi and Toyota, which is characterized by close relationships with suppliers and a high degree of strategic and operational assistance to first-tier suppliers. Hines claims that these firms share their knowledge of performance excellence with first-tier suppliers that later emulate the development approach, transferring the capabilities acquired with the leading firms to second-tier suppliers (Hines, 1994, 2016). The leading Japanese firm and the first-tier supplier do not have a direct relationship, which is characteristic of an implicit triad.

In this implicit triad, the additional buyer (the leading Japanese firm) has a higher level of capability, shares its knowledge, and encourages the focal buyer to carry out the same development with its direct suppliers. The additional buyer positively affects the supplier development occurring in the lower relationship tier, as depicted in Figure 24.

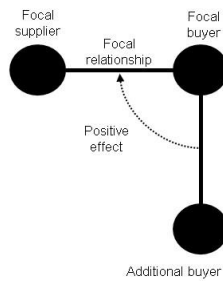


Figure 24. Implicit triad with an additional buyer connected via the focal buyer (TT 4)

Triad type 10. This type of triad has also been discussed in terms of the supply base of a leading Japanese firm. Hines and Rich (1998) consider how Toyota has, since the 1960s, developed its policy deployment, cross-functional management, and production system capabilities internally, as well as become efficient at diffusing these capabilities to suppliers. With the help of Toyota, many first-tier suppliers applied the same diffusion of capabilities to second-tier suppliers (Hines and Rich, 1998; Sako, 2004). The first- and second-tier suppliers exchange information about Toyota, but the second-tier supplier has no direct relationship with Toyota, which is characteristic of an open triad.

In this open triad, the additional buyer (Toyota) has superior capability and affects the capability diffusion in the lower relationship tier positively, where Toyota’s first-tier supplier is a focal buyer to the second-tier (focal) supplier, as depicted in Figure 25.

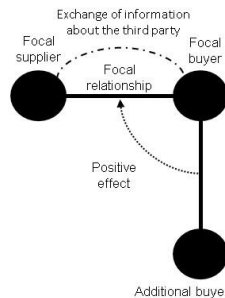


Figure 25. Open triad with an additional buyer connected via the focal buyer (TT 10)

Triad type 16-a. Hines and Rich (1998) also focus on Toyota and its supplier association that has, after decades of activities, been emulated by other sections of the supply base. In this manner, other sections of Toyota’s supply base originated similar supplier associations (Hines and Rich, 1998). The study points out that this multi-tier cascading supplier association system allows Toyota to share its capabilities rapidly with lower relationship tiers (ibid.). In the supplier association meetings, a lower-tier supplier can meet occasionally with a partner two tiers higher.

In this semi-closed triad, the upper-tier partner (an additional buyer), which is closer to Toyota in the capability cascading system, has a higher level of capabilities than the focal buyer in the lower tier. The additional buyer transfers capabilities to the lower-tier supplier, affecting the supplier development positively, as depicted in Figure 26.

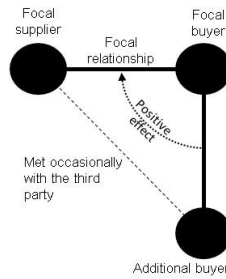


Figure 26. Semi-closed triad with an additional buyer connected via the focal buyer (TT 16-a)

Triad type 16-b. Hines and Rich (1998) also discuss how, in the 1990s, leading firms in the West attempted to emulate the Toyota supplier association and its multi-tier cascading model. In the UK, however, some leading firms provided limited resources and failed to attract new members to their associations, which jeopardized the establishment of those associations (Hines and Rich, 1998). In the establishment of an association, a tier-two supplier can meet occasionally with the leading firm, which is characteristic of a semi-closed triad.

In this semi-closed triad, the additional buyer (the leading firm) has a higher level of capability than the focal buyer, but it provides limited resources and fails in its attempts to attract the focal supplier to the supplier association. Thus, the additional buyer negatively affects the focal relationship and the supplier development that occurs in the lower relationship tier, as depicted in Figure 27.

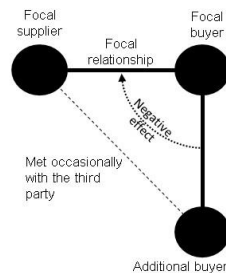


Figure 27. Semi-closed triad with an additional buyer connected via the focal buyer (TT 16-b)

Summary: Additional buyer connected via the focal buyer

The above discussion presents the contributions of an additional buyer connected via the buyer, summarized in Table 10.

Table 10. Involvement of an additional buyer connected via the focal buyer

Triad type	Literature	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 4	Hines (1994, 2016)	Encouraging its supplier to spread capabilities to the second-tier supplier	Positive	Third party
TT 10	Sako (2004); Hines and Rich (1998)	Diffusing its capabilities to a second-tier supplier	Positive	Third party
TT 16-a	Hines and Rich (1998)	Diffusing its capabilities to a second or lower relationship tier	Positive	Third party
TT 16-b	Hines and Rich (1998)	Diffusing its capabilities to a second or lower relationship tier	Negative	Third party

The additional buyer connected via the focal buyer is involved in supplier development by encouraging or diffusing its capabilities to second-tier supplier. The involvement of an additional buyer connected via the focal buyer is primarily beneficial to supplier development, with positive effects. The exception is triad type 16-b, where an additional buyer with lower levels of supplier development capabilities does not provide the necessary resources to the supplier development occurring in a lower relationship level.

5.1.2 Analyzing triads with an additional supplier

The types of triads with an additional supplier are presented in Table 11.

Table 11. Triads with an additional supplier

Triad type	Connected via	Additional supplier – II
Implicit triad	Focal supplier	2
	Focal buyer	5
Open triad	Focal supplier	8
	Focal buyer	11
Semi-closed triad	Focal supplier	14
	Focal buyer	17
Closed triad	Focal supplier	20
	Focal buyer	23

Involvement of an additional supplier connected via the focal supplier

Triad type 20. Handfield et al. (2000) report that the firm IBM, when it needed to increase production of components rapidly, supported a second-tier supplier in reducing its production lead time (Handfield et al., 2000). The authors discuss that, in this process, IBM transferred its capabilities to the second-tier supplier, but it also bought the necessary parts from the second-tier supplier and later sold them to the benefit of the first-tier supplier (ibid.). However, during the intervention, the relationship of IBM with the second-tier buyer became a focal relationship, because IBM developed the second-tier supplier and started buying from it directly (in this particular example, then, IBM

became a focal buyer for its second-tier supplier the moment that it started to buy from that supplier directly). In the supplier development, the first-tier supplier became an additional third-party supplier in the focal relationship.

In this example, all three parties have a direct relationship, as in a closed triad where the additional supplier has a lower level of supplier development capabilities than the focal buyer. The additional supplier benefits from the supplier development, but has no effect (a neutral effect) on the supplier development, as depicted in Figure 28.

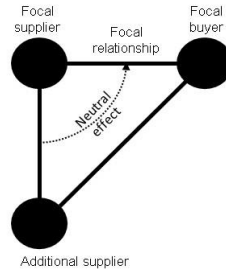


Figure 28. Closed triad with an additional supplier connected via the focal supplier (TT 20)

Summary: Additional supplier connected via the focal supplier

The study discussed above is the only example of an additional supplier connected via the focal supplier, and is summarized in Table 12.

Table 12. Involvement of an additional supplier connected via the focal supplier

Triad type	Reference	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 20	Handfield et al. (2000)	Benefits from the supplier development without direct involvement	Neutral	Focal buyer

In triad type 20, the supplier development triad changes from an initial state where IBM is a third party to the relationship of the first-tier and the second-tier supplier. After IBM’s intervention, the first-tier supplier becomes a third party and IBM becomes a focal buyer. In this later triad, the additional supplier connected via the focal supplier benefits from the supplier development without direct involvement.

The triads with additional supplier connected via the focal supplier that are not presented in the literature (triads 2, 8, and 14) are all discussed in the conceptual model (Section 2.4). These are cases in which an additional supplier does not engage in a direct relationship with a focal buyer. For these triad types to occur, the additional supplier must affect the supplier development via the focal supplier, by sharing information and its experiences or meeting with the focal supplier eventually. Nevertheless, to the best of our knowledge, there are no discussions in the literature of such cases, with the exception of a triad of type 20 where the focal buyer also has a direct relationship with the additional supplier.

Involvement of an additional supplier connected via the focal buyer

Triad type 17. Khan and Nicholson (2014) present a focal buyer that coordinates the linkage of suppliers in different countries, allowing technological capabilities to be transferred from one

supplier to the other. Through on-the-job training and technical visits to a foreign supplier, the additional supplier facilitates technological capability building that would not occur without the linkage made by the focal buyer (Khan and Nicholson, 2014). The study discusses that, in a first step, the focal buyer judges the reliability and trustworthiness of the focal supplier, so that it can receive sensitive information; then, the focal buyer coordinates the knowledge transfer from an additional supplier with superior technological capabilities from another country (ibid.). The authors also comment that, since the focal supplier and the additional supplier offer similar products, the additional supplier may be reluctant to transfer knowledge to the focal supplier. However, the focal buyer offers a commercial agreement to ensure that, after the technology transfer to the focal supplier, it will not reduce its business with the additional supplier. The focal supplier and the additional supplier meet occasionally, but the interaction is discontinued once the capability transfer is finished.

In this semi-closed triad, the additional supplier has superiority in specific technological capabilities, and the transfer of these capabilities has a positive effect on the supplier development. Nevertheless, if the additional supplier does not share parts of its capabilities, as a strategy to secure its competitiveness and to prevent losing business to a potential competitor, the effects could be negative, as depicted in Figure 29.

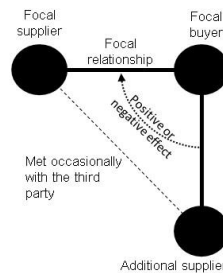


Figure 29. Semi-closed triad with an additional supplier connected via the focal buyer (TT 17)

Triad type 23. Dyer and Nobeoka (2000) discuss how supplier learning teams employed by Toyota promote lateral supplier–supplier knowledge transfer and learning. The activities developed in these teams include on-the-job training, joint problem solving, production improvement, and temporary personnel transfer (Dyer and Nobeoka, 2000; Liker and Choi, 2004). The individual participating suppliers testify to the benefits of such teams and to the positive effects of having an additional supplier as a teacher (Dyer and Nobeoka, 2000). While each supplier learning team may comprise dozens of suppliers, a closed triad captures the relationships of each individual additional supplier.

In this closed triad, the relationship between the focal buyer (Toyota) and the additional supplier (another team member) affects the supplier development in the focal relationship. The positive effect arises because the focal supplier more easily absorbs capabilities from the additional supplier which has more tier-specific knowledge than the focal buyer, as depicted in Figure 30.

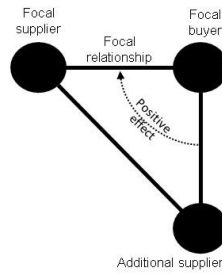


Figure 30. Closed triad with an additional supplier connected via the focal buyer (TT 23)

Summary: Additional supplier connected via the focal buyer

The examples in the literature on cases of an additional supplier connected via the focal buyer, presented above, are summarized in Table 13.

Table 13. Involvement of an additional supplier connected via the focal buyer

Triad type	Reference	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 17	Khan and Nicholson (2014)	Transferring its capabilities to the focal supplier	Positive or negative	Third party
TT 23	Dyer and Nobeoka (2000); Liker and Choi (2004)	Transferring its capabilities to the focal supplier	Positive	Third party

Only examples of triad types 17 and 23 with an additional supplier connected via the focal buyer are found in the literature, and in both cases the additional supplier transfers its capabilities to the focal supplier. Nevertheless, in type 17, the additional supplier–focal supplier connection is temporary, which does not allow for a direct relationship to develop between the focal and the additional supplier. Conversely, in type 23, a direct additional supplier–focal supplier relationship is established in the learning teams.

5.1.3 Analyzing triads with an ancillary organization

The triads with an ancillary organization are as presented in Table 14.

Table 14. Triads with an ancillary organization

Triad type	Connected via	Ancillary organization – III
Implicit triad	Focal supplier	3
	Focal buyer	6
Open triad	Focal supplier	9
	Focal buyer	12
Semi-closed triad	Focal supplier	15
	Focal buyer	18
Closed triad	Focal supplier	21
	Focal buyer	24

Involvement of an ancillary organization connected via the focal supplier

Triad type 9. Quayle (2000) states that to learn best practices and new technologies and to improve competitiveness, UK-based suppliers have transferred key employees temporarily to leading firms abroad. The study observes that, after 3 to 12 months abroad, these employees return to the UK and are expected to apply new technical capabilities and best practices acquired with the leading firm abroad that can improve the cost, quality, and delivery time of the supplier (ibid.). The UK-based suppliers, in a relationship with a UK focal buyer, exchange information about the leading firm abroad, which has no direct relationship with the UK focal buyer, which is characteristic of an open triad.

In this open triad, an ancillary organization (the leading firm abroad) is referred to in the focal relationship and has higher capabilities than the focal buyer in the UK. Thus, this ancillary organization affects supplier development positively, as depicted in Figure 31.

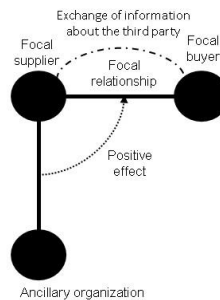


Figure 31. Open triad with an ancillary organization connected via the focal supplier (TT 9)

Triad type 15. Rodríguez et al. (2016) discuss that non-governmental organizations (NGOs) often bridge the resource and capability gaps between leading global firms and local suppliers in developing economies. The NGO’s knowledge of local idiosyncrasies allows a better interaction with local suppliers (ibid.). Leading firms often find it too risky or costly to develop local suppliers alone but reduce their risk and cost in supplier development with the support of an NGO in fundraising, training, and relationship strengthening (ibid.). Although NGOs can support the interaction, there is no legal instrument in place to ensure that the focal supplier engages exclusively or preferentially with the leading firm in question (ibid.). Thus, the NGO and the leading firm must gain the commitment of the focal supplier without the support of legal instruments, which has proved challenging (ibid.). The NGO and the leading firms meet occasionally to agree on the supplier

development support, but they do not have a direct relationship, which is characteristic of an open triad.

In this open triad, the ancillary organization (the NGO) has a higher level of knowledge about the local idiosyncrasies and interacts better with the local/focal supplier. For this reason, the ancillary organization has higher capabilities than the focal buyer (the leading firm) and positively affects supplier development. Nevertheless, if the focal supplier chooses to interrupt the commitment with the focal buyer, the effect is negative, with losses in the supplier development investment, as depicted in Figure 32.

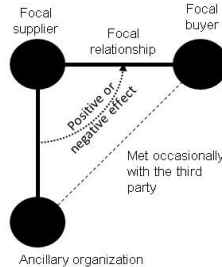


Figure 32. Semi-closed triad with an ancillary organization connected via the focal supplier (TT 15)

Triad type 21-a. In some countries, the government and its agencies have supported supplier development programs that aim to boost the development of local and regional industry (Arráiz et al., 2013; Arroyo-López et al., 2012; Liu et al., 2018). One such program was supported by the Mexican government and its national chamber of industry, the Ministry of the Economy, and a national financial institute (Arroyo-López et al., 2012). The program aimed to support the creation of long-term relationships and the transfer of new technology and knowledge from leading firms to suppliers (ibid.). All parties involved are interacting, and thus, have direct relationships, as in a closed triad.

In this closed triad, the Mexican governmental agency supported the creation of a long-term relationship between a focal supplier and a focal buyer, and thus affected the supplier development positively, as depicted in Figure 33.

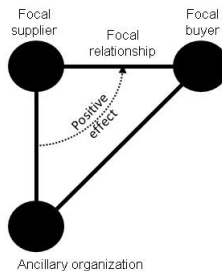


Figure 33. Closed triad with an ancillary organization connected via the focal supplier (TT 21-a)

Triad type 21-b. Arráiz et al. (2013) report that, in Chile, a national supplier development program aimed to strengthen the management practices of suppliers, providing subsidies and financial support to focal buyers to hire consulting firms. As a part of this program, the consulting firm designed and implemented a supplier development plan lasting up to three years, focusing on the capabilities that the focal buyer wished to develop (ibid.). The consulting firm, the focal buyer, and the focal supplier all have direct relationships to each other, which represents a closed triad.

In this closed triad, the ancillary organization (the consulting firm) designed and implemented a supplier development plan on behalf of the focal buyer, which affected the supplier development positively, as depicted in Figure 34.

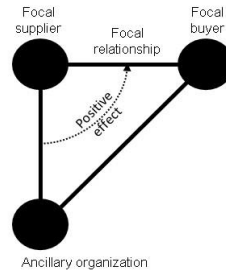


Figure 34. Closed triad with an ancillary organization connected via the focal supplier (TT 21-b)

Summary: Ancillary organization connected via the focal supplier

The above discussion shows how the literature has presented contributions of an ancillary organization connected via the focal supplier, as summarized in Table 15.

Table 15. Involvement of an ancillary organization connected via the focal supplier

Triad type	Reference	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 9	Quayle (2000)	Teaching new techniques and best practices	Positive	Third party
TT 15	Rodríguez et al. (2016)	Establishing contact between buyer and supplier	Positive or negative	Focal buyer
TT 21-a	Arroyo-López et al. (2012)	Supporting the creation of long-term relationships	Positive	Focal buyer
TT 21-b	Arráiz et al. (2013)	Designing and implementing a supplier development plan	Positive	Third party

An ancillary organization connected via the focal supplier is involved in teaching new techniques, establishing contact between a focal buyer and a focal supplier, supporting the creation of long-term relationships, and designing and implementing supplier development programs. The literature examples primarily discuss positive effects of ancillary organizations in supplier development, but triads of type 15 can also have a negative effect. Moreover, the ancillary organization has a lower level of capability in triads of types 15 and 21-a, where the ancillary organization establishes buyer–supplier contact and supports long-term relationship creation. When the ancillary organization teaches new techniques to a supplier or designs and implements a supplier development plan (as in types 9 and type 21-b), it has a higher level of capabilities than the focal buyer.

Involvement of an ancillary organization connected via the focal buyer

Triad type 6. Sancha et al. (2015) report that the Japanese national government implemented a law on promoting green purchasing that requires firms to buy from suppliers that meet specific environmental standards. Thus, a buying firm in this market must either find a supplier that already meets the standards or apply supplier development to help the supplier to achieve compliance with the standards. If the buyer applies supplier development, the Japanese government is an ancillary

organization that is not referred to but affects the supplier development, which is characteristic of an implicit triad.

In this implicit triad, the focal buyer must have a higher level of capabilities in the environmental standard to be able to transfer them to the supplier, affecting it positively. Nevertheless, Sancha et al. (2015) find that measures such as law enforcement do not necessarily lead to the adoption of supplier development with a focus on environmental standards. Consequently, the laws created by the ancillary organization (in this case, the Japanese national government) may have no effect (a neutral effect) on this type of supplier development, as depicted in Figure 35.

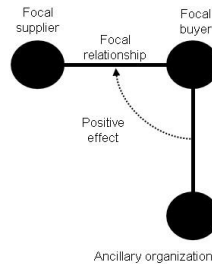


Figure 35. Implicit triad with an ancillary organization connected via the focal buyer (TT 6)

Triad type 12. Arráz et al. (2013) report that the Chilean national government, through its economic development agency, gathers and disseminates information to help international firms to identify local material suppliers. The authors also note that the government subsidizes supplier development activities conducted by an international firm, such as professional advice, training, technical assistance, and technology transfer (ibid.). The international firm exchanges information about the government and its support with the focal supplier, but has no direct relationship with the government, which is characteristic of an implicit triad.

In this implicit triad, the ancillary organization (the Chilean government, through its agency) provides information to the focal buyer that leads the firms to interact, and financially supports the supplier development activities. The ancillary organization has a lower level of supplier development capabilities than the focal buyer, but it affects the supplier development positively, as depicted in Figure 36.

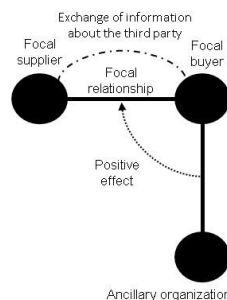


Figure 36. Open triad with an ancillary organization connected via the focal buyer (TT 12)

Triad type 18. Sako (2004) discusses that, in Japan, the local government of Aichi municipality conducted a consultancy of Toyota and a dozen of its key suppliers. The consultancy “resulted in heightened expectation that Toyota provide assistance to improve suppliers’ company-wide managerial capabilities” (Sako, 2004, p. 286). The study also observes that, after the consultancy exercise, Toyota started systematically educating suppliers, conducting lectures, seminars, and

training courses to develop the capabilities of the suppliers (Sako, 2004). During the consultancy exercise, the government and a focal supplier met occasionally, but they hold no direct relationship, which is characteristic of a semi-closed triad.

In this semi-closed triad, although the ancillary organization (the local government) eventually met a focal supplier during the consultancy, it directed its expectations to the focal buyer (Toyota). Thus, the ancillary organization affects the supplier development positively, as depicted in Figure 37.

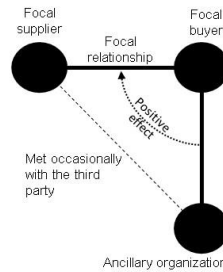


Figure 37. Semi-closed triad with an ancillary organization connected via the focal buyer (TT 18)

Triad type 24. Brix-Asala et al. (2020) report that, in some developing economies, multinational firms partner in supplier development with local NGOs, which have extensive knowledge of the local suppliers’ idiosyncrasies. The authors claim that these organizations help the focal buyer (a multinational firm) to fill capability gaps in its supply base through education, training, and on-site consultation (ibid.). Since all parties are interacting, the situation represents a closed triad.

In this closed triad, the focal buyer (a multinational firm) has less local knowledge than the ancillary organization (an NGO) that helps the focal buyer to build the focal supplier’s capabilities, affecting supplier development positively, as depicted in Figure 38.

