Understanding company specific Lean production systems.
Is Lean getting lost in translation?

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Abstract

This research explores how Lean could be translated from a generic concept into a company specific production system (XPS). These types of translations are in practise often made by a XPS Support Function (XPS SF). The XPS SF of three cases serves as respondents. Theoretical implications of this research concern the translation of Lean as an important tool to understand the integration of Lean. Managerial implications concern the role of using translations of all Lean principles to develop a system that develops over time. Even if Lean is not completely lost in translation there are considerable difficulties to overcome.

Keywords: Lean, Production system, Translation

Introduction

Using a multiple case study approach, the purpose of this research is to explore how the Lean concept is translated by a support function into a company specific production system, a so-called XPS (Netland, 2012). Since the popularization of Lean by "The Machine that Changed the World" by Womack et al. (1990) and the subsequent "Lean Thinking" (Womack & Jones, 2003), Lean has achieved a widespread global usage, often through an adaption into an XPS. However, in many cases, the integration of Lean seems to be problematic (Hines et al., 2010; Mann, 2005; Sörqvist, 2013). Adding to this, the concept of Lean itself is not well defined (Pettersen, 2009; Keys et al., 1994). To overcome this dilemma, a common approach is to appoint an XPS Support Functions (XPS SF) to support the integration of Lean. Even though the importance of an XPS SF is noted by several scholars (Netland et al. 2015; Boscari et al. 2016), its role and function remain somewhat undefined. In practice, however, this function assumes the role of internal Lean specialists. Given this role, the translation of Lean into an XPS is a natural

first step in a Lean integration managed by the XPS SF. Langstrand (2012) proposes three types of Lean translations; these are idea-oriented, object-oriented and practice-oriented. For the purpose of this paper, the concept of translation will be limited to idea-oriented translation, with a case study design that focuses on how conceptual ideas are translated to a local rhetoric; this is important as it strongly influences peoples understanding of the concept. The objective of this paper is, therefore, to better understand how the Lean concept is translated by XPS SF:s and to explore potential challenges in that translation process. The research objective is operationalized into the following two research questions:

RQ 1: How could a Lean translation process be described?

RQ 2: What are challenges in a Lean translation process?

First, the paper starts with a theoretical framework with seven views of Lean adapted from Osterman (2015); these views provides a framework for data collection and analysis. The paper continues with a description of methods of investigation with case descriptions and how data was collected. Next results and analysis are presented, and finally, the paper ends with conclusions, theoretical and managerial implications together with suggestions for future research.

Theoretical framework

Lean has been studied extensively over several decades. The term Lean was proposed by Krafcik (1988), and the concept was popularized by Womack et al. (1990) and Womack & Jones (2003). They all established fundamental conceptual aspects of Lean such as flow, customer value, and waste. Even more important though, they proposed that this was a management concept that was applicable for *any* kind of operation. Over the years Lean descriptions were further developed by for instance Liker (2004), Wilson (2010), Emiliani (2007); the technical aspects to Lean integrations was expanded to philosophical, cultural as well as leadership aspects. This made possible an establishment of a kind of ideal image of Lean, still with numerous challenges though.

Within companies and organizations attempting to integrate Lean, the ideal image of Lean is often translated into a company specific production system, an XPS. The XPS can be formed from a pallet of Lean principles into a production system suited to specific circumstances (Netland, 2013). This selection can be seen as a translation from generic to specific (Langstrand, 2012). Even so, for instance, in an analysis of thirty XPS:s, none of them adopted exactly the same type of principles (Netland, 2012) indicating that the translational process is far from straightforward. For the purpose of this paper, a framework of seven views (See Table 1) is used to compare XPS integrations, but also to better understand in detail, how an XPS SF translates Lean into an XPS.

