



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

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Dipartimento di Tecnica e Gestione dei Sistemi Industriali

SCUOLA DI DOTTORATO DI RICERCA IN
INGEGNERIA GESTIONALE ED ESTIMO

CICLO XXVII

**LEAN SYSTEMS EFFECTIVENESS AND TRANSFERABILITY
ACROSS MULTINATIONAL CORPORATIONS:
THE ROLE OF CULTURE**

Direttore della Scuola: Chiar.mo Prof. Cipriano Forza

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Dottorando: Stefania Boscari



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Summary

Lean management is a managerial approach widely recognized as powerful in reducing waste and continuously improving production processes of a factory. Many manufacturing organizations worldwide have implemented it obtaining significant enhancement in operational performance. Besides adopting it locally within a single factory, in recent decades a growing number of multinational corporations (MNCs) have sought to implement lean across their foreign factories. However, several lean projects at both single- and multi-factory level encountered problems, and some even failed to achieve such benefits.

Culture is widely considered to be a critical success factor for lean implementation. There is yet a strong debate whether societal culture or organizational culture is most important in determining the success of lean implementation projects. Therefore, this thesis aims to enhance the understanding of the role of culture – both at societal and organizational level – in lean implementation by examining two related topics:

1. The distinctive characteristics of a successful lean manufacturing unit;
2. The transferability of successful lean systems across dispersed manufacturing factories within MNCs.

To that purpose, two main research projects have been conducted. The High Performance Manufacturing project, involving 317 manufacturing units in 3 sectors and 10 countries, was used to explore the first topic according to survey methodology. For what concerns the second topic, I studied 7 successful lean transfer projects by mean of a multiple case study and an in-depth case study. The projects involved European sources and Chinese and U.S. recipients belonging to 4 different multinational corporations; in-depth case study focused on one of such project, launched by an Italian MNC towards its subsidiary in China.

The findings of my research indicate that successful and unsuccessful lean factories differ for some organizational culture dimensions and for the extent of adoption of soft lean practices (i.e., lean practices concerning people and relations). Therefore, these characteristics are likely to make the difference in the successful implementation of lean.

With regard to transferability of successful lean systems, results from in-depth case study stress the influence of cultural differences – in terms of extent of difference between source and recipient as well as peculiarities of the latter – on the success of the lean transfer project, and the importance of adopting a transfer approach that take into account such differences.

Moreover, results from the multiple case study suggest that major problems in transferring a lean system are context specific – i.e., similar within a context and different between China and U.S.. In order to succeed in transferring lean, source should adapt their projects; as

shown by the cross-case analysis, the level of adaptation can be affected by the socio-cultural characteristics of a recipient unit and the organizational culture of the source.

Collectively, these results contribute to the literature by providing a better understanding of the role of culture in lean implementation not only within local factories, but also in manufacturing subsidiaries overseas. Results can be particularly useful also for practitioners that are facing the challenging of implementing lean at international level.

Riassunto

Il lean management è un approccio manageriale ampiamente riconosciuto come efficace nella lotta alla riduzione degli sprechi aziendali e nel miglioramento continuo dei processi produttivi di uno stabilimento. Molte imprese produttive in tutto il mondo hanno implementato tale approccio ottenendo significativi miglioramenti delle performance operative. Oltre ad adottarlo a livello locale all'interno di un unico stabilimento, negli ultimi decenni un numero crescente di imprese multinazionali hanno cercato di implementare il lean nei loro stabilimenti stranieri. Tuttavia, molti progetti lean sia a livello di singolo stabilimento che coinvolgenti più stabilimenti hanno incontrato difficoltà ed addirittura alcuni non hanno garantito i benefici previsti.

La cultura è ampiamente considerata un fattore critico di successo per l'implementazione del lean. In letteratura, però, vi è un forte dibattito riguardo l'importanza dei valori di cultura nazionale o di cultura organizzativa nel determinare il successo dei progetti di implementazione del lean. Questa tesi si propone quindi di migliorare la conoscenza del ruolo della cultura – sia a livello nazionale che organizzativo – nell'implementazione del lean esaminando due argomenti strettamente correlati:

1. Le caratteristiche distintive degli stabilimenti lean di successo;
2. La trasferibilità di sistemi lean di successo tra stabilimenti produttivi localizzati globalmente, nel caso delle imprese multinazionali.

A tal fine, sono stati condotti due principali progetti di ricerca. Il progetto “High Performance Manufacturing”, che coinvolge 317 unità di produzione in 3 settori e 10 paesi, è stato utilizzato per esplorare il primo tema secondo il metodo survey. Per quanto riguarda il secondo argomento, ho studiato 7 progetti di trasferimento del lean di successo per mezzo di un caso studio multiplo e un caso studio singolo approfondito. I progetti sono avvenuti tra stabilimenti europei e destinatari cinesi e statunitensi di 4 diverse multinazionali; il caso studio singolo riguarda uno di tali progetti, avviato da una multinazionale italiana verso la sua filiale Cinese.

I risultati della mia ricerca indicano che gli stabilimenti lean di successo si differenziano dagli stabilimenti lean con basse prestazioni operative per alcune dimensioni della cultura organizzativa e per il livello di utilizzo delle pratiche lean soft (i.e., le pratiche lean che riguardano la gestione delle persone e delle loro relazioni). Pertanto, queste sembrano essere le caratteristiche che fanno la differenza nell'implementazione di successo del lean.