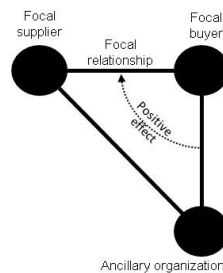


Figure 38. Closed triad with an ancillary organization connected via the focal buyer (TT 24)

Summary: Ancillary organization connected via the focal buyer

Table 16. Involvement of an ancillary organization connected via the focal buyer

Triad type	Reference	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 6	Sancha et al. (2015)	Requiring the focal buyer to relate with suppliers that meet sustainability standards	Positive or neutral	Focal buyer
TT 12	Arráiz et al. (2013)	Connecting the focal firms and supporting financially supplier development	Positive	Focal buyer
TT 18	Sako (2004)	Expecting the focal buyer to assist suppliers	Positive	Focal buyer
TT 24	Brix-Asala et al. (2020)	Providing education, training, and on-site consultation	Positive	Third party

Examples of all triad types with an ancillary organization connected via the focal buyer were found in the literature. Ancillary organizations require the focal buyer to relate with a supplier that meets sustainability standards, connect the focal firms and support supplier development financially, expect the focal buyer to assist suppliers, and provide education, training, and on-site consultation to suppliers. In three out of four examples, the level of capability of the third party is lower than that of the focal buyer. Only in triad type 24 example. does the ancillary organization have a higher level of capability than the focal buyer, which is transferred to the supplier. In the other examples (on types 6, 12, and 18), the contribution of the ancillary organization lies not in transfer of its capabilities but in formal requirements, financial support, expectations of the focal buyer, and connecting the focal firms. There are examples of almost all triad types with an ancillary organization in the literature. The exception is type 3. Triad type 21 has more than one literature example, and eight examples of triads with an ancillary organization are found in total. Table 17 summarizes how the involvement of third parties in lean supplier development is addressed in extant research.

Table 17. Involvement of third parties addressed in extant research

Third party	Connects via	Triad type	Effect on supplier development	Party with a higher level of capability
Additional buyer	Supplier	TT 1-a	Positive	Focal buyer
		TT 1-b	Negative	Third party
		TT 1-c	Positive	Focal buyer
		TT 7	Negative or positive	Third party
		TT 13	Negative	Focal buyer
		TT 19-a	Negative or positive	Third party
	TT 19-b	Negative or positive	Third party	
	Buyer	TT 4	Positive	Focal buyer
		TT 10	Positive	Third party
		TT 16-a	Positive	Third party
TT 16-b		Negative	Third party	
		TT 22	No example	
Additional supplier	Supplier	TT 2	No example	
		TT 8	No example	
		TT 14	No example	
		TT 20	Neutral	Focal buyer
	Buyer	TT 5	No example	
		TT 11	No example	
		TT 17	Negative or positive	Third party
TT 23		Positive	Third party	
Ancillary organization/ organization	Supplier	TT 3	No example	
		TT 9	Positive	Third party
		TT 15	Negative or positive	Focal buyer
		TT 21-a	Positive	Focal buyer
		TT 21-b	Positive	Third party
	Buyer	TT 6	Neutral	Focal buyer
		TT 12	Positive	Focal buyer
		TT 18	Positive	Focal buyer
		TT 24	Positive	Third party

5.2 Third-party involvement in lean supplier development

As in the previous section, the following discussion will present the involvement of third parties related to the triad types presented in the conceptual model in Section 2.4. The basis of the discussion is the lean supplier development initiative NSI, which involves one focal buyer (Kongsberg Maritime Subsea, or KMS), six of the buyer's strategic suppliers, and four other third parties. The discussion of each triad will analyze the effects of the third party on supplier development (positive, negative, or neutral) and which party has a higher level of capability (third party or KMS).

5.2.1 Third parties involved in NSI

Involvement of an additional buyer

Triad type 1. In NSI, one of the suppliers participating mentioned a previous experience of being developed by an additional buyer; for approximately two weeks, the additional buyer

intervened only in the production line related to the components or products that the additional buyer needed. Specialists from the additional buyer came to the focal supplier’s plant and changed the layout of the production line, implementing new performance measures and establishing quality indicators. During the intervention, the additional buyer did not take time to share knowledge with the focal supplier. After the intervention was completed, the additional buyer required cost reductions in line with the improvements achieved. The additional buyer and KMS did not have a direct relationship, which is characteristic of an implicit triad.

In this implicit triad, the additional buyer is connected via the focal supplier, but has an approach to supplier development that is inferior to the approach of KMS, because there is no transfer of knowledge of how to perform the intervention, along with cost reduction requirements that the focal supplier may be unable to meet.

In NSI, on the other hand, the supplier development involved lean knowledge transfer and had no immediate cost reduction requirements. Thus, the inferior approach of the additional buyer affected the supplier development positively, as depicted in Figure 39 and summarized in Table 18.

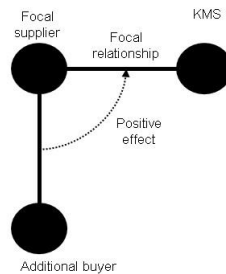


Figure 39. Implicit triad with an additional buyer connected via the focal supplier (TT 1)

Table 18. Involvement of an additional buyer in NSI

Triad type	Third party	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 1	Additional buyer	Applying a less beneficial approach to supplier development	Positive	KMS

Involvement of an additional supplier

In NSI, some triads of type 23 with additional supplier were identified.

Triad type 23. IN NSI, value stream mapping teams were organized. Value stream mapping is a lean tool employed to map the inter-organizational flows of products and to plan improvements in the value stream, differentiating between wasteful and necessary processes (Hines et al., 1998; Wee and Wu, 2009). In NSI, these teams were divided into subgroups of two to four suppliers, where suppliers map the value flow of information and material of a particular product, from order to delivery, in order to improve the value stream. In the process of mapping inter-firm value streams, the suppliers also have the opportunity to learn from each other how to improve the value stream.

In these teams, which can be seen as a small network, there are a couple of closed and similar triads, where one focal supplier learns with an additional supplier. In these closed triads, an additional supplier with superior capability related to parts of the value stream shares its knowledge with a focal

supplier. The additional supplier affects the supplier development positively, as in depicted in Figure 40 and Table 19.

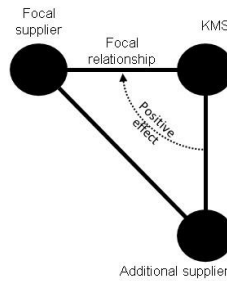


Figure 40. Closed triad with an additional supplier connected via KMS (TT 23)

Table 19. Involvement of an additional supplier in NSI

Triad type	Third party	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 23	Additional supplier	Transferring its capabilities to the supplier	Positive	Third party

Involvement of an ancillary organization

Triad type 15. In NSI, lean specialists from the research institute Sintef Raufoss Manufacturing (SRM) were allocated to provide consultancy for each supplier participating in the lean supplier development initiative. The SRM specialist aimed to improve the lean capabilities of the suppliers and carried out seven two-day visits to the suppliers. The SRM specialist also met occasionally with KMS, although their primary relationship was with the focal suppliers, as in a semi-closed triad.

In these semi-closed triad⁵, the research institute SRM, being a lean specialist, has a higher level of lean capabilities than KMS, which is starting its lean implementation. The lean capability transfer performed by SRM affects the supplier development positively, as depicted in Figure 41.

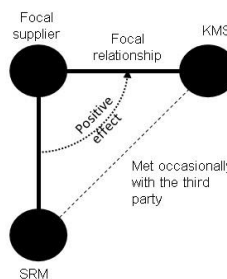


Figure 41. Semi-closed triad with SRM connected via the focal supplier (TT 15)

Triad type 24-a. In NSI, the policy instrument agency (Innovation Norway) provided inputs from previous experiences, financial support, and general guidelines to the initiative. They gave input

⁵ The NSI network comprised KMS, six suppliers, and several third parties. The NSI network can be decomposed into a set of triads. Each third party engaged in six triads, all of which had KMS as the focal buyer but with each of the six different suppliers as the focal supplier.

to the selection of suppliers and participated in the NSI board, interacting with all parties. Innovation Norway also supported the lean supplier development initiative with financial resources, which subsidized the hire of consultants.

The Innovation Norway relationship with the six suppliers in NSI and KMS can be seen as a small network, containing six closed and similar triads. In these closed triads, Innovation Norway represents an ancillary organization that supports the lean supplier development initiative with financial resources that subsidize the hire of consultants. The ancillary organization has a lower level of lean capabilities than KMS, but the support of the ancillary organization affects the supplier development positively, as depicted in Figure 42.

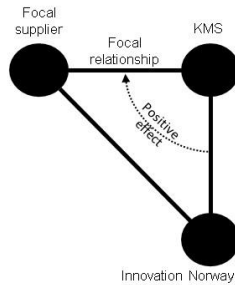


Figure 42. Closed triad with Innovation Norway connected via KMS (TT 24-a)

Triad type 24-b. In NSI, the cluster support organization –NCE Systems Engineering (NCE-SE)– was responsible for administrative support in the lean supplier development initiative. This ancillary organization was responsible for overall communication and information, administration of finances, and facilitation and organization of activities, in interaction with both KMS and the suppliers.

The NCE-SE relationship with the six suppliers in NSI with the suppliers and KMS can be seen as a small network, containing six closed triads. In these closed triads, NCE-SE has a lower level of lean capabilities than KMS, but through its administrative support affects the supplier development positively, as depicted in Figure 43.

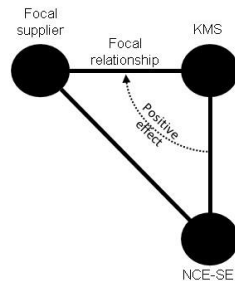


Figure 43. Closed triad with NCE-SE connected via KMS (TT 24-b)

Triad type 24-c. In NSI, Semcon Devotek provided teaching, training, and project management services for integrated product development with early supplier involvement to the focal buyer and the suppliers. The teaching and training was delivered in line with lean principles.

Semcon Devotek relationship with the six suppliers and KMS can be seen as a small network, containing six closed and similar triads. In these closed triads, Semcon Devotek has a higher level of capability in lean and its area of expertise, and affects the supplier development positively, as depicted in Figure 44.

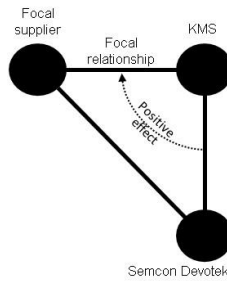


Figure 44. Closed triad with Semcon Devotek connected via KMS (TT 24-c)

Triad type 24-d. As discussed in triad type 15, SRM institute was providing consultancy in NSI. Additionally, the SRM institute conducted theoretical and practical lean training at its lean lab facility. The training, which involved senior and middle managers from KMS and the suppliers, aimed to establish a common understanding of basic lean principles, terminology, and practices.

The SRM relationship with the six suppliers and KMS in the lean training can be seen as a small network, containing six closed and similar triads. In these closed triads, SRM has higher levels of lean capabilities than KMS, and affects the supplier development positively, as depicted in Figure 45.

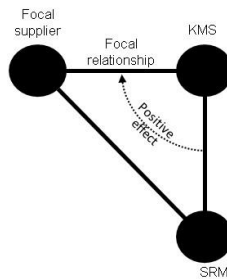


Figure 45. Closed triad with SRM connected via KMS (TT 24-d)

The NSI triads with an ancillary organization are discussed above; the involvement of an ancillary organization is summarized in Table 20.

In NSI, third parties with a higher level of lean capabilities replace or supplement the capability of KMS, in triads of types 15, 23, 24-c, and 24-d. In triads of types 15, 24-c, and 24-d, consultancy, teaching, and training allow transfer of lean capability from the ancillary organization to the focal supplier. In the type 15 triad, lateral learning allows transfer of capability from the additional supplier to the focal supplier.

Conversely, in triads of types 1, 24-a, and 24-b, the third parties have lower levels of lean capabilities than the focal buyer. In these triads, the third party may offer a less beneficial approach to supplier development (type 1), provide financial support and guidelines to the lean supplier development initiative (type 24-a), or support the initiative administratively (type 24-b). Finally, in all the NSI triads, the effect of the third party in supplier development is positive.

Table 20. Involvement of ancillary organizations in NSI

Triad type	Third party	How the third party is involved	Effect on supplier development	Party with a higher level of capability
TT 15	Research institute SRM	Providing consultancy through lean specialist	Positive	Third party
TT 24-a	Policy instrument agency (Innovation Norway)	Supporting financially and provides guidelines	Positive	KMS
TT 24-b	NCE Systems Engineering	Supporting administratively	Positive	KMS
TT 24-c	Semcon Devotek	Teaching and training within lean principles	Positive	Third party
TT 24-d	Research institute SRM	Conducting theoretical and practical lean training	Positive	Third party

5.2.2 How various types of third parties can contribute to lean supplier development

This section discusses how various types of third parties can contribute to lean supplier development. The supplier development case initiative (NSI) is analyzed, and, to enhance the analysis, the triads in NSI are compared with and related to similar triads exemplified in the literature. Table 21 summarizes the third parties that contribute to the lean supplier development in NSI and compares them with the corresponding examples in the literature.

Table 21. Third parties in NSI and the corresponding examples in the literature

Triad types	Third-party type	Relevant literature	Similarities	Differences
TT 1	Additional buyer	Dyer and Nobeoka (2000); Liker and Choi (2004)	Approach of the third party is less beneficial	—
TT 23	Additional supplier	Bortolotti et al. (2016); Dyer and Nobeoka (2000)	Supplier-supplier lateral knowledge transfer	In the literature, the activity has a longer-term involvement.
TT 15	Ancillary organization	Arráiz et al. (2013)	Presence of consultants that develop the supplier	In NSI, the consultants are involved primarily with the focal supplier. There is no lean capability involved in the literature.
TT 24-a		Arráiz et al. (2013); Arroyo-López et al. (2012); Quayle (2000)	Presence of government agencies that support the program	In the literature, the third party is involved primarily with the focal supplier.
TT 24-b		Marksberry (2012)	Provision of administrative support	In the literature, there is no third party involved. The focal buyer has the supporting role.
TT 24-c		Quayle (2000); Brix-Asala et al. (2020)	Ancillary organization has superior capabilities that are transferred to the focal supplier	In the literature, no lean capabilities are involved.
TT 24-d				

At the beginning of the NSI initiative, the focal buyer, KMS, was in the early stages of implementing its internal lean program. Thus, the empirical case represents the lean supplier development of a buying firm whose capabilities are still evolving, or a firm in transition to lean

(Soriano-Meier and Forrester, 2002). For this reason, the following discussion concerns the lean supplier development of a firm in transition to lean.

In NSI, there is only one triad type (type 1) with an additional buyer, which, owing to an approach to supplier development that is different from that of the focal buyer, affects the initiative. In this triad, the focal supplier evaluates the approach of the additional buyer and finds the approach of the focal buyer more beneficial, which affects the supplier development positively. This NSI triad is comparable to the examples in the literature of triad type 1 (Dyer and Nobeoka, 2000; Liker and Choi, 2004).⁶

In triad type 23 in NSI, an additional supplier is involved in lateral supplier–supplier learning in value stream mapping teams that allow capability transfer from the additional supplier to the focal supplier. Similarly, the literature on triad type 23 presents supplier learning teams established by Toyota that also allow lateral supplier–supplier learning (Bortolotti et al., 2016; Dyer and Nobeoka, 2000). Nevertheless, the value stream mapping teams in NSI were temporary in character, lasting only while the lean supplier development initiative was active (for about four years), whereas supplier learning teams in Toyota are more permanent in character.

In NSI, there are more types of triads with an ancillary organization than other types, which shows their relevance to the lean supplier development of firms in transition to lean. In triad type 15, the research institute SRM engages with the focal supplier, sending a lean specialist to develop the focal supplier. Similarly, the literature on triad type 21 concerns a buying firm that hires a consulting firm to act on its behalf to develop the focal supplier (Arráiz et al., 2013). The difference between the two situations is that, in NSI, the consultants are focused on teaching lean capabilities, whereas in the literature, there is no information on which types of capabilities are developed.

In triad type 24-a in NSI, Innovation Norway provides financial support and general guidelines to the lean supplier development initiative. Similarly, the literature describes how government agencies in Chile (Arráiz et al., 2013), Mexico (Arroyo-López et al., 2012), and the UK (Quayle, 2000) have supported supplier development programs. The ancillary organization (the government agencies) are involved primarily with the focal supplier (Arráiz et al., 2013; Arroyo-López et al., 2012), which represents a triad of type 21. In NSI, the ancillary organization, Innovation Norway, interacts with both the focal buyer and the focal supplier, and thus represents a triad of type 24.

In triad type 24-b in NSI, NCE Systems Engineering supports the lean supplier development initiative through administration of finances, and facilitation and organization of activities. There are few examples in the literature where a third party is involved in supplier development in this manner, such as the example from Marksberry (2012), who observed a focal buyer providing similar administrative support to a lean supplier development initiative.

In triad type 24-c in NSI, Semcon Devotek, is an ancillary organization that provides teaching and training in integrated product development with early supplier involvement, in line with lean principles. This third party has superior capabilities in these areas that benefit the focal buyer and the suppliers. As for triad type 24-d in NSI, the research institute SRM also has superior lean capabilities, conducting theoretical and practical training at the lean lab facility.

⁶ Since there is not enough discussion in the literature about the transfer of lean capabilities in supplier development initiatives specifically, the discussion in Section 6.1 of higher levels of capabilities addresses two dimensions of the supplier development capability: capability to perform supplier development (or execution capability, following Talluri et al., 2010) and specific capabilities that are to be transferred to the focal supplier. In the empirical case analysis, however, the discussion refers exclusively to different levels of *lean* capabilities.

In the literature, there are instances of all types of third parties transferring capabilities to suppliers. First, there are triads with additional suppliers (types 17 and 23). Second, there are triads with additional buyers (types 1, 7, 10, 16, and 19). Third, two examples in the literature involve an ancillary organization with superior capabilities to those of the focal buyer, which are transferred to a supplier (types 9 and 24). Nevertheless, these examples do not involve lean capabilities, whereas in the empirical case the triads always deal with superior lean capabilities.

In NSI, the triads discussed point to the important role of third parties, in particular ancillary organizations, in transferring lean capabilities which, at the start of the initiative, were not mature, but emerging in the focal firm.

Thus, there are triads in the literature that are similar to all the third parties involved in NSI. Despite the many similarities, there are also differences between the triads in the literature and the corresponding NSI triads, as shown in Table 21. For example, regarding the involvement of an additional supplier, the literature example on triad type 23 indicates a more long-term focus.

As for triads of types 15 and 24-a in NSI, with an ancillary organization, the involvement of the third party is primarily with the focal supplier, whereas in the literature, the third party is also involved with the focal buyer. As for triad type 24-b in NSI, the ancillary organization supports the supplier development administratively, a type of third party support that was not found in the literature (only a focal buyer is found in Marksberry, 2012)

The triads of types 15, 24-c, and 24-d in NSI have an ancillary organization with superior lean capabilities supporting lean supplier development, which in the corresponding literature example involves types of capabilities other than lean capabilities. The literature has not yet discussed about lean capabilities being transferred in this way by third parties.

6 Conclusions

This chapter presents the conclusions of the thesis. The research questions are answered, and the implications for research and managerial practice are considered. The chapter ends with suggestions for future research.

6.1 Addressing the research questions

This thesis aims to explore the involvement of third parties in lean supplier development in terms of the following two research questions:

RQ1. How is the involvement of third parties in lean supplier development addressed in extant research?

RQ2. How can various types of third parties contribute to lean supplier development?

To answer RQ1, various aspects of how third parties are involved in lean supplier development were identified and discussed, including the level of analysis (from the dyadic to the network level), the type of parties involved and how they are involved, effects on lean supplier development, characteristics, and key elements. To answer RQ2, the involvement of various types of third parties was explored empirically in a lean supplier development case initiative (NSI).

To answer these research questions, a conceptual model was developed based on the concept of triads and taking into account third-party involvement and relationship connectedness, as shown in Figure 46.

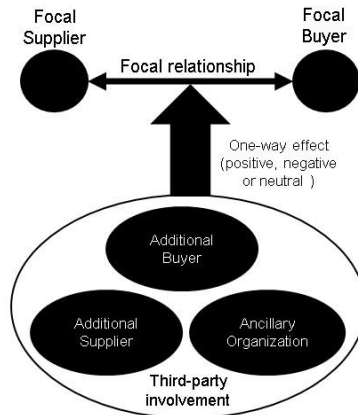


Figure 46. The conceptual model

The main features of the model are as follows:

- It accounts for various types of third parties: additional buyers, additional suppliers, and ancillary organizations.
- It accounts for the third party's one-way effect on supplier development, which can be neutral, positive, or negative.
- It considers how the third party is connected to the focal relationship via the focal buyer or supplier.

6.1.1 Addressing research question 1

The conceptual model presented in Section 2.4 was used to discuss and analyze the literature to determine how the involvement of third parties in lean supplier development has been addressed in extant research. Insights from the literature reviews (Papers 1 and 2) were added to address various aspects of how third parties are involved in lean supplier development.

From dyadic to network level on lean supplier development

Approaches to the involvement of third parties vary according to the research level of analysis (dyadic or network). Supplier development studies adopting a dyadic level of analysis accord greater centrality to the “supply chain” and “performance” themes, as shown in Paper 1. The “performance” theme in supplier development, which is important for studies using the dyadic level and studies using the network level, has been addressed more centrally in papers with a dyadic orientation. This preference may be due to greater confidence on the part of researchers in measuring the effects of the buyer’s efforts when assuming away effects to and from the network context of the dyad. In contrast, the “knowledge transfer” and “capability development” themes are more prevalent in research employing a network level of analysis, which may indicate that ensuring that capabilities are developed is more central when more parties than the focal ones are involved. This preference may also reflect the fact that networks offer more possibilities for knowledge sharing and that knowledge sharing in networks is more complex and critical.

The network level is also addressed in lean supply studies, albeit in fewer discussions than those that address the dyadic level, as shown in Paper 2. Most of the discussion of these studies has focused on the dyadic level, and the network setting has received limited research attention. In the key elements of lean supply, the network level has mainly been discussed in relation to value chain integration, supplier base reduction, and supplier development. For supplier development, the involvement of third parties is present (for example, in the discussions of the involvement of an additional supplier supporting lateral supplier–supplier learning), but third-party involvement in lean supply has not been addressed as a matter in its own right.