Table 1 - Different views of Lean, adapted from Osterman (2015)

Lean view	Analysis	Aspects
Foundational view (FV)	The intent and principles of the founders of TPS and others. These are based on self-reliance, pragmatic solutions, and cost control.	Just in time, Respect for people, Productivity, Non Cost principle, Hands-on experiments, Learning, Gemba, etc (Ohno, 1988; Ohno & Mito, 1988; Shingo, 1989; Monden, 2012)
Evolutionary view (EV)	The adaptable and evolutionary aspects of Lean where any situation can be improved.	Continuous improvement, Five why, Pursuit of perfection, True North, Sense of urgency, etc (Womack & Jones, 2003; Ohno, 1988; Fujimoto, 1999)
Tools & Methods view (T&MV)	The methods and tools of Lean can be seen as generalized sets of solutions. In essence, they describe the building blocks of Lean.	A3, Standardized work, Takt, Heijunka, Problem solving, S&EQDC, Pulse meetings, Customer value, Process results, Visualization, 7 Waste, etc. (Womack & Jones, 2003; Liker & Meier, 2012; Wilson, 2010)
Systems view (SV)	The dependencies of the tools and methods of Lean. The system is originally designed to be holistic and "fragile" to expose hidden problems.	Focus on whole flow, System factors, Framework Efficient flows, Value streams, 3M, Holistic view, etc. (Shimada & Macduffie, 1986; Monden, 2012; Shingo, 1989)
Philosophical view (PV)	The knowledge, attitudes and reasoning of individuals working with Lean.	Values, Respect, Brave, Commitment Accountability, Attitude, Challenge, Knowledge, Ownership, Motivation, A way of thinking, etc. (Ohno, 2013; Ohno & Mito, 1988; Liker, 2004)
Cultural view (CV)	The thoughts and ideas of Lean transformed into behavior and action, both on an individual level as well as the collective level.	Behaviour, Don't wait for a perfect situation, Action, Good enough, Teams, Competence, Knowledge sharing, Coaching, etc. (Mann, 2005; Fujimoto, 1999; Liker & Hoseus, 2012)
Leadership view (LV)	The balancing and direction of the Lean system. Prioritizing and deciding both what needs to be achieved and how. Training others as well as themselves.	Discipline, Escalation, Decision, Leadership, Support, Assign resources, Walk the talk, Create commitment, Feedback, Confirmation and follow up, Direction, Etc. (Liker & Meier, 2012; Ohno & Mito, 1988; Wilson, 2010)

The *Foundational view (FV)* is focused on the historical intent of the founders. Based on a sense of self-reliance combined with a pragmatic approach to problems and insights into human nature. FV origins from many sources, but the main contributors are Sakichi Toyoda, Kichiro Toyoda, Eiji Toyoda Shoichi Saito, Taiichi Ohno and Shigeo Shingo (Monden, 2012; Ohno, 1988, 2013; Ohno & Mito, 1988; Shingo, 1989; Sugimori et al., 1977). The evolution of what we today call Lean has been developed through trial and error (Monden, 2012). The *Evolutionary view (EV)* captures the emergent traits observed in a Lean production system in, what can be seen as, a maturity process (Hines et.al., 2004). This evolution has resulted in numerous tools and methods in generalized sets of solutions. The tools of Lean in the *Tools & Methods view (T&MV)* are the practical, context-dependent, manifestations of Lean principles in a system (Monden, 2012), and often depicted as a house or a temple. The system is intentionally designed to be "fragile" (Shimada & Macduffie, 1986) in order to make problems visible to resolve underlying causes. This is defined as the *Systems view (SV)* of Lean. The *Philosophical view (PV)* of Lean is the individual understanding of ideas, concepts and paradoxes that arise in the application of Lean. The *Cultural view (CV)* of Lean concerns how concepts and paradoxes are formed into a behavioral pattern within organizations (Liker & Hoseus, 2008). The cultural view of Lean also considers both collective and individual aspects of Lean. Finally, the *Leadership view (LV)* in Lean covers training and follow up (Monden, 2012) as well as commitment (Liker & Convis, 2012) and structure (Liker & Meier, 2006).

Method of investigation

Each case has been integrating Lean into their operation for some time, spanning from a few years to a few decades. All cases have an XPS SF that is responsible for the integration process and for formulating and visualizing the XPS. Each case has a variation in terms of business, product and scope. With an exploratory research approach, each case is designed as an example of a translation from Lean towards XPS.

Case 1 (C1) is a multinational transport company with around eleven thousand employees around the world. C1 has been working with the integration of Lean since 2010, driven by the difficult situation for their industry around the world. The C1: XPS has been developed over several years with SF traveling between facilities providing management with support and training in the integration of Lean into the various existing operations. The workshop was designed with 8 participants from the XPS SF at one of the company facilities; this enables the researchers (both authors) to observe XPS practices and artifacts.