Per quanto riguarda la trasferibilità dei sistemi di lean di successo, i risultati del caso studio singolo sottolineano l'influenza delle differenze culturali – intese sia in termini dell'entità della differenza tra gli stabilimenti nonché delle peculiarità dello stabilimento ricevente – sul

successo di un progetto di trasferimento lean e l'importanza di adottare un approccio di trasferimento che tenga conto di tali differenze.

Inoltre, i risultati del caso studio multiplo suggeriscono che i principali problemi nel trasferimento di un sistema snello sono specifici del contesto – cioè, simili in uno stesso contesto e diversi tra Cina e Stati Uniti. Al fine di trasferire il lean con successo, i progetti dovrebbero essere adattati; come mostrato dall'analisi cross-case, il livello di adattamento può essere influenzato dalle caratteristiche socioculturali dell'unità ricevente e dalla cultura organizzativa dello stabilimento che gestisce il progetto.

Collettivamente, questi risultati contribuiscono alla letteratura fornendo una migliore comprensione del ruolo della cultura nell'implementazione del lean, non solo all'interno di stabilimenti locali, ma anche nelle filiali produttive all'estero. I risultati possono essere particolarmente utili anche per i professionisti che si trovano ad affrontare la sfida di implementare il lean a livello internazionale.

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1. Introduction

1.1 Background: lean management and culture

Lean management is a philosophy that follows five principles – value, value stream, flow, pull, and perfection – to eliminate every source of waste from the production processes (Womack and Jones, 1996). It leverages an integrated socio-technical system of practices which reduce internal as well as external process variability, thus allowing operational performance improvement (Shah and Ward, 2003; Li et al., 2005). The success achieved by Toyota, the Japanese automotive firm who conceived and implemented lean first, and by several other lean organizations in different countries and industries has led many firms to start a lean project to eliminate waste and significantly improve their performance. In particular, driven by the steeply increasing globalization, in recent decades a growing number of multinational corporations (MNCs) have sought to implement lean not only locally, within a single factory, but across factories located worldwide (Netland and Aspelund, 2014).

However, several lean projects at both single- and multi-factory level encountered problems, and some even failed to achieve benefits (Liker and Rother, 2011). Scholars advanced several causes for this lack of success, namely, the complexity of lean implementation (Lander and Liker, 2007; Mackelprang and Nair, 2010), the existence of contingency factors limiting its positive impact (Bortolotti et al., 2013), the focus on Just-In-Time practices without adequate consideration of other important operations management dimensions (Matsui, 2007; Agarwal et al., 2013), and the lack of attention to human resource management (Bateman, 2005; Agarwal et al., 2013). In particular, culture is certainly among the most critical and widely acknowledged in the lean literature (e.g., Spear, 1999; Liker, 2004; Rother, 2009; Kull et al., 2014).

Scholars have studied the role of culture in successful lean implementation focusing on two main levels of culture: organizational culture and societal culture. On the one hand, some authors provided evidence that factories which successfully implement lean are characterized by specific organizational culture values and behaviors, such as long-term thinking and strategic approach to management, use of a lot of face-to-face contact and open communication, cooperation between employees, even those working in different functions/divisions as well as in different hierarchical levels (Spear, 1999; Liker, 2004; Rother, 2009). On the other hand, some scholars found that societal cultural values may favor or hinder the adoption of lean practices, thus affecting its effectiveness (Hofer et al., 2011; Kull et al., 2014). According to a practice-culture perspective (Lozeau et al., 2002; Ansari et al., 2010), in fact culture values characterizing a particular country may be different

from lean ones; the resulting incongruence between values and lean practices may lead to difficulties or even unsuccessful implementation of lean. In particular, studies on lean implementation at single-factory are quite unanimous in considering organizational culture as a fundamental factor influencing performance, while in case of multi-factory implementation also societal culture seems to be of primary importance in determining the success of lean projects.

1.2 Motivation for the doctoral thesis, main objectives and research questions

Although literature highlights the importance of analyzing the interplay between lean and culture, previous contributions on this issue are fragmented and show significant limitations. In particular, a first limitation of studies focusing on lean implementation within a single factory is linked to the narrow set of organizational culture dimensions, lean practices and performance considered. Instead, an in-depth understanding of how lean and organizational culture can interact thus influencing a firm's performance requires a comprehensive view of the phenomenon, which should be based on a holistic model considering the various dimensions of organizational culture, lean and performance. In addition, the majority of researchers studied organizational culture as an antecedent of lean practices but, as observed by Prajogo and McDermott (2005), arguments for the impact of lean practices on organizational culture were also advanced by several scholars, thus making an investigation considering the potential mutual relationships between these factors more appropriate. The basic assumption is that, not only can some organizational culture dimensions favor the successful implementation of lean, but also lean practices that are defined as soft – such as those concerning work organization, human resource management, relations or strategy. These can influence the behavior and beliefs of employees, thus creating the right organizational culture for the successful implementation of lean. Finally, previous contributions providing a more comprehensive analysis of the phenomenon (e.g., Spear, 1999; Liker, 2004; Rother, 2009) generally focused on the Toyota case history, without leveraging on well-established organizational culture models. Hence, in order to understand if and how organizational culture affects the successful implementation of lean, I distinguished between soft and hard lean practices, and examine the differences between lean implementers both in terms of organizational culture dimensions and soft lean practices. In line with other studies (e.g., Prajogo and McDermott, 2005; Rahman and Bullock, 2005; Fotopoulos and Psomas, 2009), lean practices in this research will be referred to as soft and hard. The first ones concern human resource management, relations, people and strategy and the latter refer to lean technical and analytical tools (e.g., kanban and statistical process control).