In lean supply studies, the focus has been on supply chains and, thus, on serially connected relationships and supplier–supplier interactions at the same tier. Large networks with unitary relationships among the different suppliers and supplier–other customer relationships have seldom been considered. Consequently, the extant research lacks a more comprehensive network perspective, which includes the involvement of third parties more centrally.

The different types of third parties involved in lean supplier development

Third parties can be involved in lean supplier development in ways that resemble either the focal buyer’s indirect supplier development (offering incentives for or enforcing supplier development) or the direct supplier development (in activities for capability building, education, and investment). Consequently, third-party involvement can resemble indirect supplier development, that is, third party encouragement. Third-party involvement can also resemble direct supplier development, that is, third-party engagement (third-party encouragement and engagement are both discussed in Paper 1). Third parties may interact mainly with the focal buyer, the focal supplier, or both parties. For this reason, a third party can connect to the focal relationship (i.e., interact) via either the focal buyer or the focal supplier.

An additional buyer connected via the focal supplier contributes either by transferring its capabilities to the supplier on its own or by cooperating with the focal buyer, affecting the focal relationship positively, as shown in Figure 47. Consequently, in developing suppliers, the focal buyer

can work with or rely on an additional buyer, which shows that the focal buyer is not always the one transferring capabilities to the suppliers and, in some cases, is not alone in transferring capabilities.

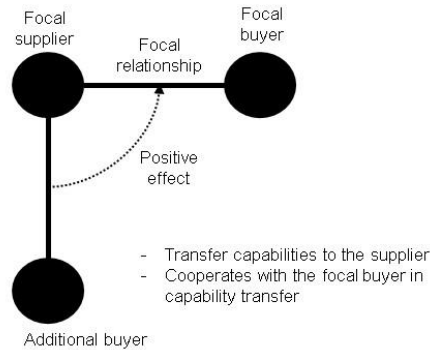


Figure 47. Effect and contributions of an additional buyer connected via the focal supplier

Moreover, when an additional buyer is connected via the focal buyer, it either encourages its supplier to spread capabilities to the second-tier supplier or diffuses the capabilities to the second-tier supplier. The focal buyer supports the spread of capabilities in lower relationship tiers on behalf of the additional buyer on an upper relationship tier. In such cases, an upper-tier buyer wishes to diffuse important capabilities to a lower-tier supplier, and a focal supplier helps to bridge the capability transfer to these suppliers, affecting the focal relationship positively, as in Figure 48.

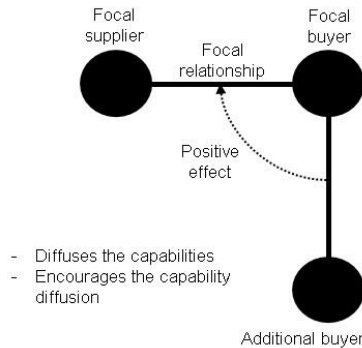


Figure 48. Effect and contributions of an additional buyer connected via the focal buyer

Additional suppliers transfer their capabilities to the focal supplier on behalf of the focal buyer. As required by the focal buyer, the additional supplier can assist in developing suppliers' capabilities in other countries, affecting the focal relationship positively, as in Figure 49.

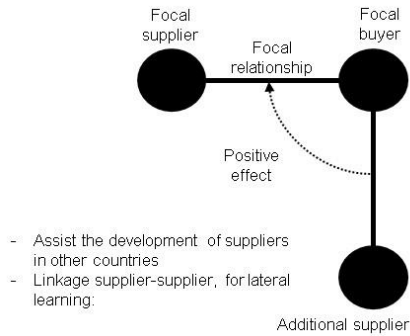


Figure 49. Effect and contributions of an additional supplier connected via the focal buyer

An additional supplier can also assist the focal buyer in developing the focal supplier in supplier-supplier lateral learning activities (e.g., the supplier learning teams organized by Toyota). In such cases, the focal buyer, knowing of an additional supplier with the capabilities that are needed, coordinates the linkage between the focal and additional supplier, affecting the focal relationship positively, as in Figure 49. The linkage can take the form of a temporary endeavor to transfer a specific capability, or it can be structured as an ongoing activity, as in the supplier learning teams.

When ancillary organizations are connected via the focal supplier, they are teaching new techniques and best practices to the focal supplier, establishing business contact between the focal buyer and the focal supplier, supporting the creation of long-term relationships, or designing and implementing a supplier development plan, as in Figure 50.

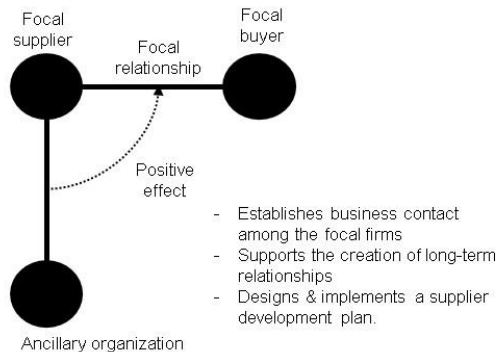


Figure 50. Effect and contributions of an ancillary organization connected via the focal supplier

When ancillary organizations are connected via the focal buyer, they connect the focal firms, support supplier development financially, and provide training and on-site consultation. They are also involved indirectly (i.e., third-party encouragement), requiring the focal buyer to relate with suppliers that meet specific rules or standards and expecting the focal buyer to assist suppliers or provide education. Thus, ancillary organizations connect, supplement, or complement focal firms' capabilities in many ways, affecting the focal relationship positively (Figure 51).

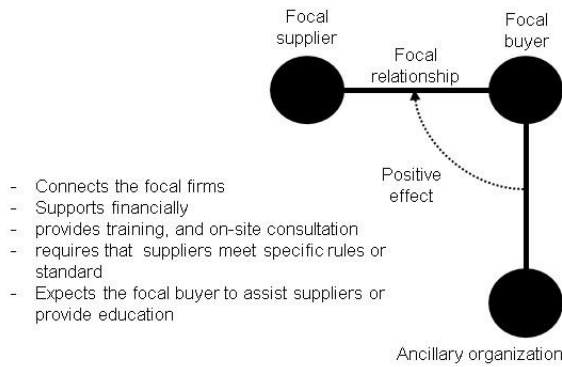


Figure 51. Effect and contributions of an ancillary organization connected via the focal buyer

Third-party effects on lean supplier development

Many contributions of third parties have an effect that is exclusively positive, as seen above. Nevertheless, the third-party effects on lean supplier development can also be neutral, as when a third party implements activities to spread capabilities in the supply chain but with no significant results on supplier development. However, when two buying firms are investing cooperatively in a focal supplier, the effects can also be negative, resulting in a reduced level of individual investment.

In some cases, third parties can have effects that are either positive or negative, depending on the interests of and trust among the parties. Considering that the focal buyer expects a positive effect from the third-party involvement, the focal buyer must, in some cases, (a) relinquish control to the third party, who needs to take care of the focal buyer’s interests above its interests, (b) trust in the focal supplier without its formal commitment, or (c) trust in a potential competitor of the focal supplier to act as a third party.

Characteristics and key elements of the involvement of third parties

To achieve lean supplier development, deep supplier relationships and direct and advanced supplier development and relationship management are necessary. Thus, firms gain inspiration from lean supplier development in mature lean firms, especially Toyota, which has designed activities for explicit and tacit knowledge sharing on lean and employed network development stages.

Lean supplier development endeavors carried out by mature lean firms aim to build the lean capability of suppliers. The lean supplier development initiatives represent a focal relationship that involves all three layers of the substance of a business relationship: activity links, resource ties, and actor bonds. These relationship layers are perceived in closer relationships in lean supplier development, leading to several actor bonds between the focal firms, such as when employees are transferred among the focal firms. Significant resources are also involved in lean supplier development, especially for lean training, sharing best practices, and capability building. Additionally, lean supplier development takes place in an advanced activity structure under the umbrella of the supplier associations.

6.1.2 Addressing research question 2

To answer RQ2, “How can various types of third parties contribute to lean supplier development?”, an empirical case of lean supplier development involving a buyer in transition to lean was analyzed and discussed using the conceptual model presented in Section 2.4. Insights from the

supplier development literature review and the empirical study (Papers 1 and 3) were added to address various third-party contributions to lean supplier development.

How the additional buyer contributes

An additional buyer connected via the focal supplier that has a less beneficial approach contributes to lean supplier development. For example, a less beneficial approach based on an intervention without knowledge transfer but with cost reduction requirements puts pressure on the focal supplier to improve effectiveness immediately. Meanwhile, lean supplier development includes lean knowledge transfer and does not normally have immediate cost reduction requirements. Thus, when comparing the approaches of the additional buyer and the focal buyer, the perception of the focal supplier is that the additional buyer's approach is inferior, which has a positive effect on the engagement of the focal supplier in the lean supplier development approach of the focal buyer, as shown in Figure 52.

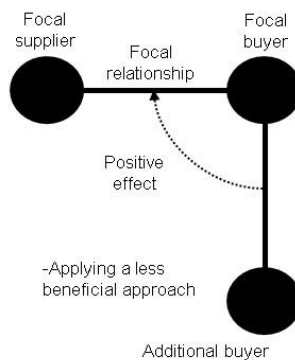


Figure 52. Effect and contribution of an additional buyer to lean supplier development

In such a case, the focal supplier's experience of being developed in an inferior way by an additional buyer can affect lean supplier development. The supplier can identify the advantages of being developed within lean principles compared to other types of supplier development that are not in line with lean principles, resulting in a positive attitude and increased engagement in lean supplier development.

How the additional supplier contributes

An additional supplier contributes to activities involving supplier-supplier lateral learning (e.g., extended value stream mapping teams) by transferring its capabilities to another supplier. In such a case, the additional supplier has superior capabilities related to processes or parts of the value stream and shares its knowledge with the focal supplier, affecting supplier development positively, as shown in Figure 53.

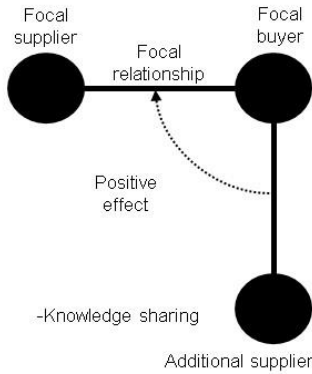


Figure 53. Effect and contribution of an additional supplier to lean supplier development

In lean supplier development, the contribution of an additional supplier is key for supplier–supplier lateral knowledge transfer of tacit lean knowledge, which leads to strong network ties. Nevertheless, achieving such strong network ties among suppliers requires that supplier–supplier team activities are ongoing and organized systematically by the focal firm, as in mature lean firms. Since they allow the effective spread of lean tacit knowledge, supplier–supplier team activities are also important for the initiatives of buyers in the transition to lean. In most cases, however, such buyers initially direct the available resources to their internal lean development. Thus, the availability of resources to invest in other systematic activities is reduced, which can hinder the involvement of additional suppliers in those buyers’ initiatives. Nevertheless, as discussed below, ancillary organizations can support the buyer in the transition to lean in many ways, which can liberate resources for, among other projects, the organization of supplier–supplier team activities.

How the ancillary organizations contribute

Ancillary organizations provide important resources for lean supplier development. Their engagement in lean supplier development can be direct, providing capital, administrative, or planning support, or indirect, encouraging lean supplier development by connecting the focal parties, supporting the relationships, and providing inputs from previous experiences and guidelines to the initiatives, as shown in Figure 54.

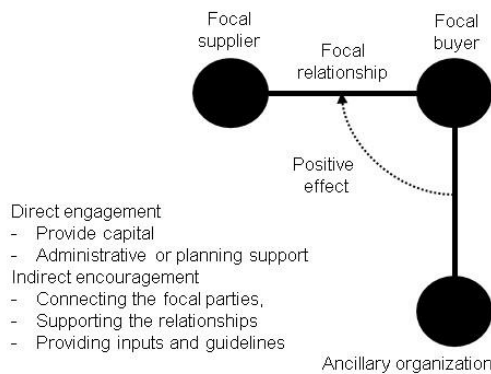


Figure 54. Effect and contributions of an ancillary organization in lean supplier development

Ancillary organizations with high levels of lean capabilities play a key role in lean capability transfer, helping buyers in transition to lean with their own internal lean development and with the development of lean suppliers. Ancillary organizations can provide teaching and training in accordance with lean principles and conduct theoretical and practical lean training and consultancy through lean specialists, as shown in Figure 55.

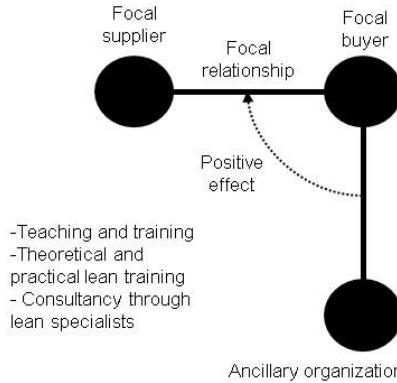


Figure 55. Effect and contributions of an ancillary organization with high levels of lean capabilities

The participation of ancillary organizations that have reached a high level of lean capabilities is key to the success of the lean supplier development initiative of buyers in the transition to lean.

6.2 Implications for research

6.2.1 Implications for research on supplier development considering lean and capabilities

From the dyadic to the network level of lean supplier development

Responding to calls to expand the understanding of supplier development in a network context (Aune et al., 2013) and the complexities of the lean supplier development approach (Marksberry, 2012), this thesis contributes to research that applies a network level of analysis to lean supplier development. The literature has focused chiefly on dyadic relationships (Aune et al., 2013; Friedl and Wagner, 2016) and focal buyer initiatives (Ahmed and Hendry, 2012; Nagati and Rebolledo, 2013), and this thesis is the first to explore third-party involvement in lean supplier development explicitly and systematically. Previous studies have emphasized that focal firms are not the only two important parties in supplier development initiatives with more ambitious capability development aims. Such initiatives are linked to the development of local industry (Brix-Asala et al., 2020; Esteves and Barclay, 2011; Rodríguez et al., 2016) and environmental sustainability capabilities (Liu et al., 2018; Sancha et al., 2015). Accordingly, this thesis has presented the importance of third parties in supplier development that aims to develop lean capabilities, which involves transferring tacit and difficult-to-codify lean knowledge to the network of suppliers. It has also explored an even more ambitious supplier development aim: the simultaneous development of lean capabilities in both the focal firm and its suppliers.

Different types of third parties involved in lean supplier development

Previous research has touched upon the involvement of an additional buyer that applies a less beneficial approach to supplier development than lean supplier development initiatives (e.g., Dyer and Nobeoka, 2000; Liker and Choi, 2004). In such cases, the approach of the additional buyer is compared with the lean supplier development approach and considered less efficient, which has a positive effect, leading to greater engagement of the focal supplier in lean supplier development. A similar effect was observed in the empirical material of this thesis.

Additional suppliers are of fundamental importance in lean supplier development, and their involvement is key to the achievement of strong network ties that allow for multilateral (i.e., supplier–buyer and supplier–supplier) transfer of tacit knowledge (Dyer and Nobeoka, 2000). Studies have explored supplier–supplier team activities in the context of Toyota and other large Japanese automakers (e.g., Dyer and Hatch, 2004; Liker and Choi, 2004; Sako, 2004; Suh, 2017). However, this study is the first to discuss how a buyer in transition to lean can, at the same time, develop lean internally and support supplier–supplier team activities.

The literature has also discussed ancillary organizations as consultants, trade organizations, NGOs, and other organizations with high capability levels in areas other than lean that are developing suppliers (Arráiz et al., 2013; Brix-Asala et al., 2020; Quayle, 2000). Nevertheless, apart from some discussion of the involvement of the Japanese government in the early days of the Toyota supply association (Fujimoto, 1999; Sako, 2004), previous studies have not considered the involvement of ancillary organizations in lean supplier development. This thesis addresses this gap by considering the involvement of different ancillary organizations that are transferring lean capabilities to suppliers on behalf of buyers in transition to lean who do not have mature capabilities that could be transferred to the suppliers.

Effects on lean supplier development

Previous research has focused on lean supplier development, predominantly from a dyadic point of view, focusing on a buyer and supplier (e.g., Bicheno and Holweg, 2016; Lamming, 1993; Liker and Choi, 2004; MacDuffie and Helper, 1997; Myerson, 2009). By extension, the role of other parties in developing suppliers has received little attention. Thus, this thesis has investigated the effects—positive, negative, or neutral (Ritter, 2000)—of a possible third-party relationship on the focal relationship in lean supplier development. The study has highlighted the importance of the third party and the prevalence of these effects in the literature. An important contribution of this study is its systematic, step-by-step process and mapping of the current literature in light of the effects a third party has on lean supplier development.

There are many instances in which third parties positively impact the focal relationship; for example, when an additional buyer transfers capabilities to suppliers (Aune et al., 2013), encourages the spread of capabilities, or diffuses capabilities to a second or lower relationship tier (Hines, 1994; Hines and Rich, 1998; Sako, 2004). Another example is when an additional supplier transfers its capabilities to the focal supplier (Dyer and Nobeoka, 2000; Liker and Choi, 2004), positively affecting supplier development. Furthermore, ancillary organizations exert positive effects by teaching new techniques and best practices to suppliers (Quayle, 2000), as they often provide education, training, and on-site consultation to suppliers (Brix-Asala et al., 2020). Moreover, ancillary organizations support the creation of long-term relationships (Arroyo-López et al., 2012), and offer financial support to supplier development (Arráiz et al., 2013).

There are some instances in which third parties do not have a significant impact, making this impact on the focal relationship neutral. One example is when an ancillary organization tries to

implement regulations, but the desired effect is not sustained (Sancha et al., 2015). Another type of neutral effect is when an upper-tier buyer intervenes in a lower-tier supplier's development, and the direct first-tier supplier (in relation to the upper-tier buyer) becomes a third party that has no effect on supplier development (Handfield et al., 2000).

There are also instances in which third parties negatively impact the focal relationship. Negative effects occur, for example, when an additional buyer adopts a poor approach to supplier development, which can interrupt the interaction (Dyer and Nobeoka, 2000). Such effects are also found when, due to resource limitations and unsuccessful establishment of supplier associations, an additional buyer negatively affects supplier development (Hines and Rich, 1998).

Finally, this study also highlights instances where the impact on the focal relationship is initially positive but then turns negative. One such example is when the focal buyer needs to relinquish control over the development of the supplier to the third party (an additional buyer) for the supplier development to occur, creating a conflict of interest between the additional buyer and the focal buyer (Aune et al., 2013).

As defined by Ritter (2000), the effects of a third-party relationship can enable and enforce (positive effect) but can also lead to relationship interruption (negative effect). Similarly, this thesis has found many instances of a positive effect but also some instances of an unsatisfactory approach and limited resources invested in lean supplier development. In addition to exclusively positive or negative effects of a third party, this research has found shifts from positive toward negative effects in lean supplier development related to relational aspects such as trust and control (Aune et al., 2013), commitment (Rodriguez et al., 2016), and knowledge protection (Khan and Nicholson, 2014).

Characteristics and key elements

The characteristics of lean supplier development have mainly been investigated in mature lean firms on the basis that the application of lean towards suppliers comes in later stages of lean implementation (e.g., Hu et al., 2015; Knol et al., 2018; Marksberry, 2012). Therefore, the characteristics and key elements of lean supplier development initiatives by a buyer in transition to lean have not been investigated. Nevertheless, even the characteristics of lean supplier development conducted by a buyer in transition to lean are worth investigating since, as discussed in this thesis, such firms can successfully employ lean supplier development and improve their suppliers' lean capabilities and performance.

The supplier development literature has discussed primarily the involvement of third parties with higher levels of capabilities that complement the focal buyer's capabilities, either by adding to the depth of the capability (e.g., Quayle, 2000; Handfield et al., 2000; Karaer et al., 2019) or by adding to the scarce capacity of the buyer (e.g., Aune et al., 2013; Khan and Nicholson, 2014; Zhang et al., 2017). In discussions related to lean capabilities specifically, there has been less focus on the capabilities of third parties, as most of the literature has focused on the role of the focal buyer as the lean master responsible for lean capability development in suppliers (Ballé and Handler, 2012; Dyer and Nobeoka 2004; Hines, 1994). In current discussions, the lean master is a specialist who works for the focal buyer with a high level of lean capability, and this thesis discusses the possibility of the personnel working for third parties also assuming the lean master role.

6.2.2 Implications for third-party involvement: Industrial network and triads

The development of suppliers' lean capabilities, or lean supplier development, involves an array of activities and stages of development that may include actors other than a single buyer and supplier (i.e., a dyad) (e.g., Dyer and Nobeoka, 2000; Hines, 1994, 2016; Hoque, 2021; Kito et al., 2014; Marksberry, 2012; Powell and Coughlan, 2021; Sisson and Elshennawy, 2015). Thus, not only

the actors in the dyad but also third parties connected through relationships with either the buyer or the supplier can be essential in lean supplier development (see, e.g., Hines, 1994; Hines and Rich, 1998; Kito et al., 2014; Marksberry, 2012). However, much of the discussion of lean supplier development has focused on dyads (e.g., Bicheno and Holweg, 2016; Lamming, 1993; Liker and Choi, 2004; MacDuffie and Helper, 1997; Myerson, 2009), and the literature has not explored the issue of third-party involvement in lean supplier development explicitly or systematically. This thesis addresses this gap by presenting a detailed and novel view of lean supplier development, with an explicit and systematic exploration of third-party involvement in lean supplier development.

This thesis draws on the industrial network approach and its concepts of business relationships and third-party involvement in networks, captured by the concept of triads. Previous studies have discussed the concept of triads in the industrial network approach, and some of these studies have proposed classifications of triads (e.g., Blankenburg and Johanson, 1992; Havila, 1996). Other studies have applied existing triad classifications to create new frameworks (e.g., Ritter, 2000). This thesis has applied the triad classification proposed by Blankenburg and Johanson (1992) and systematically developed 24 supplier development triads where a third-party contributing to the supplier development is connected via the focal buyer or via the focal supplier. Thus, the triad framework of this thesis contributes to the conceptualization of triads in the industrial network approach (Dubois et al., 2023), expanding the current classification by presenting 24 triad types and applying them in the lean supplier development context.