Case 2 (C2) is a governmental agency responsible for regulation and control as well as the guiding documents that regulate a sector of society. The agency has around four hundred employees with the majority situated at a large centralized department and with various small satellite departments distributed in the country. C2 has been working with Lean since 2013, and elements of daily follow up and improvement work was visible in some departments. The workshop had 8 participants and took place at the centralized department; this way the researchers were able to observe the XPS practices and artifacts.

Case 3 (C3) is an international company with approximately forty thousand employees with seven major and five minor production units around the world. The company has been working with the integration of Lean since around 1995 with the XPS evolving through several generations. The visual depiction of the XPS has remained mostly unchanged over the last generation. The XPS SF is centrally organized with several local XPS SF´s that are connected in a semi-autonomous design. The workshop was designed with 9 participants and took place at one of the production units; this way the researchers could observe the XPS practices and artifacts.

Data collection

The research design is inspired by the first author experience of using methods that enables visualizations during group discussions. This method uses a facilitator (first author) asking pre-prepared questions to a group. First, participants writes individual responses on one or several notes without sharing. Second, responses are shared once all participants have completed their responses to the questions. Third, the notes are placed on a board available for all participants. Fourth, any facilitator or participant question related to a response is clarified. Workshop questions were developed based on three translational agents inductively generated during the development of the workshops. Agents are here seen as interconnected aspects of the translational process. The first agent captures the formal depiction of the XPS in an illustrated form. The next agent captures the keywords used by the XPS SF to describe the system and function of the XPS. The third agent explores how the XPS SF describes the keywords in terms of meaning. The

translational agents are intended to capture the span from the perceived to the performative for the XPS SF translation of Lean (Langstrand 2012). In total, this gives three workshop questions presented in Table 2.

Table 2 - Workshop questions

Workshop question 1: *How do we illustrate the XPS?*	This question is answered with a hand-drawn image from each participant that describes the visual communication or images that are used when communicating with the rest of the organization.
Workshop question 2: *What keywords are used to describe the XPS?*	The purpose of this question is to capture the vocabulary used by the support function to describe and discuss the XPS within the organization and also to enable comparison with the visualization of the XPS.
Workshop question 3: *What is the meaning of each keyword?*	This question allows the support function to expand and discuss the meaning of each keyword from WSQ2. This captures the deeper meaning of each keyword and also any ambiguities or misalignment in the group.

The respondents were given instruction on how the method was designed, informed that participation was voluntary and that data was treated as confidential. The workshop was audio recorded. Both researchers participated in all group discussions, one (first author) acting as the workshop facilitator in an active role, and the other (second author) observing and recording. When all answers to a question were presented by the respondents, the active researcher leads the group in an effort to cluster the different answers in groups; several similar answers were grouped with a new keyword label. The observing researcher noted the manner in which the participants approached the question, if they seemed to be in agreement or whether there were any disagreements between respondents. Each session required between 4 – 6 hours to complete. The resulting boards with answers to questions were photographed and transcribed into a format suitable for in-depth analysis.

Results

The case studies resulted in totally 401 responses. For an overview of the distribution of the responses, see Table 3. The detailed distribution of the responses (below in fig 1-3) in reference to the seven views of Lean, is further illustrated in percent to enable a visual comparison within and between C1, C2 and C3.

Table 3 - The no. of responses from the multiple case study

	XPS Principles & Values	Keywords	Meaning (explanations)
Case 1	12	18	102
Case 2	8	20	95
Case 3	13	28	105