The aim is investigating whether the successful implementation of lean is related to a certain organizational culture profile and the adoption of soft lean practices.

Unlike lean adoption within a single unit, the analysis of lean implementation in multiple factories within MNCs has received little attention from scholars (Netland and Aspelund, 2014). Lean transfer projects are shown to be strategic for MNCs when seeking to achieve a superior competitive advantage (Colotla et al., 2003; Jensen and Szulanski, 2004). However, they are particularly complex to be implemented; besides problems characterizing lean adoption within a factory, managers have to deal with issues concerning the heterogeneity between contexts (Maritan and Brush, 2003). Although some scholars recognized the relevance of contextual variance in affecting lean transfer project effectiveness, and few previous studies also provide some hints on such relation, the literature is still lacking in providing a framework which explain how cultural differences influence the transfer of a successful lean system. Even if some contributions provide empirical evidence on criticalities faced by firms when transferring lean abroad (e.g., Bollbach, 2012) and give some indications on how overcoming a number of criticalities (e.g., Aoki, 2008), further research is needed to better analyze specific problems in lean transfer projects thus providing effective countermeasures. In particular, a relevant and heated debate is still present concerning the convenience of adapting source's practices and solutions when transferring lean to foreign subsidiaries. In fact, while some scholars support strong adaptation (e.g., Wallace, 2004; Lee and Jo, 2007), others consider faithful replication of the original lean knowledge a more effective transfer approach (e.g., Ferdows, 2006).

This thesis intends to provide a twofold contribution to this research stream. First, it aims at providing a deep examination of the impact of cultural differences between an Italian MNC and its Chinese subsidiary on lean knowledge transfer process, and the effectiveness of different transfer approaches. Second, the intent is to better explain how effectively managing lean knowledge across a number of lean knowledge owners and recipients in MNCs. Along with these points, problems in transferring lean knowledge across factories in different countries, and effective countermeasures adopted by MNCs to cope with such criticalities will be analyzed.

Overall, the thesis aims to provide a better understanding of *the role of culture in lean implementation* at both single- and multi-factory levels. Three set of research questions were formulated according to this purpose.

- RQ1 Do successful lean manufacturing units show a peculiar organizational culture?*
- RQ1a What is the ideal organizational culture profile for lean?*
- RQ1b Do successful lean factories adopt soft lean practices more extensively compared to unsuccessful lean factories?*

This first set of research questions focuses on lean implementation on a single-unit level and aims to define the peculiarities of successful lean factories, in terms of organizational culture dimensions and extent of use of soft versus hard lean practices.

- RQ2 How do cultural differences between an Italian unit (lean source in a MNC) and a Chinese subsidiary (non-lean recipient) influence the transfer of lean management?*
- RQ2a How do cultural differences influence the effectiveness of lean knowledge transfer approach? Why do different lean knowledge transfer approaches lead to different outcomes?*
- RQ2b How should an Italian factory adapt its lean system to fit peculiarities of a Chinese subsidiary?*

This second set of research questions concerns lean implementation within an overseas manufacturing unit of a MNC. It aims to better understand the impact of societal culture, in terms of peculiarities of the recipient unit as well as extent of the difference between source and recipient, on a lean transfer project.

- RQ3 How can MNCs handle factories' cultural differences in cross-border lean knowledge transfer projects?*
- RQ3a How do cultural contexts of the source and recipient influence cross-border lean knowledge transfer projects within MNCs?*
- RQ3b What are the main variables differentiating cross-border lean knowledge transfer projects within MNCs?*

This third group of research questions complements the second set by providing additional insights on cross-border lean implementation within MNCs. In particular, the research aims to extend the analysis of the impact of cultural characteristics on a lean transfer project by focusing on recipient as well as source cultural peculiarities. Besides identifying and describing main variables differentiating cross-border lean knowledge transfer, it intends to shed light on the influence of culture on problems as well as suitable level of adaptation of a transfer project.

1.3 Research methodology

Two main projects were used to address the research questions in Section 1.2.

1.3.1 HPM project

In order to address the *first set of research questions*, I developed two hypotheses considering the difference between successful and unsuccessful lean factories in terms of organizational culture dimensions and the extent of adoption of soft lean practices. I tested them using survey methodology. In particular, I adopted the multi-group analysis method and used the High Performance Manufacturing (HPM) database.

HPM is an international research project set out to analyze the relationships between firms' practices and performance. The HPM sample includes 317 manufacturing factories operating in mechanical, electronics, and transportation equipment sectors (SIC codes: 35, 36 and 37, respectively) and located in ten countries, i.e., Austria, China, Finland, Germany, Italy, Japan, South Korea, Spain, Sweden, and the US.

The HPM project started in the nineties. Some rounds of data collection occurred over the years. In particular, data used in this thesis belongs to the third round. Although I had not the opportunity to participate in the third round of data collection, I have collaborated in the fourth round of data gathering (in progress).

In order to investigate the research hypotheses I used the multi-group analysis method using LISREL 8.80 (Sorbom, 1974). The aim was to test for differences between high-performance and low-performance lean factories in terms of organizational culture dimensions and application of lean practices. Numerous researchers attested the advantages of Sorbom's (1974) method compared to the traditional general linear models (e.g., Lubke et al., 2003, and Raykov, 2001). These advantages are linked to the possibility of estimating the parameters for all groups simultaneously. As a matter of fact, this approach facilitates a comparison of different theoretical models to determine the one that best fits the data. Furthermore, it allows to evaluate latent mean differences, taking into account measurement error variance, thus obtaining more precise and accurate results compared to methods, such as the t-test or ANOVA (Martinez-Costa et al., 2009).