Furthermore, this thesis has discussed its framework in relation to the supplier development literature and applied it to an empirical case involving a lean supplier development initiative. This novel application of the concept of triad within the industrial network approach has proved its utility by revealing that, even in lean supplier development, no relationship is an island (Håkansson and Snehota, 1989) and that firms have relationships that are related and influenced directly and indirectly by other parties (Ford et al., 2003). This application deepens understanding of the lean supplier development and management literature, which to date has focused on dyadic relationships.

Finally, it is worth noting that a core contribution of this thesis lies in its combination of lean supplier development with industrial network approach concepts and, more specifically, with the concept of triads. These concepts have been discussed on their own and are not new, but their combination is novel.

6.3 Managerial implications

6.3.1 Implications for focal buyers

This thesis has important implications for both managers of buyers in transition to lean and managers of mature lean buyers.

Managers should be aware that in transitioning to lean, their firms can engage in lean supplier development before internal lean development matures. For such an initiative to succeed, third parties with high levels of lean capability should support the focal buyer in building the supplier's lean capabilities. Managers should also consider how to choose suppliers and design the content, frequency, and sequence of an appropriate set of activities to fit the suppliers' context, as discussed in Paper 3.

Managers working for a buying firm that is in transition to lean should be aware that, for the success of supplier development initiatives, the participation of ancillary organizations can be crucial. Therefore, they should use their business network to ensure the presence of ancillary organizations in lean supplier development. Organizations to involve include, firstly, governmental agencies that invest in and support the initiative and, secondly, lean consultants who work for research institutes,

technology companies, or consulting firms. These consultants can act as ombudsmen for the lean program, providing basic lean teaching, on-the-job training, and coaching on more advanced lean principles.

Managers of mature lean firms should also consider the involvement of third parties as an aid to the development of lean suppliers since even without the need for high levels of lean capabilities of third parties; they can support lean supplier development efforts. The implication for managers in mature lean firms is that lean supplier development should not rely on internal resources alone; they should also seek third-party involvement. Nevertheless, both managers of mature lean buyers and managers of buyers in transition to lean should ensure that the involvement of a third party is aligned with their firms' aims of supplier development and the wider network context. Without that alignment, third-party involvement could have negative effects that the managers should avoid.

6.3.2 Implications for focal suppliers

A manager of a focal supplier could seek the firm's participation in lean supplier development initiatives with third parties since third-party involvement may bring about many possible positive effects. Managers of focal suppliers should also accept an invitation from a buyer in transition to lean that involves third parties in its initiatives, as they are likely to reap positive effects from their engagement. There is great potential for learning and improvements to performance and lean capabilities in initiatives that are well-designed with appropriate mixes of activities, suppliers, and capable and committed third parties, as discussed in Paper 3. Thus, before committing to the focal buyer, managers of focal suppliers should use the above parameters to assess whether an initiative is well-designed and includes capable and committed third parties.

Managers of focal suppliers should also be aware of the potential negative effects of involvement with an additional buyer who offers a less beneficial supplier development approach that is not well aligned with lean principles. In such conditions, managers may need to choose commitment exclusively with the buyer to promote a lean supplier development initiative.

6.3.3 Implications for third parties

As presented above, one of the features of the conceptual model is the third-party connection to the focal buyer or supplier. While the key implications for third parties could have been presented regarding third-party connections (i.e., via the focal buyer or focal supplier), the following discussion does not take this approach.

Third parties who are additional buyers

Managers working for an additional buyer should be aware of the potential positive effects of lean supplier development, either contributing to its superior capabilities or supporting the focal buyer's initiative. For this reason, and to reap the potential benefits of the partnership, managers of an additional buyer could seek a partnership with another buyer in lean supplier development. Managers should also be aware that these benefits are achieved when the buying firms share common aims in supplier development and their interests are in alignment. Thus, managers should avoid partnering with focal buyers with different supplier development aims whose interests do not align with the interests of the additional buyer.

Third parties who are additional suppliers

A manager of an additional supplier might regard it as challenging to offer help to a competitor on a lean supplier development initiative, which would hinder its involvement. Nevertheless, when the focal buyer considers the interests of the additional buyer as part of the supplier development, this

thesis has found only the benefits of that involvement, notably in terms of knowledge transfer and learning from other suppliers. Thus, the managers of an additional supplier may accept an invitation to contribute to developing another supplier after considering how potential competitive elements will impact and ensuring alignment with the focal buyer regarding the conditions for participation.

Third parties who are ancillary organizations

The main implication for managers in ancillary organizations relates to the awareness of how such organizations can contribute to lean supplier development. A manager of an ancillary organization without mature lean capabilities can contribute by creating formal regulations, providing financial support, expressing an expectation that the focal buyer will perform supplier development, and connecting the focal firms. The manager can also support the ancillary organization's investment in lean supplier development and offer administrative support. Since an ancillary organization can facilitate and speed up a focal supplier's process of acquiring lean capabilities, managers of ancillary organizations should be aware of and use that potential to support lean supplier development initiatives.

More specifically, leaders in governmental agencies can see the value of their involvement by linking the parties involved and/or by supporting lean supplier development administratively. Managers of ancillary organizations that possess high levels of lean capabilities, such as lean consultancy firms and technology companies, can see their involvement in lean supplier development as an interesting business opportunity, not least in support of the initiatives of a buyer in transition to lean.

6.4 Suggestions for further research

This thesis outlines how third parties can be and are involved in lean supplier development. By means of this contribution to the literature, it can inspire further studies on lean and supplier development in contexts where third-party involvement has not yet been explicitly explored. Although the research reported in this thesis has taken initial steps to consider third-party involvement in lean supplier development, much remains to be investigated. Here, five specific avenues for future studies are suggested to expand the understanding of this topic.

First, future research should focus on firms in transition to lean that are performing lean supplier development. Extant studies have mainly investigated the transfer of lean capabilities from already mature lean firms in favor of firms on their way to becoming lean. Future research should, therefore, focus on lean supplier development by buyers in transition to lean in contexts where lean suppliers are needed urgently. Such settings include competitive industry environments or business parks that cater to firms that have high technological complexity but have not yet matured their lean capabilities.

Second, there is little discussion in the literature, specifically on the transfer of lean capabilities in supplier development. Thus, one avenue for future research is to focus on the transfer of lean capabilities in supplier development, which may shed light on factors that are not explored in this thesis but are necessary for the success of lean supplier development. Future studies could focus on the scope of activities in lean supplier development (Hines and Rich, 1998; Sako, 2004), stages of network development (Dyer and Hach, 2004; Dyer and Nobeoka, 2000), and relational elements in particular settings (Bicheno and Holweg, 2016; Kobayashi, 2014; MacDuffie and Helper, 1997). Moreover, future longitudinal studies can bring insights into changes in lean supplier development processes (Marksberry, 2012) and connected evolutionary paths of lean maturity levels (Danese et al., 2017)

Third, given two shortcomings of the present research, namely its focus on a single buyer and its limited discussion of an additional buyer as a third party, future work should seek to include more buyers. Such an approach would be relevant, as more than one buyer is sometimes involved in developing a common supplier, for example, in local ecosystems or business parks. Further research could, therefore, use triads to address initiatives that involve more than one buyer with a common aim in lean supplier development, following the initiatives observed by Aune et al. (2013).

Fourth, given its conceptual model, this thesis has only addressed the one-way effect (Blankenburg and Johanson, 1992; Ritter, 2000) of the third party's relationships with the focal buyer-supplier relationship on supplier development. Consequently, the effects on the focal relationship are considered, but the effects on the relationships connected to the third party are not. Further research could extend the scope of this work, addressing two-way effects (Ritter, 2000; Vedel, 2016) by adding the counter-effect between the relationships considered here in terms of the one-way effect. Such research would clarify the effects of lean supplier development on third-party relationships and, as a consequence, the effects on the third party. Future research could also be extended to address network effects (Chakkol et al., 2014; Durach et al., 2020; Håkansson and Snehota, 1995) beyond the scope of a triad that can be present in lean supplier development initiatives, focusing, for example, on the involvement in lean supplier development of many suppliers concurrently.

Finally, taking as a starting point the study reported in this thesis, future research could consider a larger number of cases to uncover in greater depth how third parties are involved in lean supplier development. Such research could focus on the roles of the third party, the contextual factors that are in play, how a buyer or supplier can leverage a third party to develop its lean efforts, and the associated pitfalls. Closely related to these matters is the possibility that triad types with an additional supplier connected via the focal buyer are more common in practice than in this thesis. This possibility warrants future research, which would capture supplier development initiatives in lean supplier networks or supply chains where a focal buyer has many connected suppliers and how these suppliers' relationships may affect each other.

References

- Adler, N. J., & Harzing, A. W. (2009). When knowledge wins: Transcending the sense and nonsense of academic rankings. *Academy of Management Learning & Education*, 8(1), 72–95.
- Ahmed, M., & Hendry, L. (2012). Supplier development literature review and key future research areas. *International Journal of Engineering and Technology Innovation*, 2(4), 293–303.
- Anderson, J. C., Håkansson, H., & Johanson, J. (1994). Dyadic business relationships within a business network context. *Journal of Marketing*, 58, 1–15.
Annals of Business Administrative Science, 13(2), 77–90.
- Aoki, K., & Lennerfors, T. (2013). The new, improved keiretsu. *Harvard Business Review*, 91(9), 109–113.
- Aoki, K., & Wilhelm, M. (2017). The role of ambidexterity in managing buyer–supplier relationships: The Toyota case. *Organization Science*, 28(6), 1080–1097.
- Araujo, L., Gadde, L-E., & Dubois, A. (2016). Purchasing and supply management and the role of supplier interfaces. *IMP Journal*, 10, 2–24.
- Arráiz, I., Henríquez, F., & Stucchi, R. (2013). Supplier development programs and firm performance: Evidence from Chile. *Small Business Economics*, 41, 277–293.
- Arroyo-López, P., Holmen, E., & De Boer, L. (2012). How do supplier development programs affect suppliers? Insights for suppliers, buyers and governments from an empirical study in Mexico. *Business Process Management Journal*, 18, 680–707.
- Aune, T. B., Holmen, E., & Pedersen, A. C. (2013). Beyond dyadic supplier development efforts: The multiple roles of the network in bringing about supplier development. *IMP Journal*, 7(1), 91–105.
- Ballé, M., & Handlinger, P. (2012). Learning lean: Don't implement lean, become lean. *Reflections*, 12(1), 17–32
- Bicheno, J., & Holweg, M. (2016). *The Lean Toolbox: A Handbook for Lean Transformation*. Buckingham, U.K.: PICSIE Books.
- Blankenburg, D., & Johanson, J. (1992). Managing network connections in international business. *Scandinavia then International Business Review*, 1(1), 5–19.
- Bortolotti, T., Romano, P., Martínez-Jurado, P. J., & Moyano-Fuentes, J., (2016). Towards a theory for lean implementation in supply networks. *International Journal of Production Economics*, 175, 182–196.
- Brix-Asala, C., & Seuring, S. (2020). Bridging institutional voids via supplier development in base of the pyramid supply chains. *Production Planning and Control*, 31(11–12) 903–919.
- Bryman, A. (2016). *Social Research Methods*. Oxford, U.K.: Oxford University Press.
- Busse, C., Schleper, M. C., Niu, M., & Wagner, S. M. (2016). Supplier development for sustainability: Contextual barriers in global supply chains. *International Journal of Physical Distribution and Logistics Management*, 46, 442–468.
- Capaldo, A., (2007). Network structure and innovation: The leveraging of a dual network as a distinctive relational capability. *Strategic Management Journal*, 28(6), 585–608.
- Chadegani, A. A., Salehi, H., Yunus, M. M., Farhadi, H., Fooladi, M. M., Farhadi, M., & Ebrahim, N. A. (2013). A comparison between two main academic literature collections: Web of Science and Scopus databases. *Asian Social Sciences*, 9(5), 18–26.
- Chakkol, M., Johnson, M., Raja, J. & Raffoni, A. (2014). From goods to solutions: How does the content of an offering affect network configuration? *International Journal of Physical Distribution & Logistics Management*, 44, 132–154.
- Chiarini, A. & Brunetti, F. (2019), What really matters for a successful implementation of Lean production? *Production Planning & Control*, 30 (13), 1091-1101.

- Choi, T. Y., & Liker, J. K. (1995). Bringing Japanese continuous improvement approaches to US manufacturing: The roles of process orientation and communications. *Decision Sciences*, 26(5), 589–620.
- Choi, T. Y., & Wu, Z. (2009). Taking the leap from dyads to triads: Buyer–supplier relationships in supply networks. *Journal of Purchasing and Supply Management*, 15(4), 263–266.
- Danese, P., Molinaro, M., & Romano, P. (2018). Managing evolutionary paths in Sales and Operations Planning: key dimensions and sequences of implementation. *International Journal of Production Research*, 56(5), 2036–2053.
- Denyer, D. & Tranfield, D. (2009). Producing a systematic review, In D. A. Buchanan & A. Bryman (Eds.) *The SAGE handbook of organizational research methods* (pp. 671–689) Thousand Oaks, CA: SAGE Publications.
- Dolcemascolo, D. (2006). *Improving the extended value stream: Lean for the entire supply chain*. New York, NY: Productivity Press.
- Dubois, A., & Araujo, L. (2007). Case research in purchasing and supply management: Opportunities and challenges. *Journal of Purchasing & Supply Management*, 13, 170–181.
- Dubois, A., & Gadde, L. E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, 55, 553–560.
- Dubois, A., & Gadde, L. E. (2014). Systematic combining—A decade later. *Journal of Business Research*, 67(6), 1277–1284.
- Dubois, A., Hedvall, K. and Sundquist, V. (2023), No concept is an island: conceptualising (in) the industrial network approach. *Journal of Business & Industrial Marketing*, 38 (13), 211-219.
- Dubois, A., Håkansson, H., & Hjelmgren, D. (2011). Technical development in networks. The importance of third parties. *Sinergie Italian Journal of Management*, 58(02), 45–64.
- Durach, C. F., Wiengarten, F. & Choi, T. Y. (2020). Supplier–supplier cooptation and supply chain disruption: First-tier supplier resilience in the tetradic context. *International Journal of Operations & Production Management*, 40, 1041–1065.
- Dyer, J. H. (2000). *Collaborative advantage: Winning through extended enterprise supplier networks*. New York, NY: Oxford University Press.
- Dyer, J. H., & Hatch, N. W. (2004). Using supplier networks to learn faster. *MIT Sloan Management Review*, 45 (3), 57-64.
- Dyer, J. H., Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, 21(3), 345-367.
- Easton, G. (1995). *Case Research as a Methodology for Industrial Networks: A Realist Approach*. In: IMP 11th International Conference, 369–388
- Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management*, 39, (1), 118–128.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25–32.
- Esteves, A. M., & Barclay M. (2011). Enhancing the benefits of local content: Integrating social and economic impact assessment into procurement strategies. *Impact Assessment and Project Appraisal*, 29(3), 205–215.
- Flick, U. (2014). Challenges for qualitative inquiry as a global endeavor: Introduction to the special issue. *Qualitative Inquiry*, 20(9), 1059–1063.
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12, 219–245.
- Ford, D., Gadde, L. E., Håkansson, H., & Snehota, I. (2003). *Managing business relationships*, 2nd ed. Chichester, U.K.: Wiley.
- Ford, D., Gadde, L. E., Håkansson, H., & Snehota, I. (2011). *Managing business relationships*, 3rd ed. Chichester, U.K.: Wiley.

- Friedl, G., Wagner, S. M. (2016). Supplier development investments in a triadic setting. *IEEE Transactions on Engineering Management*, 63, 136–150.
- Fujimoto, T. (1999). *The evolution of a manufacturing system at Toyota*. New York, NY: Oxford University Press.
- Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, 20 (9), 1408–1416.
- Gadde, L.-E., Håkansson, H., & Persson, G. (2010). *Supply network strategies*, 2nd ed. Hoboken, NJ: John Wiley and Sons.
- Gadde, L. E., & Snehota, I. (2000). Making the most of supplier relationships. *Industrial Marketing Management*, 29(4), 305–316.
- Galt, J., & Dale, B. (1991). Supplier development: A British case study. *International Journal of Purchasing and Materials Management*, 27, 16–22.
- Håkansson, H., Ford, D., Gadde, L.-E., Snehota, I., & Waluszewski, A. (2009). *Business in networks*. Chichester, U.K.: John Wiley & Sons.
- Håkansson, H., & Gadde, L. E., (2019). *Network triads—The linkages between small and large worlds*. Paper presented at the 35th IMP Conference, Paris, France.
- Håkansson, H., & Snehota, I. (1989). No business is an island. *Scandinavia then Journal of Management*, 5(3), 187–200.
- Håkansson, H., & Snehota, I. (1995). *Developing relationships in business networks*. London, U.K.: Routledge.
- Håkansson, H., & Snehota, I. (Eds.). (2017). *No business is an island: Making sense of the interactive business world*. Bingley, U.K.: Emerald Publishing.
- Halldorsson, A., & Aastrup, J. (2003). Quality criteria for qualitative inquiries in logistics. *European Journal of Operational Research*, 144(2), 321–332.
- Handfield, R. B., Krause, D. R., Scannell, T. V., & Monczka, R. M. (2000). Avoid the pitfalls in supplier development. *MIT Sloan Management Review*, 41, (2), 37–37.
- Harris, C., Harris, R., & Streeter, C. (2011). *Lean supplier development: Establishing partnerships and true costs throughout the supply chain*. New York, NY: CRC Press.
- Hartley, J. L., Jones, G. E., (1997). Process oriented supplier development: Building the capability for change. *International Journal of Purchasing and Materials Management*, 33, 24–29.
- Havila, V. (1996). *International business-relationship triads—A study of the changing role of the intermediating actor*. Doctoral thesis, Uppsala University, Uppsala.
- Hines, P. (1994). Internationalization and localization of the Kyoryoku Kai: The spread of best practice supplier development. *The International Journal of Logistics Management*, 5, 67–72.
- Hines, P. (2016). Toyota Supplier System in Japan and the UK. In K. S. Pawar, H. Rogers, A. Potter, & M. Naim (Eds.) *Developments in logistics and supply chain management*. London: U.K.: Palgrave Macmillan.
- Hines, P., Holweg, M., & Rich, N. (2004). Learning to evolve: A review of contemporary lean thinking. *International Journal of Operations and Production Management*, 24, 994–1011.
- Hines, P., & Rich, N. (1998). Outsourcing competitive advantage: The use of supplier associations. *International Journal of Physical Distribution & Logistics Management*, 28(7), 524–546
- Hines, P., Rich, N., & Esain, A. (1998). Creating a lean supplier network: A distribution industry case. *European Journal of Purchasing & Supply Management*, 4(4), 235–246.
- Holma, A. M. (2009). *Adaptation in triadic business relationship settings: A study in corporate travel management*. Doctoral thesis, Hanken School of Economics, Helsinki.
- Holmen, E., Pedersen, A. C. (2000). *Avoiding triadic reductionism: Serial tetrads—A useful concept for studying connected relationships?* Paper presented at the 16th annual IMP conference, Bath, U.K.
- Hoque, I. (2021). Buyer-assisted lean intervention in supplier firms: A supplier development approach. *Journal of Manufacturing Technology Management*, 33(1), 146–168.

- Hu, Q., Mason, R., Williams, S. J., & Found, P. (2015). Lean implementation within SMEs: A literature review. *Journal of Manufacturing Technology Management*, 26(7), 980–1012.
- Iwao, S. & Kato, Y. (2019). Why can Toyota's keiretsu recover from earthquakes quickly? *Annals of Business Administrative Science*, 18(6), 251–262.
- Jasti, N. V. K., & Kodali, R. (2015). A critical review of lean supply chain management frameworks: Proposed framework. *Production Planning and Control*, 26, 1051–1068.
- Jones, D. T., & Womack, J. P. (2016). The evolution of lean thinking and practice. In T. H. Netland, & D. J. Powell (Eds.). *The Routledge companion to lean management* (pp. 3–8). New York, NY: Taylor and Francis.
- Karaer, Ö., Kraft, T., & Yalçın, P. (2020). Supplier development in a multi-tier supply chain. *IIE Transactions*, 52(4), 464–477.
- Ketokivi, M., & Choi, T. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management*, 32, 232–240.
- Khan, Z., & Nicholson, J. D. (2014). An investigation of the cross-border supplier development process: Problems and implications in an emerging economy. *International Business Review* 23, 1212–1222.
- Kito, T., Brintrup, A., New, S., & Reed-Tsochas, F. (2014). *The structure of the Toyota supply network: An empirical analysis*. Working Paper 3, Saïd Business School.
- Knol, W. H., Slomp, J., Schouteten, R. L., & Lauche, K. (2018). Implementing lean practices in manufacturing SMEs: Testing “critical success factors” using necessary condition analysis, *International Journal of Production Research*, 56(11), 3955–3973.
- Kobayashi, M. (2014). Relational view: Four prerequisites of competitive advantage. *Annals of Business Administrative Science*, 13(2), 77–90.
- Krause, D. R. (1997). Supplier development: Current practices and outcomes. *International Journal of Purchasing and Materials Management*, 33, 12–19.
- Krause, D. R., & Ellram, L. M. (1997). Critical elements of supplier development: The buying-firm perspective. *European Journal of Purchasing & Supply Management*, 3, 21–31.
- Krause, D. R., Handfield, R. B., & Scannell, T. V. (1998). An empirical investigation of supplier development: Reactive and strategic processes. *Journal of Operations Management*, 17, 39–58.
- Krause, D. R., & Scannell, T. V. (2002). Supplier development practices: Product-and service-based industry comparisons. *Journal of Supply Chain Management*, 38(1), 13–21.
- Krause, D. R., Scannell, T. V., & Calantone, R. J. (2000). A structural analysis of the effectiveness of buying firms' strategies to improve supplier performance. *Decision Science*, 31, 33–55.
- Laage-Hellman, J. (1989). *Technological development in industrial networks*. Doctoral thesis, Uppsala University, Department of Business Studies, Uppsala.
- Lamming, R. (1993). *Beyond partnership: Strategies for innovation and lean supply, manufacturing practitioner series*. New York, NY: Prentice Hall.
- Lascelles, D., & Dale, B. (1990). Examining the barriers to supplier development. *International Journal of Quality & Reliability Management*, 7(2), 46-56.
- Liker, J. K. (2004). *Toyota way: 14 management principles from the world's greatest manufacturer*. New York, NY: McGraw-Hill Education.
- Liker, J. K., & Choi, T. Y. (2004). Building deep supplier relationships. *Harvard Business Review*, 82, 104–113.
- Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage Publications
- Liu, L., Zhang, M., Hendry, L. C., Bu, M., & Wang, S. (2018). Supplier development practices for sustainability: A multi-stakeholder perspective. *Business Strategy and the Environment*, 27, 100–116.
- Lynch, P., & O'Toole, T. (2006). Involving external users and third parties in the new product development process (RIKON Group). *Irish Marketing Review*, 18(1/2), 29–37.