Case 1 – eight years of XPS integration experience

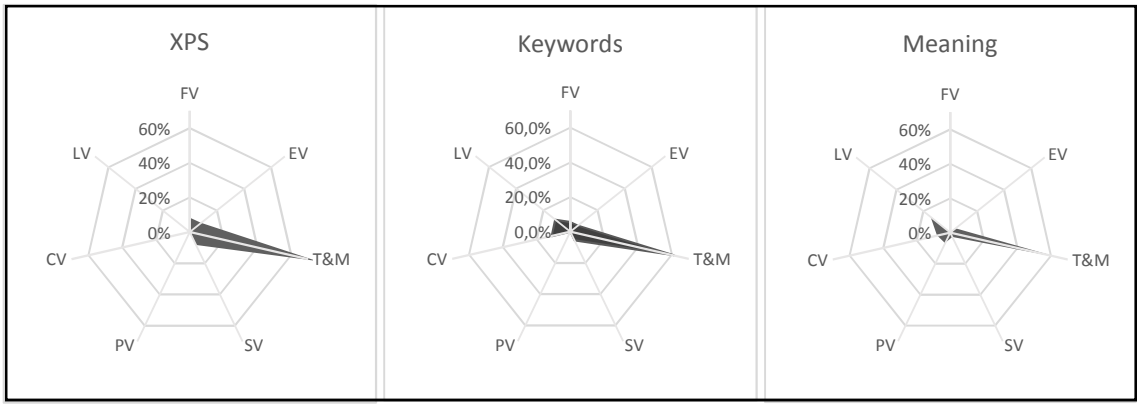

Fig 1 - Case 1: XPS-Keywords-Meaning

The XPS of case 1 is heavily focused on tools and methods (*T&M*) that are commonly associated with Lean. Some Lean views were not covered at all in the XPS. The values of the system were stakeholder-based. When asked to identify keywords describing the system the respondents kept a focus on tools and methods (*T&M*). It became obvious that the execution of specific methods and measurements according to plans and timetables was a focus of the system in all three translation agents. There was some expansion of the discussion to include leadership (*LV*) and the cultural aspects (*CV*) of Lean. Interestingly the underlying philosophical aspects (*PV*) of Lean were not covered at all. The respondents kept a distinct focus on the tools and methods (*T&M*) and the practical application of Lean with a minor emphasis on leadership and follow-up. The foundational view (*FV*) and the systems view (*SV*) were not covered at all, or to a very small extent.

Case 2 – five years of XPS integration experience

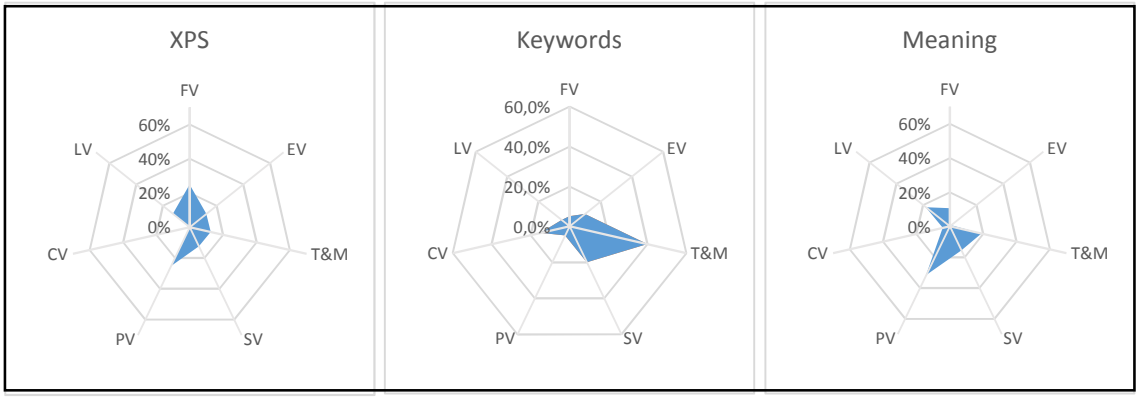

Fig 2 - Case 2: XPS-Keywords-Meaning

Case 2 covered many views of Lean but they were expressed in general or vague forms with little definition. The values were normative and attitude based, describing the desired mindset of the employees working in the system. In total, the overall impression is that the XPS is underdeveloped and lack some of the components that are typical for a Lean production system such as the Toyota Production System.

In contrast to the lack of focus in C2: XPS, when discussing the keywords, the respondents shifted to a practical approach and had a somewhat distinct tools and methods

(*T&M*) focus as well as a systems focus (*SV*). The foundational (*FV*), philosophical (*PV*) and leadership views (*LV*) were covered to a small extent. The third shift for C2 occurred when the respondents were asked to explain the meaning of keywords. Although some tools and methods remained as well as a systems aspect, the main shift was to the philosophical aspects (*PV*) of Lean as well as leadership questions (*LV*). The evolutionary aspects (*EV*), as well as the cultural aspects (*CV*) were not covered at all or to a limited extent.