1.3.2 European MNCs

In order to address the *second set of research questions*, an in-depth case study was carried out at an Italian MNC with a subsidiary in China.

In-depth case study methodology was adopted since it allows to deeply analyze the process under examination and to provide detailed insights on how transferring activities are affected by socio-cultural differences between source and recipient units (Voss et al., 2002). As highlighted by Netland and Aspelund's (2014), literature on lean knowledge transfer is scarce and several issues are still open. Yin (1989) suggested in-depth case when little prior research has been conducted.

The theoretical sampling approach guided the selection of the case study (Eisenhardt, 1989). My aim was to identify a case that would have guaranteed a transparent description of the transfer process in a setting characterized by high cultural difference. Since my research focuses on the early phases of a lean implementation project, I chose a MNC that have recently launched lean knowledge transfer initiatives towards a non-lean subsidiary. In particular, the dyad considered – i.e., a source unit and a recipient factory of a MNC (Gupta and Govindarajan, 2000) – involves a Chinese manufacturing factory and its Italian headquarters.

This firm was also included in the sample of European MNCs selected so as to answer to the *third group of research questions* according to a multiple case study method.

The research arising from the third set of research questions is explanatory as well as exploratory in its nature. Indeed, besides relating cultural differences to transfer problems and countermeasures, it also characterizes and operationalizes the main variables differentiating cross-border lean knowledge transfer projects within MNCs. Multiple case-study methodology was adopted to address the third set of research questions, since it is extremely valuable to identify and describe crucial variables as well to discover links between them (Yin, 1994). I analyzed seven transfer projects at a dyadic level, i.e., projects between a source unit and a recipient factory of a MNC, which is regarded as an appropriate unit of analysis to explore transfer project within MNCs (Gupta and Govindarajan, 2000).

The process of case selection involved two major phases. First, a list of lean MNCs was identified, considering MNCs which had collaborated in master courses/university workshops on lean management and/or member of lean clubs/associations (e.g., Lean Enterprise CLUB of CUOA Business School). Second, I gathered data on these MNCs and their lean projects so as to determine if a MNC could be interesting from my research's objective point of view. I focused on lean MNCs with headquarters in Europe that have recently transferred their lean systems to non-lean subsidiaries in China and U.S.. Data gathered on the field allowed me to select a sample which satisfies both literal and theoretical replication issues (Yin, 1994). In particular, I selected four cases in which the recipient is a Chinese factory and three cases in

which the recipient is a U.S. factory. China and U.S. provide examples of polar types of societal cultures, thus are useful to explore how such variable can affect the transferability of a lean system (Eisenhardt, 1989). Moreover, I selected dyads involving sources with both similarities and differences in terms of organizational culture values. In particular, my sample includes three cases in which the source has an OC1 characterized by a low power distance and four cases in which the source has an OC2 characterized by a high power distance.

For all cases, I verified that the source unit has attested experience in lean, and that the lean knowledge transfer project provided successful results, i.e., lean knowledge transferred was routinized and lean practices persisted within the recipient factory, and the source monitored the status of lean implementation over time through KPIs and audits (e.g., number of standard works/procedures developed over time, audits on 5S).

Given the sensitivity of the data under investigation, confidentiality was a key factor in ensuring “open and honest” dialogue with the MNCs. Therefore, I don’t disclose the MNCs’ identity.

Semi-structured interviews represent my main source of data. Managers in charge of lean knowledge transfer projects, their team members and other managers deeply involved in the transfer projects (e.g., supervisors of lean projects within the MNC, managers who supported lean transfer project planning or practice adaptation) were interviewed in the period between March 2013 and April 2014. In order to increase research reliability, I also analyzed information from other sources such as companies’ documents (e.g., A3 documents on lean strategy deployment or company’s X matrix, the handbook of lean standards, the standardized procedures for implementing each lean practice, etc.) and web source, and triangulated these information with data from interviews (Eisenhardt, 1989). In addition, guided-tours of factories within each dyad allowed direct observations of lean practices implemented, and thus to verify the correctness of the data/information gathered during the interviews and from documents. For what concerns the in-depth case study, I also closely supervised a master student who performed his master project (about 7 months of work) in the firm.

1.4 Personal interest and publications

During my first year as a PhD student, I have experienced different kinds of “multicultural contexts” on the field. During a visit of an Italian shipyard, for instance, I found out that day-by-day production activities were carried out by groups of people belonging to several countries, and

different cultures (i.e., foreign professionals required for ship building, but not available among Italians, work with Italian employees). I also recognized the need of other Italian manufacturers to face multicultural contests, as a consequence of the decision to internationalize the production. In particular, some of these MNCs were facing the challenge of replicating the successful experience of lean implementation in their subsidiaries abroad. Driven by these practical cases, which manifested an interest of practitioners toward cultural topic, and an evident lack of research in the literature, I decided to focus my research on cultural topic and, in particular, on the role of culture in lean implementation at both single- and multi-factory levels.