- MacDuffie, J. P., & Helper, S. (1997). Creating lean suppliers: Diffusing lean production through the supply chain. *California Management Review*, 39, 118–151.
- Marksberry, P. (2012). Investigating “the way” for Toyota suppliers. *Benchmarking: An International Journal*, 19(2), 277–298.
- Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & López-Cózar, E. D. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of Infometrics*, 12(4), 1160–1177.
- Martínez-Jurado, P. J., & Moyano-Fuentes, J. (2014). Lean management, supply chain management and sustainability: A literature review. *Journal of Cleaner Production*, 85, 134–150.
- Maxwell, J. A. (2012). *Qualitative research design: An interactive approach*. Los Angeles, CA: SAGE publications.
- Mero-Jaffe, I. (2011). “Is that what I said?” Interview transcript approval by participants: An aspect of ethics in qualitative research. *International Journal of Qualitative Methods*, 10(3), 231–247.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook*, 3rd ed. Thousand Oaks, CA: SAGE.
- Martínez-Jurado, P.J., & Moyano-Fuentes, J. (2014). Lean Management and Supply Chain Management: Interrelationships in the Aerospace Sector. In V. Modrák & P. Semančo (Eds.). *Handbook of research on design and management of lean production systems* (pp. 304-337). Hershey PA: IGI Global.
- Myerson, P. (2012). *Lean supply chain and logistics management*. New York: McGraw-Hill.
- Nagati, H., & Rebolledo, C. (2013). Supplier development efforts: The suppliers’ point of view. *Industrial Marketing Management*, 42, 180–188.
- Netland, T., & Powell, D. (2016). A lean world. In T. H. Netland & D. J. Powell (Eds.), *The Routledge companion to lean management* (pp. 465–473). New York, NY: Taylor and Francis.
- Nishiguchi, T. (1994). *Strategic industrial sourcing: The Japanese advantage*. Oxford, U.K.: University Press on Demand.
- Ohno, T. (1988). *Toyota Production System: Beyond large-scale production*. Boca Raton, FL: Productivity Press.
- Olsen, P. I. (2013). IMP theory in light of process-and system theories. *IMP Journal*, 7(3), 159–170.
- Polit, D. F., & Beck, C. T. (2010). Generalization in quantitative and qualitative research: Myths and strategies. *International Journal of Nursing Studies*, 47(11), 1451–1458.
- Post, C., Sarala, R., Gatrell, C., & Prescott, J. E. (2020). Advancing theory with review articles. *Journal of Management Studies*, 57, 351–376.
- Potter, A., & Wilhelm, M. (2020). Exploring supplier–supplier innovations within the Toyota supply network: A supply network perspective. *Journal of Operations Management*, 66, 797–819.
- Powell, D. J., & Coughlan, P. (2020). Rethinking lean supplier development as a learning system. *International Journal of Operations & Production Management*, 40(7/8), 921–943.
- Prajogo, D., Oke, A., & Olhager, J. (2016). Supply chain processes: Linking supply logistics integration, supply performance, lean processes and competitive performance. *International Journal of Operations & Production Management*, 36(2), 220–238.
- Putre, L. (2021). *Which automotive OEMs have the best supplier relations?* Retrieved from <https://www.industryweek.com/supply-chain/supplier-relationships/media-gallery/21165491/which-automotive-oems-have-the-best-supplier-relations>
- Quayle, M. (2000). Supplier development for UK small and medium-sized enterprises. *Journal of Applied Management Studies*, 9, 117–133.
- Ritter, T. (2000). A framework for analyzing interconnectedness of relationships. *Industrial Market Management*, 29, 317–326.
- Rodríguez, J., Thomsen, C., Arenas, D., & Pagell, M. (2016). NGOs’ initiatives to enhance social sustainability in the supply chain: Poverty alleviation through supplier development programs. *Journal of Supply Chain Management*, 52, 83–108.

- Rogers, K. W., Purdy, L., Safayeni, F., & Duimering, P. R. (2007). A supplier development program: Rational process or institutional image construction? *Journal of Operations Management*, 25, 556–572.
- Sako, M. (1996). Suppliers' associations in the Japanese automobile industry: Collective action for technology diffusion. *Cambridge Journal of Economics*, 20(6), 651–671.
- Sako, M. (2004). Supplier development at Honda, Nissan and Toyota: Comparative case studies of organizational capability enhancement. *Industrial and Corporate Change*, 13, 281–308.
- Sancha, C., Longoni, A., & Giménez, C. (2015). Sustainable supplier development practices: Drivers and enablers in a global context. *Journal of Purchasing and Supply Management*, 21, 95–102.
- Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, 25(4), 785–805.
- Shimokawa, K., & Fujimoto, T. (2009). *The birth of lean: Conversations with Taiichi Ohno. Eiji Toyoda, and other figures who shaped Toyota management*. Cambridge, MA: Lean Enterprise Institute.
- Shook, J., & Marchwinski, C. (2014). *Lean lexicon: A graphical glossary for lean thinkers*. Cambridge, MA: Lean Enterprise Institute.
- Sisson, J., & Elshennawy, A. (2015). Achieving success with lean. *International Journal of Lean Six Sigma*, 6(3), 263–280.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339.
- Soriano-Meier, H., & Forrester, P. L. (2002). A model for evaluating the degree of leanness of manufacturing firms. *Integrated Manufacturing Systems*, 13(2), 104–109.
- Sucky, E., & Durst, S. M. (2013). Supplier development: Current status of empirical research. *International Journal of Procurement Management*, 6, 92–127.
- Suh, Y. (2017). Knowledge network of Toyota: Creation, diffusion, and standardization of knowledge. *Annals of Business Administrative Science*, 16, 91–102.
- Talluri, S., Narasimhan, R., & Chung, W., (2010). Manufacturer cooperation in supplier development under risk. *European Journal of Operations Research*, 207, 165–173.
- Torraco, R. J. (2005). Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review*, 4, 356–367.
- Tortorella, G. L., Miorando, R., & Marodin, G. (2017). Lean supply chain management: Empirical research on practices, contexts and performance. *International Journal of Production Economics*.
- Torvatn T., Pedersen, A. C., & Holmen, E. (2016) Lean purchasing. In T. H. Netland & D. J. Powell (Eds.). *The Routledge companion to lean management* (pp. 202–211). New York, NY: Taylor and Francis.
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14, 207–222.
- Ugochukwu, P., Engström, J., & Langstrand, J. (2012). Lean in the supply chain: A literature review. *Management and Production Engineering Review*, 3, 87–96.
- Vedel, M. (2016). The triad value function—theorizing the value potential of connected relationships. *Journal of Business & Industrial Marketing*, 31(7), 849–860.
- Vedel, M., Holma, A.-M., & Havila, V. (2016). Conceptualizing inter-organizational triads. *Industrial Marketing Management*, 57, 139–147.
- Wagner, S. M. (2006). Supplier development practices: An exploratory study. *European Journal of Marketing*, 40, 554–571.
- Wee, H. M., Wu, S. (2009). Lean supply chain and its effect on product cost and quality: A case study on Ford Motor Company. *Supply Chain Management: An International Journal*, 14(5), 335–341

- Widodo, H. P. (2014). Methodological considerations in interview data transcription. *International Journal of Innovation in English Language Teaching and Research*, 3(1), 101–107
- Womack, J. P., & Jones, D. T. (1996). *Lean thinking: Banish waste and create wealth in your organisation*. New York, NY: Simon and Shuster.
- Womack, J. P., & Jones, D. T. (2003). *Lean thinking: Banish waste and create wealth in your organisation*. 2nd ed. New York, NY: Free Press
- Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world: The story of lean production—Toyota's secret weapon in the global car wars that is now revolutionizing world industry*. New York, NY: Free Press.
- Yin, R. K. (2018). *Case study research and applications: Design and methods*. London, U.K.: SAGE publications.
- Zhang, M., Pawar, K. S., & Bhardwaj, S. (2017). Improving supply chain social responsibility through supplier development. *Production Planning and Control*, 28, 500–511.

Part II

Paper 1

**Who develops the suppliers?
The role of third parties in bringing about supplier development**

Leandro D. B. dos Santos (leandro.santos@ntnu.no)

Elsebeth Holmen

Ann-Charlott Pedersen

Norwegian University of Science and Technology, Trondheim, Norway

Summary

Third parties are often involved in supplier development. However, their involvement has received little explicit attention in the literature. In a systematic review, we analyze and conceptualize third party involvement in supplier development. We find that third parties are primarily other buyers, complementary suppliers, government organizations, NGOs, and consultancy companies. We outline six different manners in which third parties can be involved in supplier development. Finally, we suggest four reasons why third party's involvement in supplier development is beneficial.

Keywords: buying firms, supplier development, third parties

This paper was presented at IPSERA ONLINE CONFERENCE 2021 'Purchasing Innovation and Crisis Management' 30TH ANNUAL MEETING and is not included in NTNU Open due to IPSERA copyright restrictions

Paper 2

<https://www.emerald.com/insight/content/doi/10.1108/JBIM-02-2019-0066/full/html>

This is the author accepted manuscript (post-print) of an article published by Emerald.

dos Santos, L., Holmen, E. and Pedersen, A. (2019), "Viewing lean supply from the IMP perspective", *Journal of Business & Industrial Marketing*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/JBIM-02-2019-0066>

Paper title: Viewing Lean supply from the IMP Perspective

Abstract

Purpose

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

Design/methodology/approach

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

Findings

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

Research limitations/implications / Practical implications

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

Originality/value

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

Keywords

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

1. Introduction

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

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

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

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

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

RQ1: What are the key elements of Lean supply?

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

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

2. Lean supply: literature and characteristics

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

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

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

2.1 Lean supply research phases

Some studies have examined the research phases that Lean and Lean supply approaches have gone through. Hines et al. (2004) define four stages in the evolution of the general Lean approach focusing on: 1) cell and line (1980-1990), 2) shop-floor (mid-1990s), 3) value stream (mid to late 1990s), and

4) value system (2000 and onward). Thus, although Lean research started with an operational level focus, it has evolved to embrace a product's entire value-chain, or supply chain (Hines et al., 2004; Scherrer-Rathje et al., 2009). Thus, the last two stages of Lean research are strictly related to Lean supply.

Singh and Pandey (2015) reviewed the Lean literature related to Lean supply, focusing mainly on suppliers rather than on general Lean management, and identified 3 research phases: network management (1996-2001), Lean environment (2003-2009) and "Leagility" (2010-2013), where the latter phase addresses supply chain characteristics and strategies that combine agile and Lean approaches (Singh and Pandey, 2015). Other authors have also addressed the differences between agile and Lean supply strategies (Naylor et al., 1999) and suggested that differing types of supply chains are appropriate for each strategy. We shall return to this discussion later. First, we shall present and compare four LS literature reviews which will enable us to identify key characteristics and elements of Lean Supply. One of the reviews is from the Lean environment phase, and the other three studies are from the leagility/value-system phase.

2.2 Literature reviews on Lean supply

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

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

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

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

Collaborative and long term relationships, a small supplier base, low vertical integration and systems (sub-assembly) supply, single or dual supply from close suppliers, multi-criteria

supplier selection, supplier development and technical support, frequent communication with information sharing, participation in product development and design, frequent delivery, focus on quality assurance and lastly, joint problem solving (Martínez-Jurado and Moyano-Fuentes, 2014).

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

Regarding the last pillar, leadership commitment is a common debate in Lean contexts; see for example Liker (2004), who points to “leadership engagement in the philosophy” as one important principle. Nevertheless, this principle is mainly framed as a concern for the internal organization, and we have found little discussion on this issue in the LS literature we have reviewed. Therefore, in our Lean supply model, this characteristic will be left out.

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

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

3. A Lean supply model

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

Table I - Elements of Lean supply in different literature reviews

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

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

LS1: Delivery practices – Lean production and logistics

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

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

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

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

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

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

As discussed by Ugocuchukwo et al. (2012), Lean supply includes not only flow integration but also extended value stream mapping (EVSM). A Value stream mapping can be performed by a firm with the aim to draw a diagram of the flow of materials and information related to a specific product or product family (Shook and Marchwinski, 2014). In its extended version, EVSM, the mapping considers flows beyond the internal organization, to the supply chain. Lean supply literature stresses EVSM as an efficient tool for improvement in the value chain. It allows supply chain members to

visualize, in a simple but comprehensive manner, processes and product families in value streams (Jones and Womack, 2002; Dolcemascolo, 2006). Jones and Womack (200) conclude that “Extended mapping cuts through this clutter to focus on just one stream in order to think of improvements that can eventually apply to all streams” (Jones and Womack, 2002, p.3). Thus, external firms are part of the overall product’s value addition.

LS5: Customer focus

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

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

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

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

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

For these reasons, the literature portrays Lean buyer-supplier relationships as long-term and stable (c.f. e.g., Lamming, 1993; Kerber and Dreckshage, 2011; Jasti and Kodali, 2015a; Harris et al., 2016). To integrate the supply chain and resource flows, as well as to perform collaborative improvement,

requires a coordinated effort. This requirement is stressed by Lamming (1993, p. 188), “for lean supply to be a reality, customers must (...) accept ideas that come from upstream, as readily as they expect to influence their supply chain partners.” This implies a willingness to collaborate intensely in business relationships, as well as advanced supply management, covering the dimensions discussed in the next section.

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

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

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

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

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

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

4. Characteristics of the IMP tradition

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

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

dependent on these external relations, for example with suppliers (Håkansson and Snehota, 1995; Gadde et al., 2010).

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

In IMP, business relationships are seen “as the pattern of interactions and the mutual conditioning of behaviors over time” (Ford et al., 2003, p.38). The analysis of business relations takes place by understanding the elements that make up a relationship and how these elements affect the way relations develops (Ford et al., 2003). Beyond the discussion of the (dyadic) relationship and the extended network, IMP frameworks deal with how relationships evolve in the business landscape, through interaction and interplay among the relationship primary elements which are resources, activities, and actors (Håkansson and Snehota, 1995), also known as the ARA model. In the next section, we address each of the elements in this framework (Håkansson and Snehota, 1995; Håkansson et al., 2009).

4.1 Actors

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

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

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

4.2 Resources

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

Suppliers may be seen as a sophisticated collection of production resources, products, knowledge, and relationships (Gadde, 2010). In the IMP perspective, resources are considered heterogeneous,

which means that their value results from the manner in which they are combined within and across firm boundaries, and the resulting resource ties that connect the firms' resource collections into wider constellations. Resources are not only accessed through interaction, but "interaction is the major means by which companies systematically combine their resources, activities, and actors to harvest collective gains from such combining" (Olsen, 2013, p. 162). Learning in and across relationships is thus a significant benefit that results from interaction in the resource layer.

4.3 Activities

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

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

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

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

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

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

and structures must be considered in the analysis and management of activity structures (Dubois, 1998).

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

5. Analyzing LS elements in light of IMP concepts

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

LS1: Delivery practices – Lean production and logistics

To adopt Lean production in the supply chain is the aim of Lean supply. To achieve such an aim, many aspects of the relationship need to be considered. It must first take into account single relationships of a company, but it also involves the complex network of its suppliers. Furthermore, all elements of the relationship (activities, resources, and actors) may be involved when transferring Lean production principles and practices beyond the internal organization to suppliers, in order to improve activity management in the supply chain and in the suppliers' organizations. One example is the 1 Extended value stream mapping (EVSM), an LS tool based on the drawing of a product flows which cuts across several firms and actors and involves both logistics and production resources in the activities performed in a particular value chain.

LS2: Problem-solving with continuous improvement

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

LS3: Flow integration and systems supply

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

activities that have taken place (such as EVSM) and the resources involved (such as systems/components), which are fundamental to achieving flow integration.

LS4: Supplier involvement in product development

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

LS5: Customer focus

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

LS6: Supplier quality assurance

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

LS7: Effective communication and Information sharing

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

LS8: Collaboration and partnership

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

LS9: Long-term relationships

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

LS10: Few suppliers in the supply base

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

LS11: Multi-criteria supplier selection

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

LS12: Supplier development and support

Advanced relationship management is necessary to achieve supplier development and support in LS terms. The complexity comes to the fore in the initiatives and structures that leading Lean firms establish for training and transferring capabilities to suppliers (Hines et al., 1998; Sako, 2004). These structures comprise, for example, supplier associations, training centers, and employee transfers or visits among firms (Liker and Choi, 2004). All elements of the ARA model are activated, and both the dyadic and the network level can be involved.

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

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

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

Where:

x: part of this element
X: central in this element

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

6. Analysis and discussion

6.1 Dyadic versus Network level

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

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

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

6.2. Activities, resources, and actors (ARA) model

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

Moreover, the IMP perspective emphasizes the distinctions and relations between standardized activities and activities adapted expressly to particular counterparts. In Lean supply chains, activities may be seen as highly specialized, due to many interdependences originating from the use of Lean production and logistic tools, such as just-in-time inventory systems. Thereby, Lean supply may contain a higher amount of specific activities than standardized ones. Activities in Lean supply settings thus cannot be easily adjusted, i.e., standardized, to firms that do not apply LS, which, in turn, makes it more challenging to adjust LS activity combinations, or to implement Lean supply.

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

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

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

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

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

7. Conclusions

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

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

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

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

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

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

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

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

References

- Benders, J. and van Bijsterveld, M. (2000), "Leaning on lean: The reception of a management fashion in Germany". *New Technology, Work and Employment*, Vol. 15, pp. 50-64.
- Dolcemascolo, D. (2006), *Improving the Extended Value Stream: Lean for the Entire Supply Chain*, Productivity Press, New York.
- Dubois, A. (1998), *Organizing Industrial Activities Across Firm Boundaries*, Routledge, London.
- Flood, R. L. (1993), *Beyond TQM*, John Wiley and Sons, Chichester, UK.
- Ford, D. (1980), "The development of buyer-seller relationships in industrial markets", *European Journal of Marketing*, Vol. 14, pp. 339-353.
- Ford, D., Gadde, L.E., Håkansson, H., and Snehota, I. (2003), *Managing Business Relationships*, John Wiley and Sons, Chichester, UK.
- Fujimoto, T. (1999), *The Evolution of a Manufacturing System at Toyota*, Oxford University Press, New York.
- Gadde, L.E., Håkansson, H., and Persson, G. (2010), *Supply Network Strategies*, John Wiley and Sons, Chichester, UK.
- Gadde, L.E. and Wynstra, F. (2018), "Purchasing management and the role of uncertainty". *IMP Journal*, Vol. 12, pp. 127-147.
- Håkansson, H. (1982), *International Marketing and Purchasing of Industrial Goods: An Interaction Approach*, John Wiley and Sons, Chichester, UK.
- Håkansson, H., Ford, D., Gadde, L.E., Snehota, I., and Waluszewski, A. (2009), *Business in Networks*, John Wiley and Sons, Chichester, UK.
- Håkansson, H. and Persson, G. (2004), "Supply chain management: the logic of supply chains and networks". *The International Journal of Logistics Management*, Vol. 15, pp. 11-26.
- Håkansson, H. and Snehota, I. (1989), "No business is an island: the network concept of business strategy". *Scandinavian Journal of Management*, Vol. 5, pp. 187-200.
- Håkansson, H. and Snehota, I. (1995), *Developing Relationships in Business Networks*, Routledge, London.
- Harris, C., Harris, R. and Streeter, C. (2016), *Lean Supplier Development: Establishing Partnerships and True Costs throughout the Supply Chain*, CRC Press, New York.
- Hines, P., Holweg, M., and Rich, N. (2004), "Learning to evolve: A review of contemporary lean thinking". *International Journal of Operations and Production Management*, Vol. 24, pp. 994-1011.
- Hines, P., Rich, N., and Esain, A. (1998), "Creating a lean supplier network: a distribution industry case". *European Journal of Purchasing and Supply Management*, Vol. 4, pp. 235-246.
- Hopp, W. J. and Spearman, M. L. (2004), "To pull or not to pull: what is the question?", *Manufacturing Service Operations Management*, Vol. 6, pp. 133-148.
- Jasti, N. V. K. and Kodali, R. (2015a), "A critical review of lean supply chain management frameworks: proposed framework". *Production Planning and Control*, Vol. 26, pp. 1051-1068.
- Jasti, N. V. K. and Kodali, R. (2015b), "Lean production: literature review and trends". *International Journal of Production Research*, Vol. 53 No. 3, pp. 867-885.
- Jones, D. T. and Womack, J. P. (2002), *Seeing the Whole: Mapping the Extended Value Stream*, Lean Enterprise Institute, Cambridge, MA.
- Kerber, B. and Dreckshage, B. J. (2011). *Lean Supply Chain Management Essentials: A Framework for Materials Managers*, CRC Press, New York.
- Lamming, R. (1993), *Beyond Partnership: Strategies for Innovation and Lean Supply*, Prentice Hall, New York.
- Liker, J. K. (2004), *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, McGraw-Hill, New York.