Case 3 – more than two decades of XPS integration experience

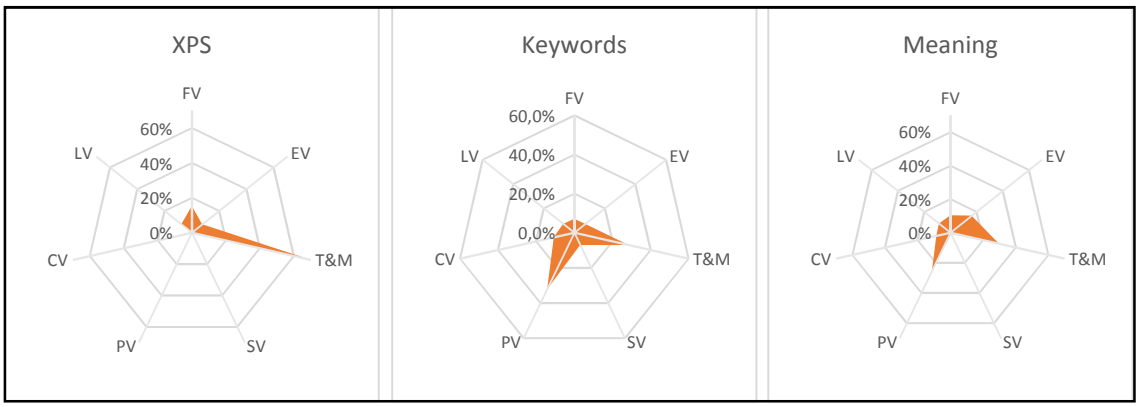

Fig 3. - Case 3: XPS-Keywords-Meaning

The XPS of Case 3 had principles that cover quality and demand, continuous improvements as well as flow with a major focus on the tools and methods (*T&M*) of Lean and very little focus on the other views of Lean. The values of the system were stakeholder-based. In discussions of the production system keywords, the respondents referred very little to the principles of the formal XPS but retained to a general tools and method focus (*T&M*). In addition to this, the understanding of the system was clearly important and the philosophical view (*PV*) became more important. This was a shift from the C3 XPS where neither the philosophical view (*PV*) nor the cultural view (*CV*) was mentioned. The balance between the tools and methods (*T&M*) and the philosophical view (*PV*) remained stable when the respondents were asked to explain the production system. Interestingly the systemic aspects (*SV*) of the production system were not discussed at all although the rest of the Lean views were, at least to some extent, covered in the discussion.

Analysis

Referring back to the research questions and relating to the translational agents, the following Lean translation process is proposed, see Fig 4. Using the seven views of Lean as a reference, it seems that a translation from generic Lean into an XPS is neither clear or self-evident.

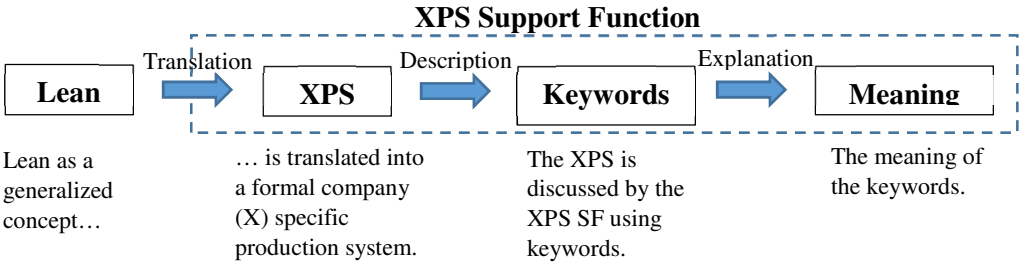

Fig 4 - Lean translation process

As the research design of this study is explorative, the categories for answering RQ1 in Table 4 (Stable /Shifting) and RQ2 in Table 5 (Broad/Narrow/Dual focus) are all inductively generated.

*Table 4 - Description of a **Lean translation process***

	XPS → Keywords	**Keywords → Meaning**
Case 1	Stable	Stable
Case 2	Shifting	Shifting
Case 3	Shifting	Stable

Stable: Insignificant changes from XPS to keywords or from keywords to meaning, indicating consistency
Shifting: Significant changes from XPS to keywords or from keywords to meaning, indicating inconsistency

For C1 the pattern was predictable. The C1 XPS was consistently described and explained during the workshop. Although the C1 XPS SF discussed the meaning of certain keywords, a consensus was achieved quickly. For C2 the pattern was more complicated. There were significant differences between what the C2 XPS stated, how it was described in the keywords and how the keywords later were explained. The C2 XPS SF had a great need to discuss the meaning of keywords but did not indicate awareness of shifting inconsistencies in meanings. For C3 the XPS seemed almost irrelevant but the XPS SF also indicated consistency between the keywords and their meaning. Although there were disagreements between XPS SF participants the dialogue was focused on refining details and not specifying general concepts.