During my PhD I have conducted both individual and collaborative research with enthusiasm. As a result of the great effort and devotion I put in my work, I also realized some scientific publications, which were presented in renowned national as well as international conferences in operations management, and published in qualified academic journals. The following publications are related with the present thesis:

1. *Bortolotti, T., Boscari, S., & Danese, P. (2015). Successful lean implementation: Organizational culture and soft lean practices. **International Journal of Production Economics**, 160, 182-201.*
2. *Bortolotti, T., Boscari, S., & Danese, P. (2013). LEAN MANAGEMENT AND ORGANIZATIONAL CULTURE: EVIDENCES FROM HPM PROJECT. At AiIG Conference 2013, Milano (Italy), 17-18 ottobre 2013.*
3. *Boscari S., Danese P., & Romano P. (2014). Creating a lean culture across national boundaries. At Cross Cultural Business Conference 2014, Steyr (Austria), 14 maggio 2014.*
 - **Under revision in International Journal of Production Economics**
4. *Boscari S., Danese P., & Romano P. (2014). Effective lean knowledge transfer across manufacturing units in multinational corporations. At EurOMA 2014, Palermo (Ireland), 20-25 giugno 2014.*
 - **Winner of Harry Boer Highly Commended Award**
 - **Invited for possible inclusion in the EurOMA 2014 special issue in International Journal of Operations & Production Management**
 - **Under revision in International Journal of Operations & Production Management**

1.5 Structure of the thesis

The following part of the thesis is structured into 6 chapters.

Chapter 2 evaluates the state-of-the-art of the research into culture and lean management. Literature review involved two main phases. First phase concerns a general literature overview concerning the three main areas involved in this thesis: Section 2.1 focuses on culture in operations management, Section 2.2 on practice or knowledge transfer and Section 2.3 on lean management. Second phase concerns the literature analysis of studies dealing with culture and lean implementation at both single- and multi-factory level, discussed in Sub-Section 2.4.1 and 2.4.2 respectively.

Chapter 3 focuses on successful lean implementation within a manufacturing unit. Section 3.1 presents the research hypotheses considering the distinctive characteristics of successful lean factories in terms of organizational culture dimensions and extent of use of soft lean practices. Section 3.2 describes the methodology adopted and Section 3.3 presents the results.

Chapter 4 and 5 focus on the transferability of successful lean systems across dispersed manufacturing factories within MNCs. In particular, Chapter 4 considers the lean transfer project launched by an Italian MNC towards its Chinese subsidiaries. Section 4.1 describes the methodology adopted, Section 4.2 presents the case study and Section 4.3 summarized the key lessons learned from the experience of the Italian MNC.

Chapter 5 considers the 7 lean transfer projects between European MNCs and Chinese and U.S. subsidiaries. Section 5.1 describes the methodology adopted, Section 5.2 presents the within-case analysis and Section 5.3 reports the cross-case analysis.

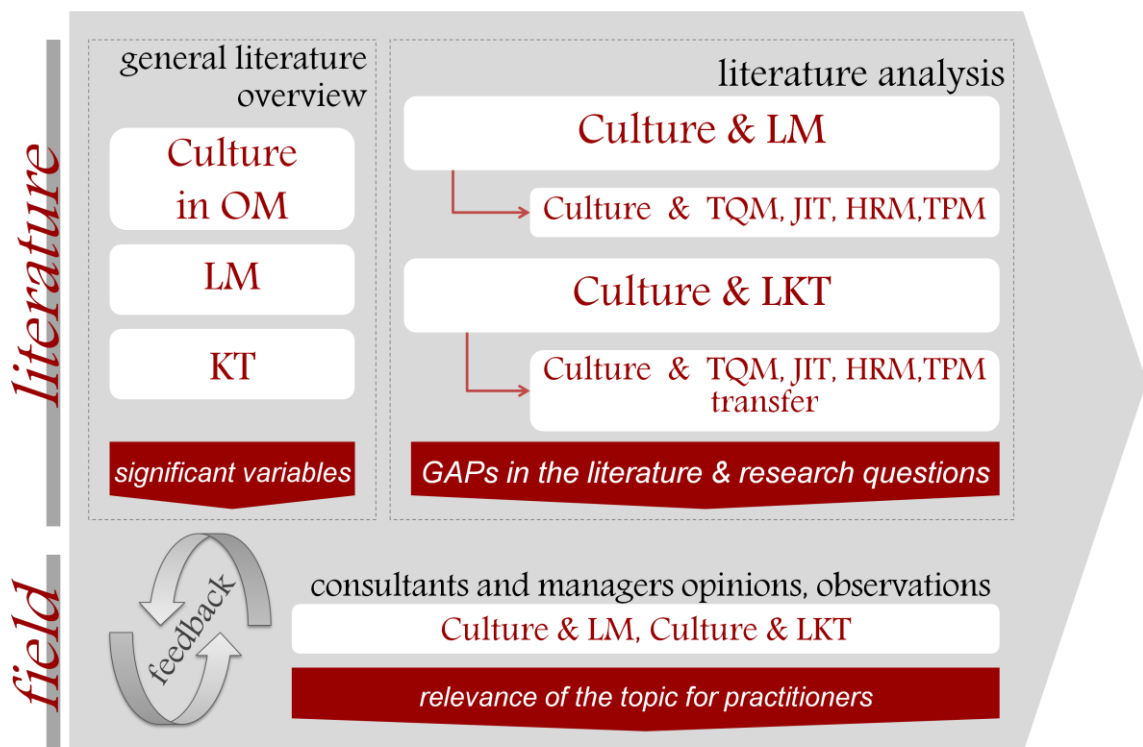
Chapter 6 discusses the contributions of the thesis, limitations and opportunities for future research. In particular, Section 6.1 focuses on lean implementation within a manufacturing unit, while Section 6.2 concerns lean knowledge transfer between units of MNCs.