- Liker, J. K. and Choi, T. Y. (2004). "Building deep supplier relationships". *Harvard Business Review*, Vol. 82, pp. 104-113.
- Martin, J. W. (2007), *Lean Six Sigma for Supply Chain Management: The 10-step Solution Process*, McGraw-Hill, New York, NY.
- Martinelli, E.M., Tunisini, A., and Guercini, S. (2017), "Customer-driven supply chains under IMP lens: A systematic literature review and conceptual framework". *IMP Journal*, Vol. 11 No. 2, pp. 289-300.
- Martínez-Jurado, P. J. and Moyano-Fuentes, J. (2014), "Lean management, supply chain management and sustainability: A literature review". *Journal of Cleaner Production*, Vol. 85, pp. 134-150.
- Mcivor, R. (2001), "Lean supply: the design and cost reduction dimensions". *European Journal of Purchasing and Supply Management*, Vol. 7, pp. 227-242.
- Monczka, R. M., Handfield, R. B., Giunipero, L. C. and Patterson, J. L. (2016), *Purchasing and Supply Chain Management*, Cengage Learning, Boston, MA.
- Myerson, P. (2012), *Lean Supply Chain and Logistics Management*, McGraw-Hill, New York.
- Naylor, J. B., Naim, M. M., and Berry, D. (1999), "Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain". *International Journal of Production Economics*, Vol. 62, pp. 107-118.
- Netland, T. and Powell, D. (2017), "A Lean World", in: Netland, T. H. and Powell, D. J. (Eds.), *The Routledge Companion to Lean Management*, Taylor and Francis, New York, NY, pp. 465-473.
- Ohno, T. (1988), *Toyota Production System: Beyond Large-Scale Production*, Productivity-CRC Press, Portland, OR.
- Olsen, P. I. (2013), "IMP theory in light of process-and system theories". *IMP Journal*, Vol. 7 No. 3, pp. 159 -170.
- Qrunfleh, S. and Tarafdar, M. (2013), "Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement". *Supply Chain Management: An International Journal*, Vol. 18, pp. 571-582.
- Sako, M. (2004), "Supplier development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement". *Industrial and Corporate Change*, Vol. 13, pp. 281-308.
- Scherrer-Rathje, M., Boyle, T. A. and Deflorin, P. (2009), "Lean, take two! Reflections from the second attempt at lean implementation". *Business Horizons*, Vol. 52, pp. 79-88.
- Schniederjans, M., Schniederjans, D. and Cao, R. Q. (2009), *Topics in Lean Supply Chain Management*, World Scientific, New Jersey.
- Shah, R. and Ward, P.T., 2007. "Defining and developing measures of lean production". *Journal of Operations Management*, Vol. 25 No. 4, pp. 785-805.
- Shook, J. and Marchwinski, C. (2014), *Lean Lexicon: a Graphical Glossary for Lean Thinkers*, Lean Enterprise Institute, Cambridge, MA.
- Singh, S. C. and Pandey, S. K. (2015), "Lean Supply-Chain: A State-of-the-art Literature Review". *Journal of Supply Chain Management Systems*, Vol. 4 No. 3, p. 33.
- Srinivasan, M. M. and Mandyam, S. (2012), *Building Lean Supply Chains with the Theory of Constraints*, McGraw-Hill, New York, NY.
- Ugochukwu, P., Engström, J., and Langstrand, J. (2012), "Lean in the supply chain: A literature review". *Management and Production Engineering Review*, Vol. 3, pp. 87-96.
- Womack, J. P. and Jones, D. T. (1996), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. Simon and Shuster, New York, NY.
- Womack, J. P., Jones, D. T., and Roos, D. (1990), *The Machine that Changed the World*, Rawson Associates, New York.

Paper 3

How can a buying company develop a Toyota-style supplier network while its lean capabilities are still evolving?

Abstract

Purpose

Toyota had mature lean capabilities when developing its supplier network. This paper explores how companies can develop a Toyota-style supplier network (TSN) while their lean capabilities are still evolving.

Design/methodology/approach

Theoretically, this paper relies on the literature on lean maturity levels and lean supplier network development. Empirically, the paper portrays a Toyota-style initiative, detailing the buyer's efforts to develop internal lean capabilities concurrently with developing lean in its supplier network. It compares the Network for supplier innovation (NSI) initiative with TSN development regarding activities, organizations, and knowledge-sharing routines.

Findings

Unlike the sequential development in the case of Toyota, NSI improved performance and capabilities in the buyer's supplier network by implementing lean in the firm and its supplier network concurrently. Third-party involvement was the key to the initiative's success.

Research limitations/implications

The findings are based on an in-depth single-case study which allows theoretical generalization but not statistical generalization. Furthermore, the case study concerns an initiative with Norwegian firms during a financial recession. Future studies should consider these limitations on how firms with evolving lean capabilities can develop a TSN-style supplier network and the importance of involving third parties operating in the role of lean master.

Practical implications

This study suggests what buying firms should consider when designing a TSN initiative, enrolling suppliers, and engaging third parties that can take on the role of lean master.

Originality

Previous research has focused on how mature lean firms develop lean suppliers and networks. This paper extends this to firms whose lean capabilities are still evolving.

Keywords: Lean capabilities, Supplier network development, Toyota

1. Introduction

Increased specialization and dependence on competent suppliers have led buying firms to consider developing their suppliers and supplier networks (Dyer and Nobeoka, 2000; Liu *et al.*, 2018). There are two approaches to supplier development: In the *indirect* approach, buying firms limit their involvement and resource commitment, set targets and encourage and incentivize suppliers to improve (Sucky and Durst, 2013; Jia *et al.*, 2021). In the *direct* approach, buying firms actively organize the learning context and dedicate human or capital resources to develop specific suppliers (Krause *et al.*, 2000; Glock *et al.*, 2017).

Japanese automobile firms are considered superior in developing their supplier systems (MacDuffie and Helper, 1997; Liker and Choi, 2004; Aoki and Lennerfors, 2013; Hines, 2016; Aoki and Wilhelm, 2017). Toyota is renowned for its comprehensive, direct approach to developing suppliers' lean capabilities, with systematic efforts that benefit single suppliers and the supplier network in the long run (Nobeoka *et al.*, 2002; Dyer and Hatch, 2004; Sako, 2004; Hines, 2016). Toyota's supplier network (TSN) has been studied extensively as a benchmark for high-performance networks (Dyer and Nobeoka, 2000; Hines, 2016; Aoki and Wilhelm, 2017). For a complete lean transformation, buying firms must extend their internal lean efforts to the supply chain or network (Lamming, 1993; Bicheno 1999; Emiliani *et al.*, 2003; Bruce *et al.*, 2004; Hines *et al.*, 2004; Liker 2004; Wee and Wu 2009; Azadegan *et al.* 2013; Sisson and Elshennawy, 2015; Bortolotti *et al.*, 2016; Powell and Coughlan, 2020). However, because most studies on lean development have an internal focus, more studies that capture in detail how lean can be spread to suppliers are needed (Aoki and Lennerfors, 2013; Shamah, 2013; Marodin *et al.*, 2016; Tortorella *et al.*, 2017; De Silva and Jayarathne, 2018; Reitsma *et al.*, 2021). In particular, there is a dearth of in-depth investigating efforts to create Toyota-style supplier networks and the outcomes of lean implementation (Jayamaha *et al.*, 2014; Reitsma *et al.*, 2021).

Toyota is clearly the lean master in developing its lean supplier network (Ballé and Handler, 2012). In fact, most studies on lean implementation in supplier systems implicitly assume, directly state, or empirically show that buying firms *first* develop *internal* lean capabilities and *then* transfer their lean knowledge and practices to their suppliers (Womack and Jones, 2003; Hines *et al.*, 2004; Prajogo *et al.*, 2016; Chiarini and Brunetti, 2019; Reitsma *et al.*, 2021). They assume that buying firms cannot expect suppliers to develop lean practices if their own lean capabilities are not mature (Marksberry, 2012; Hu *et al.*, 2015; Knol *et al.* 2018). However, Chiarini and Brunetti (2019, p.1093) observed that "*it is not clear whether the involvement of suppliers has to be managed at the beginning of the Lean journey or after Lean has been implemented within the company*". They surveyed the issue and found that suppliers generally become involved *after* the buyer has implemented lean (Chiarini and Brunetti, 2019, p.1098).

In addition to studies emphasizing *that* and *when* lean should be extended to the supplier systems, a few studies describe in detail *how* buying firms can develop lean suppliers. For example, Reitsma *et al.* (2021) studied how a buying firm with a mature lean capability extended its internal lean training to four strategic suppliers. However, Powell and Coughlan (2020) and Hoque (2021) investigated lean supplier development efforts that occurred without a mature lean buyer. While Powell and Coughlan (2020) focused on lean learning systems Hoque (2021) studied lean interventions endorsed by a foreign national development cooperation agency where the foreign buying firm only was indirectly involved, i.e. selected the suppliers to be developed and introduced the suppliers' managers

to a researcher supervising the intervention. While all studies found positive effects, Reitsma *et al.* (2021) and Hoque (2021) only captured initiatives that developed suppliers individually and not in networks, and none of them primarily attended to the maturity of the buying firm's lean capabilities when embarking on lean supplier network development.

Based on an in-depth single-case study, the purpose of this paper is to explore how a buying firm can create a Toyota-style supplier network while its lean capabilities are still developing. It focuses on third parties' roles as lean masters in developing suppliers' lean capabilities. The paper also adds to the research on lean supplier networks and lean masters or senseis (Ballé and Handler, 2012; Holmemo *et al.*, 2018).

The remainder of this paper is organized as follows. Section 2 addresses lean capability development and maturity levels and presents the TSN model with its structure of activities, types of knowledge shared, and relationship and network development stages. Section 3 explains the methodology, and Section 4 develops a single-case study of a company that developed a TSN-style lean supplier network while its own lean capabilities were evolving. Section 5 compares the findings to TSN-style lean supplier and network development and discusses factors that enabled the company's endeavors. Section 6 concludes with implications for buying companies, their suppliers, third parties and avenues for future research.

2. Literature review

2.1 Mature lean capabilities

The resource-based view argues that all organizational capabilities follow a life cycle from the founding and development stages (no or unstable functionality) to the mature stage (robust functionality) (Helfat and Peteraf, 2003). Lean capabilities are organizational capabilities, and their development and maturity have received considerable attention (Nightingale and Mize, 2002; Womack and Jones, 2003; Cocca *et al.*, 2019).

Massachusetts Institute of Technology (MIT) developed a lean enterprise self-assessment tool (Lean Advancement Initiative, 2001; Nightingale and Mize, 2002; Wan and Chen, 2008) indicating a firm's lean maturity level from one (least capable firms) to five (world-class companies). Womack and Jones (2003) suggested that it takes at least four years for a firm to achieve a mature lean capability or complete a "transformation to the lean business system" through three phases: "get started" (six months), "create a new organization" (18 months), and "install business systems" (24 months). Soriano-Meier and Forrester (2002) built a model with three lean maturity levels: "traditional firms" with no lean experience, "firms in transition", and "mature lean firms". Many methods for evaluating lean maturity levels exist (Shah and Ward, 2007; Hallam and Keating, 2014; Mumani *et al.*, 2022), but few address supplier issues (Cocca *et al.*, 2019;) and none capture the multiple features of TSN.

Regardless of the method used, Toyota has a mature lean capability (Helfat and Peteraf, 2003; Suh, 2017) and its capabilities for supplier development are the benchmark for firms seeking to develop lean supplier networks (Hines *et al.*, 2004; Iwao and Kato, 2019; Potter, 2022; Powell and Coughlan, 2022).

2.2 Key features of Toyota's supplier network capabilities

Since the 1990s, Japanese supply networks have been considered superior because of different practices and activities that build lean capabilities (Womack *et al.*, 1990; Hines and Rich, 1998; Iwao and Kato, 2019):

- *Deep supplier relationships.* Toyota developed relationships with high involvement and strong interdependencies early (Hines, 1994; MacDuffie and Helper, 1997). Even today, compared with other automotive firms, Toyota has closer relationships with its suppliers (Iwao and Kato, 2019; Irwin, 2021; Putre, 2021).
- *Dual sourcing.* Toyota has fewer suppliers per component than Western automakers because of dual sourcing (Lamming, 1993; Sako, 2004; Bicheno and Holweg, 2016; Mukai *et al.*, 2019; Giunipero and Denslow, 2022). In addition, Toyota avoids grouping competitors in highly interactive processes, whereas Honda lets competing suppliers participate in such processes (Liker and Choi, 2004; Sako, 2004; Potter and Wilhelm, 2020).
- *Direct development of suppliers' lean capabilities.* Toyota not only sets targets and encourages performance improvements, but develops their suppliers' lean capabilities through unprecedented direct involvement in the suppliers' operations over time (MacDuffie and Helper, 1997; Liker and Choi, 2004; Loh and Lau, 2019; dos Santos *et al.*, 2020). In TSN, suppliers gain access to Toyota's internal lean experts and competence centers that provide arenas for knowledge-sharing (Hines *et al.*, 2004; Suh, 2017; Iwao and Kato, 2019; Powell and Coughlan, 2020).
- *Early supplier involvement.* Japanese firms involve suppliers early in design processes to improve information exchange, minimize design changes, reduce information processing workload, and reduce lead times (Lamming, 1993; Fujimoto, 1999; Schoenherr and Wagner, 2016; Morgan and Liker, 2020; Potter and Paulraj, 2020; Potter and Wilhelm, 2020).

2.3. Features of TSN development

2.3.1 Knowledge-sharing routines

Shared knowledge can be explicit (easily transmitted through meetings, shared documents, and data) or tacit (experience-based, harder to codify, and requiring shared practice) (Nonaka, 1994; Schoenherr *et al.*, 2014; Hadjimichael and Tsoukas, 2019). Several studies have explored TSN development and its broad scope of activities enabling explicit and tacit knowledge-sharing (Dyer and Nobeoka, 2000; Dyer and Hatch, 2004; Sako, 2004; Aoki and Lennerfors, 2013; Kokayashi, 2014; Suh, 2017; Iwao and Kato, 2019). Lean capabilities often involve tacit knowledge (Henriksen and Rolstadås, 2010).

To transfer *explicit* knowledge, TSN has a multi-tiered supplier association (SA) structure that supports information exchange (Hines and Rich, 1998; Dyer and Nobeoka, 2000; Aoki and Lennerfors, 2013; Kobayashi, 2014; Suh, 2017; Potter and Wilhelm, 2020). Through its SA in Japan, Toyota *shares* its overall expectations and policies, develops a sense of identity and belonging, and helps newcomers fit into the network (Sako, 2004; Choi and Wu, 2009; Kobayashi, 2014; Suh, 2017). The SA also hosts bi-monthly meetings, either general meeting (focusing on production plans, market trends etc.) or meetings on topics suggested by members (cost control, quality improvement etc.). The SA also *organizes study visits* to best-practice plants, inside and outside the automotive industry,

for first-hand observation of production excellence (Dyer and Nobeoka, 2000; Suh, 2017; Iwao and Kato, 2019).

Toyota's suppliers deliver components just-in-time based on lean principles (Cusumano, 1994; Fujimoto, 1999; Lu and Bodek, 2018) which are difficult to codify and transfer because they entail *tacit* know-how (Langfield-Smith and Greenwood, 1998; Dyer and Nobeoka, 2000; Suh, 2017; Nordin *et al.*, 2019). Therefore, Toyota employs on-the-job activities to teach suppliers the Toyota Production System (Bicheno and Holweg, 2016; Hines, 2016; Suh, 2017). To enable these activities, Toyota established the Operation Management Consulting Division (OMCD) in Japan. They employ highly skilled lean production engineers to provide on-site consultancy to suppliers (e.g., assistance in achieving process improvement and using lean problem-solving tools) (Liker and Choi, 2004; Sako, 2004; Aoki and Lennerfors, 2013; Suh, 2017). The OMCD is independent of Toyota's internal operations to avoid conflicts between purchasing decisions and goals of long-term learning. Thus, the OMCD acts as a "pseudo" third-party (Sako, 2004; Marksberry, 2012; Kobayashi, 2014).

Furthermore, OMCD *coordinates several supplier learning teams* of 6-12 suppliers with similar business processes (Dyer and Nobeoka, 2000; Dyer and Hatch, 2004). The teams rotate among non-competing supplier plants, supporting problem identification and solving. Each supplier hosts a learning team for two months, meeting once a week to set improvement targets and implement improvement ideas. At an annual meeting, all the teams gather to share experiences and successes (Dyer and Nobeoka, 2000; Kobayashi, 2014; Suh, 2017), thereby transferring knowledge to and from Toyota and its suppliers (Dyer and Nobeoka, 2000; Sako, 2004; Suh, 2017; Iwao and Kato, 2019). OMCD is tailored to transfer and share tacit knowledge. Toyota values geographical proximity and requires suppliers to be located close to Toyota's sites.

In addition, the Global Production Centre *diffuses standardized and unstandardized knowledge*, by using videos and animations (Suh, 2017).

2.3.2 Network development stages

In 2000, Dyer and Nobeoka suggested that Toyota's success in implementing TSN rested on three distinct stages through which the network developed. Later, Aoki and Lennerfors (2013) described the subsequent developments of TSN, in what we may coin "Stage IV".

Stage I: Creating weak network relationships

Stage I began in the late 1930s when Toyota established its first SA in Japan (Nishiguchi, 1994; Hines and Rich, 1998). In the post-war period, suppliers in SA were evaluated by a Japanese government consultancy, providing guidelines and incentives for Toyota to continue working closely with suppliers, triggering Toyota to develop its assistance to suppliers (Fujimoto, 1999; Sako, 2004). Although SA has evolved into a complex, multi-tiered network, SA activities still support creating and maintaining (weak) network relationships (Aoki and Lennerfors, 2013; Powell and Coughlan, 2020).

Stage II: Creating strong dyadic relationships

In the mid-1960s, Toyota Japan inaugurated its consulting division, OMCD (Dyer and Nobeoka, 2000; Suh, 2017). Thirty years later, the Toyota Supplier Support Center (TSSC) was established in the US (Sako, 2004; Liker and Wu, 2006; Marksberry, 2012) to enhance the capabilities of single suppliers through on-site consultancy involving deep buyer-supplier interaction. Thus, this created

strong dyadic relationships between Toyota and the individual suppliers (Dyer and Nobeoka, 2000; Aoki and Lennerfors, 2013; Suh, 2017).

Stage III: Creating strong network relationships

In OMCD and TSSC, supplier learning teams with participants from several suppliers perform repetitive on-the-job learning. As suppliers learn from each other in practice, such teams are effective for network learning (Sako, 2004; Suh, 2017) and help create and maintain strong relationships in the network. Toyota's US suppliers affirmed that the most valuable operational learning comes from working in these teams (Dyer and Nobeoka, 2000).

Stage IV: Creating a more ambidextrous network

As the crisis hit the automotive industry in the 1900s, Toyota adjusted its supplier policy, by starting to buy from global, low-cost mega-suppliers in addition to buying from its long-term suppliers, setting target costs for long-term suppliers, demanding that suppliers provide integrated systems of components, and involving suppliers in product development at the planning stage (Aoki and Lennerfors, 2013). In addition, the more turbulent environment has increased the focus on innovation with long-term suppliers (Iwao and Kato, 2019; Potter and Graham, 2019; Potter and Wilhelm, 2020).

2.4 Analytical framework

The characteristics of TSN development can be summarized as follows:

- Key relational features
 - Deep, geographically close relationships, with high involvement and interdependency, and a long-term orientation (MacDuffie and Helper, 1997; Irwin, 2021; Putre, 2021)
 - Dual-sourcing approaches, with controls for competition (Lamming, 1993; Sako, 2004; Bicheno and Holweg, 2016; Mukai *et al.*, 2019)
 - Direct development of lean supplier capabilities (Hines, 2016; Loh and Lau, 2019; dos Santos *et al.*, 2020)
 - Early supplier involvement (Lamming, 1993; Fujimoto, 1999; Morgan and Liker, 2020)
- An array of activities to support knowledge transfer and sharing
 - Organized by the SA to transfer explicit knowledge (Hines and Rich, 1998; Dyer and Nobeoka, 2000; Potter and Wilhelm, 2020)
 - General meetings to diffuse Toyota's expectations and policies (Dyer and Nobeoka, 2000; Dyer and Hatch, 2004)
 - Topic meetings for discussion of specific themes (*ibid.*)
 - Study visits to provide inspiration and learning-by-observing (Dyer and Nobeoka, 2000; Powell and Coughlan, 2020)
 - Organized by the OMCD/TSSC to transfer tacit knowledge
 - On-site consultancy to support single suppliers in lean production (Sako, 2004; Liker and Wu, 2006; Marksberry, 2012)
 - Supplier learning teams to promote lean network learning (Liker and Choi, 2004; Suh, 2017)
- Network development stages
 - Stage I: Establishing weak dyadic relationships within the early SA (Sako, 2004; Powell and Coughlan, 2020)

- Stage II: Triggered by government consultants, OMCD and TSSC help individual suppliers, thus creating strong dyadic relationships (Dyer and Nobeoka, 2000; Marksberry, 2012; Suh, 2017)
- Stage III: Employing supplier learning teams for knowledge-sharing, thus creating strong relationships in the network (Dyer and Nobeoka, 2000; Sako, 2004; Suh, 2017)
- Stage IV: Global sourcing, target costing, buying systems, and involving suppliers earlier and deeper in product development (Aoki and Lennerfors, 2013).

2.5 Research question

Toyota's lean capabilities and supplier network have evolved since the 1930s. However, companies aiming to improve their competitiveness by developing lean capabilities internally and in their extended supplier network may not afford such protracted development processes. Therefore, this paper poses the following research question:

How can a company develop a Toyota-style supplier network while its lean capabilities are still evolving?

Therefore, this study investigates a TSN-inspired initiative of a buying firm in the early stages of its lean capability development, focusing on the following sub-questions:

- a. How can a company design a TSN-style initiative with an appropriate mix of activities?
- b. How can a company select an appropriate mix of suppliers for a TSN-style initiative and relate them to each other, and to suppliers outside the initiative?
- c. How can a company identify and involve an appropriate mix of third parties who can take on the role of a lean master and support a TSN-style initiative?

The third question is essential in settings where the lean capabilities of the buying firm are still evolving, as it focuses on *who* is to take on the role of lean master responsible for developing the suppliers' lean capabilities (Ballé and Handlinger, 2012). In TSN, Toyota's engineers perform this role (Fujimoto, 1999; Dyer and Nobeoka, 2000). Recent studies on internal lean implementation found internal lean masters to be more effective than external consultants (Holmemo *et al.*, 2018; Chiarini and Brunetti, 2019), particularly when embedded in lean leadership and company cultures (Holmemo *et al.*, 2018). Other studies indicate that external parties may contribute as a lean master in internal or external lean implementation (Sisson and Elshennawy, 2015; Powell and Coughlan, 2021; Hoque, 2021), but none of them hone in on third parties involved in TNS-style development.