*Table 5 - **Challenges in a Lean translation process***

	XPS	**Keywords**	**Meaning**
Case 1	Narrow	Narrow	Narrow
Case 2	Broad	Dual focus	Broad
Case 3	Narrow	Dual focus	Dual focus

Narrow: One view is the most important
Dual focus: Two views are most important.
Broad: Several different views indicated as important

For C1 the focus was narrow. The tools and methods of Lean were indicated clearly as being important by the C1 XPS SF at the exclusion of almost all other views. This was also clear when listening to the pragmatic and results-oriented attitude of the C1 XPS SF. C2 was almost of the completely opposite nature. The C2 XPS had a broad approach, but when explaining the C2 XPS through keywords the focus shifted to the *System view* and also the *Tools & Methods view* of Lean. When asked to explain what the keywords meant, the focus shifted again to a *Philosophical view* and *Leadership view* of Lean. The C2 XPS SF indicated uncertainty of the concept in discussions. For C3 the focus of the C3 XPS

was as single-minded *Tools & Methods view* as for C1, but when asked to explain the C3 XPS using keywords, the C3 XPS SF used a different and much more complex vocabulary with a focus on the *Philosophical view* of Lean without excluding the *Tools & Method view.* Apart from the dual focus, the other views were indicated as important but to a significantly lesser extent. The dual focus remained mostly the same in the process of explaining the meaning of keywords.

Conclusion

By using the three translational agents in the research design it became obvious that a simple examination of the terminology of an XPS by itself is not sufficient to understand how a company or an organization translates Lean. Using an exploratory workshop design with respondents from XPS SF, several problems were observed. Referring back to RQ1, translation from generic *Lean → XPS → Explanation → Meaning* could be either stable or shifting. This could be indicating agreement and calibration such as for C1, or uncertainty and lack of calibration within the XPS SF such as for C2. A third example was C3, that had the most experience of integrating Lean among the three cases, was shifting when translating from *XPS → Explanation* but obviously stable when going from *Explanation → Meaning*. Reviewing the data, a possible explanation could be that the C3 XPS was outdated compared to how the C3 XPS SF worked in practice. Interpreting the results of RQ2 is more complicated. A narrow focus on *Tools & Methods* such as for C1 can give short-term results, and this was indeed observed in the process. However, there is also a risk that the organization will be unaware of the other views of Lean, threatening the sustainability of the gains. The example of C2 has a broader approach but when combined with the results of RQ1 it seems that the focus, although covering several views of Lean, is immature and shifting. The C2 XPS SF is still finding its way. C3 exemplifies the problem of how to review and update a successful concept. The C3 XPS focused on *Tools & Methods,* but when asked for keywords and meaning the C3 XPS SF expanded to the *Philosophical view* using a more complex language. This indicates that there is a temporal aspect to the translation of Lean with a need to retranslate after some time. Theoretical implications of this research concern the concept of XPS as a research tool. XPS, as defined by Netland (2012), is an important tool to understand the integration of Lean. However, understanding an XPS by its stated principles alone does not seem to be sufficient. This research is, therefore, an attempt to add depth to the creation of an XPS through an illumination of the translational process and the role of the XPS SF. There are also several managerial implications. C2 serves as an example that an XPS might be too simplistic when attempting to integrate Lean. If the XPS is to serve as a template for the organization, it has to describe all the principles that are necessary for Lean or it will not work as a system, opening up for local interpretation and cherry picking. Secondly, as exemplified by C3, the XPS development is time-dependent. For example, the *Tools & Methods* emphasis in the C3 XPS are outdated compared to how the C3 XPS SF actually describes and understands the C3 XPS. As the focus of this research has been an idea-oriented translation with translation agents, future research should include object-oriented translation and practice-oriented translation as proposed by Langstrand (2012). Further understanding of how Lean is translated into an XPS also requires a broader case study design with more variations. Hence, even if Lean is not completely lost in translation; shifting of meaning, selecting of focus and lack of updates implies that integration of

Lean becomes more challenging than it has to be. Finally, the role and abilities of the XPS SF need to be further explored.

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