Finally, Chapter 7 summarizes the theses briefly reporting the research questions, the answers to such questions based on the research findings, contributions and limits.

2. Literature review, research gaps and research questions

As schematized by **Figure 1**, literature review involved two main phases. First phase concerns a general literature overview. In particular, I analyzed studies concerning culture in operations management (OM) so as to identify the most significant variables used by operations management scholars to deal with culture. In addition, I reviewed contributions on lean management (LM) to provide a general overview of this stream of research. In particular, I focused on lean adoption within a single-factory (indicated as LM in **Figure 1**) as well as lean implementation at multi-factory level in case of MNCs – i.e., practice or knowledge transfer (KT). In fact, feedbacks from the field, which I have constantly gathered from consultants and managers since the beginning of my research, highlighted that nowadays the challenge faced by many firms is not only to implement lean within headquarters or historical local factories, but also in newer subsidiaries overseas. Therefore, I also analyzed studies concerning practice or knowledge transfer (KT).

Figure 1: Literature review



As a second phase, I conducted a deep analysis of studies exploring the role of culture in lean implementation. I examined contributions considering a wide set of lean practices as

well as those focusing on one or more relevant bundles of lean practices, such as Total Quality Management (TQM), Just-In-Time (JIT), Human Resource Management (HRM), and Total Preventive Maintenance (TPM). In particular, I focused on lean implementation within a single manufacturing factory, but I also considered lean knowledge transfer (LKT) projects between dyads – i.e., a source and recipient manufacturing units – in MNCs. This second phase allowed me to identify gaps in the literature, thus defining the research questions.

In the following sections I will present the literature review. Section 2.1 focuses on culture in operations management, Section 2.2 on practice or knowledge transfer and Section 2.3 on lean management. Studies dealing with culture and lean implementation at single- and multi-factory level will be discussed in Sub-Section 2.4.1 and 2.4.2, respectively.

2.1 Culture in Operations Management

In order to identify the most significant variables used by operations management scholars to study culture, I initially reviewed studies in the Scopus database including “Culture” or “Cultural” keywords together with “Operations Management” within “Article Title, Abstract, Keywords”. Abstract reading allowed to exclude not pertinent document titles, such as works belonging to other streams of research or dealing with culture in a very marginal way. Afterwards, partial or full paper reading led to identify the most significant variables regarding culture.

A main variable concerns the *level of culture*. In particular, the majority of the authors referred to organizational culture and societal culture values. For what concerns the *number of levels* studied, several scholars focused on organizational culture or societal culture, while few considered the interplay between the two levels. Moreover, they dealt with culture according to a different *degree of detail*, i.e., as an overall concept or considering complementary sub-dimensions (less and greater detail, respectively). Finally, a different *number of units* were analyzed. In particular, the majority of the authors focus on a singular cultural profile, while some compared the cultural profile of two or more units.

The following paragraphs provide an overview on organizational culture and societal culture.

The literature on organizational culture is deep-rooted in the field of social sciences. Since the early 80's a growing number of scholars has been interested in the topic of culture, and this has resulted in a proliferation of organizational studies on the role of culture within organizations. As noted by Ginevičius and Vaitkūnaite (2006), empirical and theoretical contributions concern three main topics: organizational culture description, organizational

culture operationalization (i.e., organizational culture dimensions and scales development), and assessment of organizational culture impact on firm performance.

Several definitions and conceptions of organizational culture have been provided by scholars over the years (Detert et al., 2000). Although a widely accepted view is still lacking in the literature, several similarities can be found among the different definitions provided (Denison et al., 2012). Indeed, Detert et al. (2000, page 851) stated that: "These definitions have in common the view that culture consists of some combination of artifacts (also called practices, expressive symbols, or forms), values and beliefs, and underlying assumptions that organizational members share about appropriate behavior".

A broad number of researchers has considered organizational culture as a measurable characteristic of organizations (O'Reilly and Chatman, 1996; Sørensen, 2002). Thus, several models have been developed in order to provide an appropriate measure; the ones by Schein (1992), Hofstede (1990), O'Reilly et al. (1991), Quinn and Rohrbaugh (1983), House et al. (2002) are among the most renowned and used.

Driven by the globalization and increasing relevance of international operations, a growing number of researchers have considered the societal culture. Similar to studies on organizational culture, it can be observed that empirical and theoretical contributions focused on the three main topics: societal culture description, societal culture operationalization (i.e., societal culture dimensions and scales development), and assessment of societal culture impact on firm performance.

Considering societal culture description and operationalization, a major debate in the literature concerned the issue whether societal culture and organizational culture could be considered as similar phenomena, thus operationalizable through the same models and dimensions. Hofstede et al.'s (1990) perspective supporting different description and operationalization seemed to prevail for a while. In particular, these scholars distinguishes between a more superficial level of culture involving practices characterizing organizational culture – process vs. result oriented, employee vs. job oriented, parochial vs. professional, closed vs. open; loose vs. tight control, and normative vs. pragmatic – and more profound values representing societal culture – power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, and long- vs. short-term orientation. However, more recently researchers of the GLOBE project empirically demonstrate the opposite view, providing a set of nine dimensions that can be used to measure both societal culture and organizational culture (House et al., 2002).