3. Methodology and empirical basis

A holistic single-case study is appropriate (Dubois and Gadde, 2014; Yin, 2018) to capture a complex phenomenon intertwined with its context. The case concerns the Network for Supplier Innovation (NSI), an initiative to develop a TSN-style network, with the Norwegian company Kongsberg Maritime Subsea (KMS) as the buyer, six strategic suppliers, and several third parties. The challenge of staying competitive in high-cost countries such as Norway impelled KMS to employ lean production internally. However, owing to extensive outsourcing, KMS realized that more benefits could be reaped if lean was extended to its key suppliers. Simultaneously, KMS was participating in a large research project on lean management and agreed to explore the case of NSI with researchers

experienced in supplier development and networks, in line with ideas of “problematization” rather than “gap-spotting” (Alvesson and Sandberg, 2011).

KMS is not the only buying firm that has aspired to develop TSN-style supplier networks (Dyer and Hatch, 2004). However, this study pays particular attention to the lean maturity level of KMS which, following Soriano-Meier and Forrester (2002), was assessed as a firm in transition to become lean.

By containing “revelatory,” “unique,” and “critical instance” elements (Bell *et al.*, 2019), the case allows exploration of whether and how a buying company, which is in transition to become lean, can concurrently develop lean suppliers in a network.

Nowadays, Toyota is an automotive industry leader with factories worldwide and a vast supplier network. However, at the beginning of the TSN-journey, Toyota, like KMS, was a national industry leader (Fujimoto, 1999; Lamming, 1993). The NSI involves six suppliers; TSN initially comprised 18 key suppliers but later expanded to a broader network. Moreover, the early formation of TSN was supported by third parties, such as the NSI. Further similarities and differences between TSN and NSI are addressed in Section 4.

Not all elements of the analytical framework were meticulously elaborated before data collection started; some emerged due to confronting data and theories (Dubois and Gadde, 2014). This abductive approach to framework building and analysis allowed the discovery of unforeseen aspects, such as the participation of various actors beyond the buyer and the concurrent development of the lean capability of the buyer and its suppliers. This increases the explanatory power of this study (Dubois and Gadde, 2014).

3.1 Data collection

Primary data were collected through semi-structured interviews, meetings and observations. In the buying organization, the researchers interviewed representatives from three departments: Supply chain, Quality, and Purchasing. In addition, representatives of all six suppliers were interviewed – CEOs, purchasing managers, and lean coordinators – obtaining both management and operations perspectives. Semi-structured interviews were planned with at least two representatives from each supplier to achieve data saturation (Fusch and Ness, 2015). However, owing to unforeseen restrictions, in two supplier firms only one representative was interviewed.

Interview guides were inspired by key references on supplier development (Krause *et al.*, 2000; Wagner, 2006), supplier relationships (Liker and Choi, 2004), supplier relationship contexts (Choi and Wu, 2009), lean supplier development and networks (Dyer and Nobeoka, 2000; Aoki and Lennerfors, 2013) and lean masters (Ballé and Handlinger, 2012) and contained topics related to the research question (Bell *et al.*, 2019). The overall themes for the first round of interviews with the suppliers appear in Table I, the detailed sub-questions are available upon request to the second author.

Table I: Main themes in supplier interviews

-
- The supplier's motivation to join the initiative
 - The supplier's relationship to KMS
 - The supplier's "lean journey" so far and how KMS's initiative relates to it
 - KMS and SRM: lean competence and lean masters
 - KMS and the supplier – insight into each other's business
 - The supplier's experiences with the individual activities in the NSI initiative
 - The supplier's experiences with the mix of activities and the overall initiative
 - The supplier's view on outcomes of the initiative
 - The supplier's view on how the initiative could be improved
 - The NSI initiative and connections to the supplier's other customers
 - The NSI initiative and connections to the supplier's own suppliers and sub-contractors
 - The NSI initiative and connections to the supplier's own customers
 - The supplier's relationships to the other suppliers in the NSI initiative
-

Interviews were carried out by teams of two researchers and were recorded, transcribed, and checked for understanding and confidentiality, which was essential to suppliers sharing their views in confidence.

The researchers also interviewed and held meetings with representatives from the involved consulting companies, the regional cluster organization, and the regional and national innovation policy instruments.

Furthermore, the researchers participated in several NSI workshops, seminars and internal meetings with employees from the Supply chain, Quality, and Purchasing departments, and Lean conferences, taking notes during direct observation and informal conversations on matters of importance to the initiative.

Two *secondary data* sources were used. First, the internal KMS documents included the supplier quality manual, supplier performance data (deliveries and quality), internal lean program brochures, and public webpages on KMS and the six suppliers. Second, the researchers gathered documents on the NSI initiative, including descriptions of activities and events, PowerPoint presentations from gatherings, consultancy reports, and press releases.

Data from the different sources were triangulated to ensure trustworthiness, the supplier interviewees read the transcripts, and results were presented to NSI participants and discussed with KMS representatives on several occasions. When preliminary results were communicated to the participants, care was taken to not reveal the identities of the interviewees, avoiding phrases common to dialects to preserve anonymity for small group interviewees in single-case studies.

3.2 Case description and analysis approach

The data were used to describe and analyze the case in relation to themes in the interview guides and additional themes emerging during the interviews. For example, data from observations, documents, and interviews were used to determine the lean maturity level of the participating firms and describe different views on the NSI initiative (Section 4.1) and activities (Section 4.2). Regarding the effects of NSI (Section 4.3), interviews captured supplier capability development (from the perspectives of

the buyer, suppliers, and third parties). In contrast, data from the buyer's and suppliers' information systems, documentation from the third parties, and notes from meetings captured performance effects (Section 4.4).

During data analysis, the analytical framework was applied and developed consistent with the systematic combining approach (Dubois and Gadde, 2014), to address the research question and compare the NSI and TSN.

4. Case and analysis

4.1 Organizations in NSI

A business unit in a Norwegian conglomerate, KMS manufactures advanced maritime robotic systems for subsea operations, outsourcing approximately 80% of the turnover. In 2014, KMS was in the early stages of implementing its internal lean program. However, confronting turbulence, increasing competition, and demands for cost reductions, KMS saw the need to extend the program to its suppliers and instigated the NSI as a strategic initiative in 2015. The main objective was to improve suppliers' capabilities and performance, by supporting them in implementing lean.

Six suppliers participated in the NSI: Flaates ElectroMek (FEM), Fosstech, Hapro, Kristiansand Skrufabrikk og Mekanisk Verksted (KSMV), Norautron, and Oswo. They were chosen for their strategic relevance to KMS, being preferred or strategic suppliers. KMS is an attractive customer for all the suppliers for various reasons, including volume, technology, knowledge, innovation, and collaborative orientation. All six suppliers are Norwegian SMEs located less than 260 km from the KMS headquarters. Some of the suppliers have buyer-supplier relationships (e.g., KSMV and Oswo) or are competitors (e.g., FEM and Fosstech, Hapro and Norautron) reflecting KMS's dual-sourcing strategy.

All suppliers "had heard about lean before the initiative." One supplier had started an internal lean program, another had been exposed to lean principles by other customers, and the other four had no prior lean experience.

Four other parties were involved in the NSI. First, the regional branch of Innovation Norway (IN-R), the Norwegian government's policy instrument for enterprise and industry innovation, provided financial support and guidelines, gave input for selecting suppliers, participated in the steering group, and enforced systematic registration of the participants' involvement. IN-R was previously involved in another supplier development initiative, in which a foreign company operating in Norway (due to local content requirements) had to find Norwegian suppliers that could be developed to fulfill its quality standards.

Second, the Norwegian Center of Excellence in Systems Engineering (NCE-SE), a cluster support organization responsible for developing regional technology suppliers, distributed information among participants, facilitated and organized activities, and administered financial support for the NSI.

Third, Sintef Raufoss Manufacturing (SRM), the manufacturing branch of the research institute SINTEF, was selected in a procurement process where candidates were evaluated on multiple criteria important to the NSI. Of particular importance were SRM's LeanLab facilities and consultants with extensive lean capabilities amassed across a wide range of customers.

Finally, Semcon Devotek provided teaching, training, and project management services for integrated product development with early supplier involvement (IPD/ESI). Like SRM, Semcon Devotek was selected for its experience, assisting various high-tech companies in the Kongsberg region.

In 2015, KMS invested substantially in the initiative. IN-R complemented the investment, whereas suppliers participated for free. From 2016, suppliers paid a yearly fee of NOK 30,000 (a small amount, considering the consultancy rates).

4.2 Activities in NSI

From 2015-2018, an array of activities inspired by TSN occurred.

4.2.1 Lean Lab (2015)

Lean Lab activities were supervised by SRM, involved top and middle managers from the participating firms, and aimed to establish a common understanding of basic lean principles, terminology, and practices. The activities involved theoretical courses and training in Lean Lab facilities where the participants could apply lean tools, simulating real-life production lines.

4.2.2 Study visits (2016-2017)

The program contained three study visits, to Parker Hannifin (Sweden), Bosch (Germany), and Variass Electronics (the Netherlands) to inspire the participants through on-site observations of exemplary lean firms. The trips also enabled participants to develop closer bonds through informal conversations.

4.2.3 Topic workshops (2017)

The NSI arranged three topic workshops hosted by the suppliers or KMS. One workshop focused on implementing lean and total production maintenance tools in production lines, such as *single minute exchange of dies*. Other seminars addressed *kata* techniques for leadership coaching and IPD/ESI. Participants varied, but were mainly middle managers and operators, from suppliers and KMS. The suppliers could suggest topics, but KMS chose them.

4.2.4 On-site consultancy (2016-2018)

Three consultants were involved, each responsible for on-site consultancy with two suppliers, non-competing in their offerings to KMS. On average, each supplier received seven two-day visits from the consultants. The literature shows that successful lean consultancy requires extensive lean expertise, a profound understanding of the firm's context, and realistic expectations of their contributions (Kim, 2015; Holmemo *et al.*, 2018). IN-R and KMS financed the consultants with semi-autonomous roles: to improve the supplier's lean capabilities, not as a carbon copy of KMS' lean system but fitted to the suppliers' contexts.

4.2.5 eVSM (2017-2018)

Extended value stream mapping (eVSM) is employed to depict the value flow of the information and materials of a product from order to delivery. It is a central practice for improving inter-organizational supply chains (Jones and Womack, 2002; dos Santos *et al.*, 2020) and is imperative for co-learning in networks (Marksberry, 2012). However, the application of eVSM can be challenging in complex systems such as supply networks (Braglia *et al.*, 2006; Wee and Wu, 2009). In NSI, subgroups of 2-4 suppliers participated in different eVSM-teams to evaluate inter-organizational flows for particular KMS products. The teams met three times: KMS was always present, the number of suppliers varied depending on the product flow being analyzed, and competition issues.

4.2.6 IPD/ESI (2018)

The NSI was to comprise two IPD/ESI projects involving different supplier subgroups. However, only one project was conducted due to industry downturns and delays. Semcon Devotek orchestrated the project, focusing on IPD/ESI and cost-efficient design. Initially, three suppliers were involved; however, as the project progressed, only one participated. Key learnings from the project were communicated to all suppliers by Semcon Devotek, KMS, and the supplier.

4.3 Effects of NSI activities

Suppliers' views on the effects of each activity were collected and meticulously tabulated and analyzed. Although there were differences, the similarities were dominant. All suppliers considered *LeanLab* "extremely useful for visualizing and introducing newcomers to practical, basic lean principles." *Study visits* were "essential for developing social bonds" as the participants could interact with people that they usually did not interact with, and gain inspiration. The suppliers' views on *Topic workshops* differed; some topics were more relevant for some suppliers than others. Suppliers with little previous lean experience found it challenging to implement all "lessons learned" in these workshops. All suppliers considered *On-site consultancy* "crucial for developing lean capabilities," with individual follow-ups and a focus on long-term results. The consultants' exercises were adapted to each supplier's needs and involved more organizational layers than other activities. Most suppliers wanted more on-site consultancy, possibly with the consultant "living with rather than visiting the organization." The *eVSM* tool enabled the suppliers to learn together and discover new methods for adjusting their internal flows to the network; most suppliers saw this as "the most important co-learning activity." Only one supplier was heavily involved in the IPD/ESI project; however, the learning from this was crucial. In summary, the activities developed for NSI enabled explicit and tacit knowledge-sharing but varied in importance and relevance for different suppliers. Nevertheless, all suppliers agreed that "the mix of activities was key" to developing individual and joint lean capabilities in the network, in the relationship with the buyer and among the suppliers. Furthermore, the suppliers realized that developing lean capabilities and a collaborative network takes time and "would have liked the program to continue for additional years, albeit less intensively," for better anchoring in and across the organizations.

4.4 NSI and performance

To evaluate NSI's impact on delivery time and quality indicators, KMS and the consultants monitored the participating firms' performance before the program and in its final phase. KMS reported a throughput time reduction for their organization, ranging between 30-70%, a 50% reduction in warranty costs, 30% in work-in-process, and 12% in tied-up capital. Although the suppliers experienced turbulent market conditions, an average improvement of 27.2% in on-time delivery was observed. Moreover, marginal quality improvement occurred, from 97.9% to 98.7%, with the target being 99% (Table II).

Table II. Performance results

Supplier*	On-time delivery (%) **		Quality conformance (%)	
	Before	After	Before	After
A	65.00	99.00	99.88	99.99
B	69.00	79.00	98.25	98.00
C	71.00	91.00	99.04	99.44
D	73.00	97.00	99.86	99.52
E	75.00	80.00	93.98	96.11
F	76.00	98.00	96.39	98.54
Improvement (average)	27.20%		0.72%	

* Supplier-requested anonymity

** One-off/small-batch deliveries for KMS projects

Suppliers reported lower stock and tied-up capital, and improved quality and on-time deliveries. “Participating in such a program, with an important customer, drives internal improvement work [and] convinces internal doubters and opponents,” reported one supplier. The suppliers “better understood the buyer’s business” (its strategy, products, production cost structure, purchasing, and operations). Some suppliers mentioned that the improvements benefited their other customers and enabled them to win contracts because of improved capabilities and reputation derived from their involvement in the NSI. Furthermore, some suppliers had cascaded lean practices toward their suppliers.

The improvements along KMS’s performance indicators and the supplementary results reported by the suppliers show that NSI improved the performance and capabilities of KMS’s supplier network. It suggested that a buyer can successfully apply a TSN-style approach while its lean capabilities are evolving, which was vital to KMS receiving the Lean Forum Norway Company award in 2017.

5. Analysis and discussion

The TSN inspired all NSI activities. Table III juxtaposes the main activities and development stages, showing actor(s) responsible for respective activities.

Table III. Contrasting TSN and NSI

TSN	Tie/knowledge type	TSN development stages	NSI relative	In NSI, conducted by
General meetings	Weak/explicit	Stage I	Lean Lab	SRM
Study visits	Weak/explicit	Stage I	Study visits	NCE-SE
Topic meetings	Weak/explicit	Stage I	Topic workshops	KMS, SRM
On-site consultancy	Strong/tacit	Stage II	On-site consultancy	SRM
Supplier learning teams	Strong/tacit	Stage III	eVSM	KMS, SRM
IPD/ESI	Strong/tacit	Stage II+III+IV	IPD/ESI	KMS, Semcon Devotek

5.1 Mix of knowledge-sharing activities

There are differences between the activities in TSN and NSI. For example, regarding knowledge-sharing content, the NSI uses LeanLab and TSN uses general meetings. Regarding frequency, topic meetings in TSN occurred more frequently than topic workshops in the NSI. The eVSM processes in TSN are shorter than those in NSI. However, both initiatives contain a mix of activities enabling explicit and tacit knowledge-sharing in settings that rely on weak dyadic, strong dyadic, or strong network relationships.

5.2 Characteristics of activities and network development stages

The duration of NSI differs markedly from that of TSN, although it is four years, proposed by Womack and Jones (2003) as the minimum for lean transformation. The number and frequency of activities per type were also lower. However, regarding stage sequencing, NSI resembled TSN: activities relying on weak dyadic ties preceded those relying on strong dyadic ties, and activities relying on weak network ties preceded those relying on strong ones. Until strong ties have been created, actions by other units in the buying firm should be explicated to not jeopardize the initiative; when the Purchasing department globally benchmarked prices on some products while the initiative was on-going caused some bewilderment among the six suppliers.

5.3 Roles of third parties

In the NSI, different third parties assumed responsibility for developing the suppliers' lean capabilities. This distribution of responsibilities was effective for six reasons:

5.3.1 Overcoming insufficient capacity for developing lean suppliers

When the NSI started, KMS was in lean transition. Although KMS had employees dedicated to developing lean capabilities internally, the capacity was insufficient for concurrently developing the suppliers' capabilities. However, the employees were in high demand: "The supplier showing the most progress should get a prize – one hour with KMS's lean coordinator" (Supplier CEO).

5.3.2 Supplementing lean capabilities during the transition

Having lean capabilities in transition means that capabilities have not yet progressed to a state of robust functionality. In such circumstances, teaching and training others is challenging, which is another reason why KMS involved third parties.

5.3.3 Building on capabilities of third parties

SRM and Semcon Devotek were contracted for their mature capabilities in lean and IPD/ESI enabling them to develop the NSI suppliers' capabilities.

5.3.4 Facilitating and improving interaction

Facilitating and improving interaction is vital in settings where interaction with a supplier occurs in confidence without the presence of the buyer or vice versa. It also carries weight in settings where both the buyer and the suppliers are present, and the third party assumes a facilitating role. Although SRM had not previously been contracted to develop lean capabilities of suppliers to a customer, their services to the NSI bore similarities to previous engagements. SRM also acted as an ombudsman between KMS and the six suppliers, resembling the pseudo-third-party role of the OMCD. Semcon Devotek developed the supplier capabilities to engage in ESI/IPD, resting on its ability to instill enough "psychological safety" (Edmondson, 1999) for the suppliers and KMS to interact openly.

5.3.5 Combining competition and cooperation

The intermediating roles of SRM and NCE-SE enabled co-opetition in the NSI. Nevertheless, the limited number of suppliers made it difficult to run several non-competitive subsets of suppliers.

5.3.6 The buyer as peer

KMS almost never acted as teacher. In some activities, it acted in the role of a diligent and engaged older student, eager to inspire the suppliers to strive towards higher levels of lean. In other activities, it was a peer walking alongside the suppliers on the lean journey, enabling the suppliers and KMS to inspire and learn from each other.

5.4 Additional relational features *important for realizing NSI*

5.4.1 Choosing deep supplier relationships

As TSN evolved, supplier relationships deepened, regarding lean and IPD/ESI. For NSI, KMS chose suppliers with whom it already had deep relationships, although these did not encompass lean and IPD/ESI and were less deep than Toyota's relationships. This enabled the NSI to compress Stage I and fast-track activities in the TSN-stages II+III+IV.

5.4.2 Using geographically proximate suppliers

In TSN, Toyota's suppliers moved facilities closer to Toyota, enabling JIT and tacit knowledge-sharing. All but one supplier selected for NSI was located nearby, convenient for tacit knowledge-sharing. The remaining supplier was located outside the region; however, the seminar schedules were adjusted to allow travel.

5.4.3 Handling dual sourcing, competition, and cooperation

Like Toyota, KMS uses dual sourcing. However, KMS did not separate the competing suppliers in the NSI as clearly as Toyota does in TSN, choosing instead to gather suppliers in most activities while keeping them apart in a few special activities focusing on tacit knowledge-sharing at supplier

premises. Some suppliers emphasized that it “takes longer to develop enough trust to interact openly in a supplier network like the NSI when competitors participate.”

5.4.4 Engaging third parties

In TSN, consultants provided by the Japanese government were central to strengthening the early Toyota SA (Fujimoto, 1999; Sako, 2004), comparable to IN-R’s role in the NSI. The focus on local and regional suppliers in the NSI coincided with the mission of IN-R which supported the NSI financially and administratively to develop SME suppliers and large companies (such as KMS). NCE-SE also had a regional focus and supported NSI administratively, organizationally, and financially, consistent with NCE-SE’s mission to develop innovative businesses based on “knowledge, competence, and collaborative solutions” among companies in the region. Involving one supplier outside the region was a point of discussion, but a compromise was reached.

5.4.5 Acknowledging supplier autonomy

KMS developed its own lean approach, “The Kongsberg Way.” Although KMS would like to be an example for its suppliers, it wanted the suppliers to develop their own approaches. Compared to TSN, KMS insisted less on the suppliers assimilating its approach, instead letting each supplier develop their way, compatible with the KMS approach but preserving the suppliers’ strategic identities and organizational cultures (e.g., Fosstech developed “The Fosstech Way”). That SRM and Semcon Devotek developed the suppliers helped preserve the suppliers’ autonomy.

In summary, this paper suggests that buying firms that aim to develop the lean capabilities of their suppliers in networks while their own lean capabilities are evolving can benefit from considering a set of partially interdependent tasks and issues related to the engagement of suppliers and third parties (Table IV), and from reflecting on how they fit the TSN-approach into their particular setting (cf. Benders and Van Bijsterveld, 2000).

Table IV: Main considerations for the concurrent development of lean capabilities

Tasks	Issues to consider
Designing the array of activities	<ul style="list-style-type: none"> • Choosing and customizing activity types that cater to <ul style="list-style-type: none"> • tacit and explicit knowledge-sharing • weak relationships, strong relationships, and strong networks • subgrouping suppliers to reflect dual sourcing, cooperation, and competition • Duration, number, and frequency of activities • Identify and allocate roles to internal participants from different layers and units • Processes in initiative's context, e.g., the timing of global benchmarking of prices
Designing the program	<ul style="list-style-type: none"> • Duration of program • Stages, and whether they can be skipped, shortened, or run concurrently
Engaging suppliers	<ul style="list-style-type: none"> • The strategic importance of relationships • Depth of relationships • Compatibility of strategy and priorities • Geographical proximity • The mix of suppliers to handle competition and collaboration • Need for strategic autonomy
Engaging third parties (lean or IPD/ESI capabilities)	<ul style="list-style-type: none"> • Mature lean or IPD/ESI capability • Available capacity • Opportunity and interest in capability redeployment • Ability to intermediate between buyer and suppliers • Ability to interact in confidence, separately, with connected parties • Ability to balance cooperation and competition among suppliers • Ability to preserve supplier autonomy
Engaging third parties (policy instruments)	<ul style="list-style-type: none"> • Compatibility of mission and goals • Responsibility for the geographical area • Relevance of programs and priorities • Availability of financial means and time frames

Thereby, we add nuances to the findings of Chiarini and Brunetti (2019) that firms implement lean internally before extending it to suppliers, and to the findings of Powell and Coughlan (2020), Hoque (2021) and Reitsma *et al.* (2021) by capturing how lean supplier capabilities can be developed in a network (rather than individually with suppliers), directly with an engaged buyer (rather than indirectly with an encouraging buyer), by involving a mix of capable third parties (rather than relying only on the buyer's capabilities and capacity).