A group of about 150 social scientists and management scholars worldwide have been engaged in the GLOBE project (House et al., 2004). One of their main purposes was to

develop a measurement model for culture and analyze the impacts of organizational culture and societal culture on company performance. Based on an extensive review of the literature GLOBE researchers developed a new measurement model of organizational culture, comprising nine dimensions: uncertainty avoidance, power distance, societal collectivism, in-group collectivism, gender egalitarianism, assertiveness, future orientation, performance orientation, and humane orientation (House et al., 2004). Beginning with the analysis of existing research, the GLOBE researchers proposed and empirically tested a comprehensive measurement model of culture including several dimensions, each measured through a multi-item scale.

In recent years, a growing number of operations management scholars have chosen to use the GLOBE measurement model to operationalize organizational culture and societal culture, thus investigating the impact of societal and organizational culture on company performance (e.g., Naor et al., 2010; Kull and Wacker, 2010; Kull et al., 2014). In line with these studies, the present thesis refers to GLOBE cultural dimensions except for gender egalitarianism dimension (**Table 1**).

Table 1: The culture dimensions considered (organizational level in italics)

| Culture dimensions | Definitions |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Power distance</i> | The degree to which members of <i>an organization</i> or society expect and agree that power should be stratified and concentrated at higher levels of an organization. |
| <i>Institutional collectivism</i> | The degree to which <i>organizational</i> and societal institutional practices encourage and reward collective distribution of resources and collective action. |
| <i>In-group collectivism</i> | The degree to which individuals express pride, loyalty, and cohesiveness in <i>their organizations</i> or families. |
| <i>Future orientation</i> | The degree to which individuals in <i>organizations</i> or societies engage in future oriented behaviors such as planning, investing in the future, and delaying individual or collective gratification. |
| <i>Performance orientation</i> | The degree to which <i>an organization</i> or society encourages and rewards group members for performance improvement and excellence. |
| <i>Gender egalitarianism</i> | The degree to which an <i>organization</i> or society minimizes gender role differences while promoting gender equality. |
| <i>Assertiveness</i> | The degree to which individuals in <i>organizations</i> or societies are assertive, confrontational, and aggressive in social relationships. |
| <i>Uncertainty avoidance</i> | The extent to which members of <i>an organization</i> or society strive to avoid uncertainty by relying on established social norms, rituals, and bureaucratic practices. |
| <i>Humane orientation</i> | The degree to which individuals in <i>organizations</i> or societies encourage and reward individuals for being fair, altruistic, friendly, generous, caring, and kind to others. |

Source: House et al. (2004)

Several studies were developed to provide empirical evidence of the relationship between culture and performance (e.g., Gordon and DiTomaso, 1992; Lee and Yu, 2004; Naor et al., 2010; Kull and Wacker, 2010; Prajogo and McDermott, 2011).

Different kinds of performance were considered (Lim, 1995), such as financial (Peters and Waterman, 1982; Kotter and Heskett, 1992) and operational performance (Prajogo and McDermott, 2011). However, in the first case, it is generally recognized that results can be affected by external factors, and thus it is difficult to distinguish the real contribution of culture dimensions to a firm's success (Prajogo and McDermott, 2011).

The interplay issue between societal culture and organizational culture has played a leading role in the stream of literature exploring cultural-performance relationships (Naor et al., 2010). The flattening of the world tendency (Friedman, 2006), and the consequent shift of competition from local to global borders, has raised its importance. In particular, two conflicting theoretical perspectives were advanced by scholars, based on the so-called *convergence versus divergence hypothesis* (Child and Kieser, 1979; Shenkar and Ronen, 1987), stating the relative dominance of organizational culture and societal culture respectively. On the one hand, the *convergence hypothesis* assumes that firms can alter the behavior of their employees, which naturally is a reflection of their societal culture. Proof of this assumption, for instance, is the gradual convergence of companies in developing nations towards practices and a corporate culture typical of firms in industrialized countries (Ralston et al., 1997). On the other hand, the *divergence hypothesis* considers a company's efforts to vainly alter their employees' behavior and values. Indeed, the value system intrinsic in societal culture, and strongly rooted in individuals, remains unchanged (Ralston et al., 1997). As remarked by several scholars (e.g., Boisnier and Chatman, 2002; Liu, 2003; Karahanna et al., 2005), the issue concerning the role of different cultural levels has been debated in the literature and has yet to be resolved.

Considering contributions focusing on *lean implementation at factory level*, some recent studies have begun to shed light on this issue (Gerhart, 2008; Naor et al., 2010). In summary, Gerhart's (2008) analysis didn't support the hypothesized role of societal culture as a constraint of organizational culture; whereas Naor et al. (2010) found that organizational culture does not completely reflect societal culture differences and that organizational culture is more dominant than societal culture or their interaction in predicting operational performance. In addition to this, literature provides several examples of how over the years some best practices, such as lean, have been effectively applied in manufacturing units across the world. For example, after 1980s, Japanese practices such as Just-In-Time and Total Quality Management began to be successfully emulated in many other countries

(Schroeder and Flynn, 2001) and today, several factories in different nations adopt lean successfully (Evans and Lindsay, 2005; Shook, 2010).

Consistently with these arguments, this thesis focuses on organizational culture when dealing with distinctive characteristics of a successful lean factory (Sub-section 2.4.1, Chapter 3, and thus Section 6.1).