6. Conclusions and implications

6.1 Conclusions

This case indicates that buying firms with evolving lean capabilities can develop a Toyota-style network and improve their supplier's lean capabilities and performance.

First, inspired by TSN, buying firms can design a mix of activities for explicit and tacit knowledge-sharing on lean and sequence these activities under the TSN-stages. The design need not be a carbon

copy of TSN, but tailored to the buying firm's context, strategic supplier relationships, and sourcing strategy.

Second, buying firms may select a mix of strategic suppliers with whom the buying firm already has deep relationships, thereby making it possible to skip, compress, or overlap some stages. Furthermore, if some suppliers are competitors, activities must be designed to accommodate co-opetition. To ensure continuity of efforts, especially if the initiative is of limited duration, buying firms should also assess the initiative's compatibility with the suppliers' strategic priorities, and anchoring in the organization.

Third, to overcome a lack of internally available, mature lean capabilities, the buying firm can engage a mix of third parties who can contribute with mature lean capabilities or financial, administrative and organizational resources, replacing or supplementing the buying firm's resources and capabilities. The buying firm must identify and mobilize third parties not only capable of developing the selected suppliers' lean capabilities but who see the engagement as well aligned with their strategy. For example, when key suppliers are local or regional, the buying firm may mobilize resources from local, regional (or national Arroyo-Lopez *et al.*, 2012) policy instruments or clusters that see it as part of their mission to develop suppliers and networks.

6.2 Implications for practitioners

Buying firms need not wait to develop their supplier networks until they have developed mature lean capabilities internally – they may start initiatives towards developing suppliers' lean capabilities while their lean capabilities are still evolving. Towards that end, they can draw inspiration from how Toyota developed its supplier network. However, it is important to choose a suitable mix of suppliers, and to design the content, frequency, and sequence of a mix of knowledge-sharing activities, as well as to involve a mix of third parties with capabilities to carry out activities adapted to the suppliers and the buying firm's particular operations, strategies, and context. In doing this, it is important to consider how well the third parties complement the buying firm, and how well they complement each other and fit with the selected suppliers. Initiatives may be limited in time; therefore, the buying firm must consider the duration, what will happen after the initiative ends, and whether it will be followed-up by third parties, the buying firm, and/or the suppliers on their own. Furthermore, the buying firm should consider how its own lean journey should develop: separate from, jointly with, or concurrently with the supplier network initiative.

Suppliers can accept invitations from buyers with evolving lean capabilities to participate in TSN-style initiatives. The potential for learning, and for improving performance and lean capabilities can be high when initiatives are well-designed with suitable mixes of activities, suppliers, and capable and committed third parties. Therefore, suppliers participating in such initiatives should consider the fit with their overall strategy and with their relational strategy for the particular buying firm.

Third parties can provide lean capabilities or financial, administrative, organizational resources to TSN-style initiatives. All types of third parties must consider how well the initiative aligns with their strategies. Policy instruments could pursue their strategies by co-designing and financing local, regional or national initiatives that cater to the development of SME suppliers to large buyers. Equally, they could strengthen the lean capabilities and cooperation among suppliers and buying firms. For lean consultants, developing suppliers on behalf of clients may be an atypical assignment. However, redeploying their lean capabilities at the level of networks may be an interesting avenue for business development.

6.3 Implications for research

Several avenues of research could be fruitful. First, when reviewing methods for assessing the lean maturity of buying firms, we found that few included supplier issues, and none to the extent that captured the TSN-approach. Therefore, one promising avenue could be to further develop lean maturity assessment methods to better capture buying firms' lean supplier network development efforts. Second, longitudinal studies could investigate how the buyer's and the suppliers' lean capabilities evolve over time, providing insight into connected evolutionary paths of lean, thus revealing what happens after the buyer's lean capabilities have reached maturity. Third, for initiatives of limited duration, time-compression diseconomies could be addressed (Dierickx and Cool, 1989) to reveal whether "too much, too fast" learning-by-doing results in shallower learning curves. Finally, further studies on lean consultation and masters (Kim, 2015; Holmemo *et al.*, 2018) could capture the interplay between a buying firm, its suppliers and third parties who can facilitate the concurrent development of lean capabilities in buying firms and their supplier networks.

References

- Alvesson, M. and Sandberg, J. (2011) "Generating research questions through problematization", *Academy of Management Review*, Vol.36, No.2, pp.247-271.
- Aoki, K. and Wilhelm, M. (2017), "The role of ambidexterity in managing buyer–supplier relationships: the Toyota case", *Organization Science*, Vol.28 No.6, pp.1080-1097.
- Aoki, K. and Lennerfors, T. (2013), The new, improved keiretsu, *Harvard Business Review*, Vol.91, No.9, pp.109-113.
- Arroyo-Lopez, P., Holmen, E., de Boer, L. (2012), "How do supplier development programs affect suppliers? Insights for suppliers, buyers and governments from an empirical Study in Mexico", *Business Process Management Journal*, Vol.18 No.4, pp.680-707.
- Ballé, M. and Handlinger, P. (2012), "Learning lean: don't implement lean, become lean", *Reflections*, Vol.12, No.1, pp.17-32
- Benders, J., Van Bijsterveld, M. (2000), "Leaning on lean: the reception of a management fashion in Germany", *New Technology, Work and Employment*, Vol.15, 50-64.
- Bicheno, J. and Holweg, M. (2016), *The lean toolbox: a handbook for lean transformation*, PICSIE Books, Buckingham.
- Bortolotti, T., Romano, P., Martínez-Jurado, P.J. and Moyano-Fuentes, J. (2016), "Towards a theory for lean implementation in supply networks", *International Journal of Production Economics*, Vol.175, pp.182-196.
- Braglia, M., Carmignani, G. and Zammori, F. (2006), "A new value stream mapping approach for complex production systems", *International Journal of Production Research*, Vol.44, pp.3929-3952.
- Bell, E., Bryman, A. and Harley, B. (2019), *Business research methods*, Oxford University Press, Oxford.
- Chiarini, A. and Brunetti, F. (2019), "What really matters for a successful implementation of Lean production?", *Production Planning & Control*, Vol.30(13), pp.1091-1101.
- Choi, T.Y. and Wu, Z. (2009), "Triads in supply networks: theorizing buyer–supplier–supplier relationships", *Journal of Supply Chain Management*, Vol.45, pp.8-25.
- Cocca, P., Marciano, F., Alberti, M. and Schiavini, D. (2019), "Leanness measurement methods in manufacturing organisations: a systematic review", *International Journal of Production Research*, Vol.57, pp.5103-5118.
- Cusumano, M.A. (1994), "The limits of Lean", *Sloan Management Review*, Vol.35, pp.27-32.
- De Silva, H.L.M. and Jayarathne, P.G.A. (2018), "Measurement scales for supplier development, buyer-supplier relationship, and supplier performance in the perspective of suppliers of the Asian countries", *International Journal of Physical and Social Sciences*, Vol.8, No.1, pp.1-19.
- Dierickx, I. and Cool, K. (1989), "Asset stock accumulation and sustainability of competitive advantage", *Management Science*, Vol.35 No.12, pp.1504-1511.
- dos Santos, L.D., Holmen, E. and Pedersen, A.-C. (2020), "Viewing lean supply from the IMP perspective", *Journal of Business & Industrial Marketing*, Vol.35 No.1, pp.172-182
- Dubois, A. and Gadde, L.-E. (2014), "Systematic combining"—A decade later", *Journal of Business Research*, Vol.67, No.6, pp.1277-1284.
- Dyer, J.H. and Hatch, N.W. (2004), "Using supplier networks to learn faster", *MIT Sloan Management Review*, Vol.45, pp. 57-63.
- Dyer, J.H. and Nobeoka, K. (2000), "Creating and managing a high-performance knowledge-sharing network: the Toyota case", *Strategic Management Journal*, Vol.21, pp.345-367.
- Edmondson, A. (1999), "Psychological safety and learning behavior in work teams", *Administrative Science Quarterly*, Vol.44, No.2, pp.350-383.
- Emiliani, B., Stec, D., Grasso, L. and Stodder, J., 2003. Better Thinking, Better Results: Using the Power of Lean as a Total Business Solution. *Center for Lean Business Management*, Kensington Connecticut.

- Fujimoto, T. (1999), *The Evolution of a Manufacturing System at Toyota*, Oxford University Press, New York.
- Fusch, P.I. and Ness, L.R. (2015), "Are we there yet? Data saturation in qualitative research", *The Qualitative Report*, Vol.20 No.9, pp.1408-1416.
- Glock, C.H., Grosse, E.H. and Ries, J.M. (2017), "Decision support models for supplier development: Systematic literature review and research agenda", *International Journal of Production Economics*, Vol.193, pp.798–812.
- Giunipero, C.L., and Denslow, L.D. (2022), "The evolution of supply chain literature: key theories, concepts and categorisations". Chapter 1 in *Handbook of Research Methods for Supply Chain Management*. Edward Elgar Publishing, Cheltenham.
- Hadjimichael, D. and Tsoukas, H. (2019), "Toward a better understanding of tacit knowledge in organizations: taking stock and moving forward", *Academy of Management Annals*, Vol.13 No.2, pp.672-703.
- Hallam, C. & Keating, J.P. (2014), "Company Self-Assessment of Lean Enterprise Maturity in the Aerospace Industry", *Journal of Enterprise Transformation*, Vol.4, pp.51-71.
- Helfat, C.E. and Peteraf, M.A. (2003), "The dynamic resource-based view: Capability lifecycles", *Strategic Management Journal*, Vol.24, pp.997-1010.
- Henriksen, B. and Rolstadås, A. (2010), "Knowledge and manufacturing strategy-how different manufacturing paradigms have different requirements to knowledge. Examples from the automotive industry", *International Journal of Production Research*, Vol.48, pp.2413-2430.
- Hines, P. (1994), "Internationalization and localization of the Kyoryoku Kai: the spread of best practice supplier development", *International Journal of Logistics Management*, Vol.5, pp.67-72.
- Hines, P. (2016), "Toyota supplier system in Japan and the UK", in Pawar, K.S., Rogers, H., Potter, A. and Naim, M. (eds.), *Developments in Logistics and Supply Chain Management*, Palgrave Macmillan, London, pp.113-124.
- Hines, P., Holweg, M. and Rich, N. (2004), "Learning to evolve: a review of contemporary lean thinking", *International Journal of Operations & Production Management*, Vol.24, pp.994-1011.
- Hines, P. and Rich, N. (1998), "Outsourcing competitive advantage: the use of supplier associations", *International Journal of Physical Distribution and Logistics Management*, Vol.28, pp.524-546.
- Holmemo, M. D.-Q., Powell, D.J., Ingvaldsen J.A. (2018), "Making it stick on borrowed time: the role of internal consultants in public sector lean transformations", *TQM Journal*, Vol.30, pp. 217-231.
- Holmemo, M.D.-Q., Rolfsen, M. and Ingvaldsen, J.A. (2018), "Lean thinking: outside-in, bottom-up? The paradox of contemporary soft lean and consultant-driven lean implementation", *Total Quality Management & Business Excellence*, Vol.29, pp.148-160.
- Hoque, I. (2022), "Buyer-assisted lean intervention in supplier firms: a supplier development approach", *Journal of manufacturing technology management*, Vol.33(1), pp.146-168.
- Hu, Q., Mason, R., Williams, S.J. and Found, P. (2015), "Lean implementation within SMEs: a literature review", *Journal of Manufacturing Technology Management*. Vol.26 No.7, pp. 980-1012.
- Irwin, J. (2021), "Toyota again has best relations with suppliers, study shows", <https://www.wardsauto.com/industry-news/toyota-again-has-best-relations-suppliers-study-shows> (2021-9-4).
- Iwao, S. and Kato, Y. (2019), Why can Toyota's keiretsu recover from earthquakes quickly? *Annals of Business Administrative Science*, Vol.18 No.6, pp.251-262
- Jayamaha, N.P., Wagner, J.P., Grigg, N. P. Campbell, N.M Harvie, A. and Harvie, W. (2014), "Testing a theoretical model underlying the 'Toyota Way' – an empirical study involving a large global sample of Toyota facilities", *International Journal of Production Research*, Vol.52 No.14, pp.4332-4350.

- Jia, M. Stevenson, M. and Hendry, L. (2021), "A systematic literature review on sustainability-oriented supplier development", *Production Planning & Control*, Vol.20, pp.1-21.
- Jones, D.T. and Womack, J.P. (2002), *Seeing the Whole: Mapping the Extended Value Stream*, Lean Enterprise Institute, Cambridge, MA.
- Kim, S. (2015), "Lean initiative practice for supplier developments in Philippines", *International Journal of Lean Six Sigma*, Vol.6 No.4, pp.349-368
- Knol, W.H., Slomp, J., Schouteten, R.L. and Lauche, K. (2018), "Implementing lean practices in manufacturing SMEs: testing 'critical success factors' using necessary condition analysis", *International Journal of Production Research*, Vol.56 No.11, pp.3955-3973.
- Kobayashi, M. (2014), "Relational View: Four Prerequisites of Competitive Advantage" *Annals of Business Administrative Science*, Vol.13, No.2, pp.77-90.
- Krause, D.R., Scannell, T.V. and Calantone, R.J. (2000), "A structural analysis of the effectiveness of buying firms' strategies to improve supplier performance", *Decision Sciences*, Vol.31, pp.33-55.
- Lamming, R. (1993), *Beyond Partnership: Strategies for Innovation and Lean Supply*, Manufacturing Practitioner Series, Prentice Hall, New York.
- Langfield-Smith, K. and Greenwood, M.R. (1998), "Developing co-operative buyer-supplier relationships: a case study of Toyota", *Journal of Management Studies*, Vol.35, pp.331-353.
- Lean Advancement Initiative. (2001), "Lean Enterprise Self-Assessment Tool (LESAT) Version 1.0", <https://dspace.mit.edu/handle/1721.1/81903> (2021-9-4).
- Liker, J.K. and Choi, T.Y. (2004), "Building deep supplier relationships", *Harvard Business Review*, Vol.82, pp.104-113.
- Liker, J.K., Kamath, R.R., Wasti, S.N. and Nagamachi, M. (1996), "Supplier involvement in automotive component design: are there really large US Japan differences?", *Research Policy*, Vol.25, pp.59-89.
- Liker, J.K. and Wu, Y.-C. (2006), "Japanese automakers, US suppliers and supply chain superiority", *Supply Chains and Total Product Systems: A Reader*, Vol.42 No.1, pp.81-93.
- Liu, L., M. Zhang, L. C. Hendry, M. Bu, and S. Wang. (2018), "Supplier development practices for sustainability: a multi-stakeholder perspective", *Business Strategy and the Environment*, Vol.27 No.1, pp.100-116.
- Loh, K.L. and Lau, D.H. (2019), "Blue ocean leadership in lean sustainability", *International Journal of Lean Six Sigma*, Vol.10 No.1, pp.275-294.
- Lu, D.J. and Bodek, N. (2018), *Kanban Just-in Time at Toyota: Management Begins at the Workplace*, (Ed.; D.J. Lu, Trans.), Routledge.
- MacDuffie, J.P. and Helper, S. (1997), "Creating lean suppliers: diffusing lean production through the supply chain", *California Management Review*, Vol.39, pp.118-151.
- Marksberry, P. (2012), "Investigating 'the way' for Toyota suppliers", *Benchmarking: An International Journal*, Vol.19 No.2, pp.277-298.
- Marodin, G.A., Frank, A. G., Tortorella, G. L., and Fetterman, D. C. (2019), "Lean production and operational performance in the Brazilian automotive supply chain", *Total Quality Management & Business Excellence*, Vol.30 No.3-4, pp.370-385
- Morgan, J.M. and Liker, J.K. (2020), *The Toyota product development system: integrating people, process, and technology*, Productivity Press, New York.
- Mukai, Y., Fujimoto, T., and Park, Y.W. (2019), "Virtual dual sourcing of specialized goods: lessons from supply chain disruption of Riken and Epson Atmix", *Journal of Enterprise Information Management*, Vol.32 No.1, pp.2-15.
- Mumani, A.A., Magableh, G.M. and Mistarihi, M.Z. (2022), Decision making process in lean assessment and implementation: a review, *Management Review Quarterly*, Vol.72, pp.1089-1128.
- Nightingale, D.J. and Mize, J.H. (2002), "Development of a lean enterprise transformation maturity model", *Information Knowledge Systems Management*, Vol.3, pp.15-30.

- Nishiguchi, T. (1994), *Strategic Industrial Sourcing: The Japanese Advantage*, Oxford University Press on Demand, Oxford.
- Nobeoka, K., Dyer, J.H. and Madhok, A. (2002), “The influence of customer scope on supplier learning and performance in the Japanese automobile industry”, *Journal of International Business Studies*, Vol.33, pp.717-736.
- Nonaka, I. (1994), “A dynamic theory of organizational knowledge creation”, *Organization Science*, Vol.5, pp.14-37.
- Nordin, N., Mohamed, R. and Uchihira, N. (2019), “Model of tacit knowledge transfer in lean management implementation in an organization”, in *Lean Manufacturing and Six Sigma - Behind the Mask*, L. Márquez, F & Ramirez, I & Bányai, T & Tamás, P (eds.) 2020, IntechOpen, London.
- Potter, A. and Paulraj, A. (2020), “Building supplier innovation triads: The effects of leadership relationships and alliance partner diversity”, *International journal of operations & production management*, Vol.40 No.2, pp.144-172.
- Potter, A. and Wilhelm, M. (2020), “Exploring supplier–supplier innovations within the Toyota supply network: A supply network perspective”, *Journal of Operations Management*, Vol.66, pp.797-819.
- Potter, A. (2022), “Exploring the role of lean managers within the Toyota supply network”, *Production Planning & Control*, Vol.33 No.8, pp.723-740.
- Powell, D.J. and Coughlan, P. (2020), “Rethinking lean supplier development as a learning system”, *International Journal of Operations & Production Management*, Vol.40 No.7/8, pp.921-943.
- Prajogo, D., Oke, A. and Olhager, J. (2016), “Supply chain processes: Linking supply logistics integration, supply performance, lean processes and competitive performance”, *International Journal of Operations & Production Management*, Vol.36 No.2, pp.220–238.
- Putre, L. (2021), “Which automotive OEMs have the best supplier relations?”, <https://www.industryweek.com/supply-chain/supplier-relationships/media-gallery/21165491/which-automotive-oems-have-the-best-supplier-relations> (2021-9-4).
- Reitsma, E., Manfredsson, P., Hilletoft, P. and Andersson, R., 2021. The outcomes of providing lean training to strategic suppliers: a Swedish case study. *The TQM Journal*, 33(5), pp.1049-1065.
- Sako, M. (2004), “Supplier development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement”, *Industrial and Corporate Change*, Vol.13, pp.281-308.
- Schoenherr, T., Griffith, D.A. and Chandra, A. (2014), “Knowledge management in supply chains: the role of explicit and tacit knowledge”, *Journal of Business Logistics*, Vol.35, pp.121-135.
- Schoenherr, T. and Wagner, S.M. (2016), “Supplier involvement in the fuzzy front end of new product development: an investigation of homophily, benevolence and market turbulence”, *International Journal of Production Economics*, Vol.180 No.10, pp.101-113.
- Shah, R. and Ward, P.T. (2007), “Defining and developing measures of lean production”, *Journal of Operations Management*, Vol.25 No.4, pp.785-805.
- Shamah, R.A.M. (2013), “Measuring and building lean thinking for value creation in supply chains”, *International Journal of Lean Six Sigma*, Vol.4, No.1, pp.17–35.
- Sisson, J. and Elshennawy, A. (2015), “Achieving success with lean”, *International Journal of Lean Six Sigma*, Vol.6 No.3, pp.263-280.
- Soriano-Meier, H. and Forrester, P.L. (2002), “A model for evaluating the degree of leanness of manufacturing firms”, *Integrated Manufacturing Systems*, Vol.13, pp.104-109.
- Sucky, E. and Durst, S.M. (2013), “Supplier development: current status of empirical research”, *International Journal of Procurement Management*, Vol.6, pp.92-127.
- Suh, Y. (2017), “Knowledge Network of Toyota: Creation, Diffusion, and Standardization of Knowledge”, *Annals of Business Administrative Science*, Vol.16, pp.91–102.
- Tortorella, G.L., Miorando, R. and Tlapa, D. (2017), “Implementation of lean supply chain: Empirical research on the effect of context”, *TQM journal*, Vol.29 No.4, pp.610-623.
- Wagner, S.M., (2006) “Supplier development practices: an exploratory study”, *European Journal of Marketing*, Vol.40, pp.554-571.

- Wan, H. and Frank Chen, F. (2008), "A leanness measure of manufacturing systems for quantifying impacts of lean initiatives", *International Journal of Production Research*, Vol.46, pp.6567-6584.
- Wee, H. and Wu, S. (2009), "Lean supply chain and its effect on product cost and quality: a case study on Ford Motor Company", *Supply Chain Management*, Vol.14 No.5, pp.335-341.
- Womack, J.P. and Jones, D.T. (2003), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation* (2.ed.), Free Press, New York.
- Womack, J.P., Jones, D.T. and Roos, D. (1990), *The Machine that Changed the World*. Rawson Associates, New York.
- Yin, R.K. (2018), *Case Study Research and Applications: Design and Methods*, SAGE Publications, Los Angeles.

ISBN 978-82-326-8020-7 (printed ver.)
ISBN 978-82-326-8019-1 (electronic ver.)
ISSN 1503-8181 (printed ver.)
ISSN 2703-8084 (online ver.)



NTNU

Norwegian University of
Science and Technology