2.2 Knowledge transfer

Review of operations management literature dealing with culture (Section 2.1) allowed to identify a group of studies concerning a particular type of practice implementation, in which culture can play a crucial role. It concerns *the transfer of knowledge between units*, such as factories of a MNC, firms in a supply chain or in a supply network, etc.. Feedbacks from consultants and managers on the field confirmed that nowadays this phenomenon is particularly relevant for lean firms with factories located in different countries; thus, I decided to deepen knowledge transfer topic.

I used Scopus database focusing on contributions involving "Knowledge Transfer" and its variants (e.g., "Practice Transfer", etc.) within "Article Title, Abstract, Keywords". Besides supporting the exclusion of not pertinent document titles, abstract and partial paper reading allowed to clearly distinguish different types of knowledge transfer, such as knowledge transfer between different firms in a supply chain or firms related by an alliance, etc.. This thesis concerns lean implementation within firms, thus I focuses on internal knowledge transfer, i.e., transfer of knowledge within units of a MNC. In particular, I analyzed the transfer of best practices between dispersed manufacturing factories of the same firm which, as mentioned before, turned out to be a main challenge for practitioners in general, and for lean MNCs in particular. Partial or full paper reading led to identify the most significant variables regarding knowledge transfer topic.

Literature in organization and management studies is rich of contributions on how learning takes place in organisations. A central stream of learning theories traditionally focused on knowledge and practice transfer among units within a single factory; more recently, driven by a growing attention of literature to inter-firm dynamics (see for example the great development of contributions in supply chain management field), many authors have devoted their studies to deeply analyze knowledge and practice transfer in interorganizational network (i.e., groups of distinct organizations, one from each other). Levering on both bodies of research, some scholars have then used previous results to provide a greater understanding of learning processes in the specific case of MNCs.

As defined by Argote and Ingram (2000; p. 161), "Knowledge transfer in organizations is the process through which one unit (e.g., group, department, or division) is affected by the experience of another." As indicated by this definition and explained by Szulanski (1996), internal knowledge transfer is a process that occurs at dyadic level between a source and a recipient units of a firm. In case of MNCs, a major role is played by inter-unit transfers such as ones between subsidiaries or dyads involving a parent group and a subsidiary factory, which often take place internationally (Kostova, 1999; Gupta and Govindarajan, 2000; Maritan and Brush, 2003; Jensen and Szulanski, 2004). Internal knowledge transfer refers to the exact or partial replication of organizational best practices that are performed in a superior way in a part of the firm (Szulanski, 1996; Kostova, 1999; Gupta and Govindarajan, 2000), and manifests itself through changes in the knowledge and performance of the recipient units (Argote and Ingram, 2000).

The transfer of organizational best practices between manufacturing units is a fundamental way in which MNCs leverage knowledge to seek competitive advantage (Jensen and Szulanski, 2004). However, studies on knowledge transfer have also indicated that such projects are often very difficult (Szulanski, 1996), with frequent incidence of transfer failure (Galbraith, 1990; Gupta and Govindarajan, 2000). Therefore, a number of scholars have focused on analyzing *factors* that can influence the difficulty of transfer and transfer project effectiveness, thus precluding the achievement of competitive advantage through reusing organizational best practices in multiple locations.

First of all, these works show that transfer difficulties are related with the characteristics of the *content* that is being replicated. Some authors have distinguished between tacit vs. explicit dimensions of knowledge (e.g., Ferdows, 2006), others for example between hard or technical vs. soft or social dimensions (e.g., Winter, 1990; Yu and Zaheer, 2010). They shown that while explicit or hard knowledge is easier to codify and can be diffuse by means of documents and manuals, tacit or soft knowledge concerns know-how and know-way that is more difficult to codify and hard to convey without high interaction between the parties (Kogut and Zander, 1993; Mohr and Sengupta, 2002).

From the literature it is also clear that certain *contextual factors* can act as facilitators or barriers to knowledge transfer, thus influencing the effectiveness of transfer projects. A first classification of contextual factors consider societal versus organizational levels.

Societal level factors are particularly important in case of knowledge transfer within MNCs, since units are often located in different nations, characterized by specific peculiarities. Several scholars referred to societal culture values of recipient factories, providing evidence of their effects on the effectiveness of knowledge transfer. Kostova (1999) observed that while some countries constitute more favorable environments for the transfer of certain

practices, others introduce a number of criticalities and challenges (Kostova, 1999). Researchers studied culture considering not only the peculiarities of a recipient unit (i.e., in absolute terms), but also the characteristics of a recipient unit respect to ones of the source unit (i.e., in relative terms). In particular, the presence of a high cultural difference between source and recipient units, which typically characterized knowledge transfer between overseas factories, can be particularly challenging (e.g., Kostova, 1999; Jensen and Szulanski, 2004).

Moreover, authors shown that also some *organizational level factors* can contribute to create a barren or a fertile context for internal knowledge transfer. In particular, organizational culture values promoting communication between the parties as well as a cultural orientation toward learning, innovation, and change can generally be favorable for practice transfer (Kostova, 1999; Gupta and Govindarajan, 2000). Furthermore, organizational culture values promoting cooperative relations among units in combination with commitment to, identity with, and trust in the parent company are likely to facilitate knowledge transfer (Kostova, 1999); while arduous (i.e. laborious and distant) relationships are likely to create additional hardship in the transfer (Szulanski, 1996). Hofstede (1994) stressed the relevance of creating common organizational culture values units within MNCs since they are what keeps multi-factory firms together.

For what concerns *recipient*, lack of absorptive capacity, i.e. “ability to recognize the value of new information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal, 1990, p. 128), is commonly referred as a characteristic that might hinder the transfer of knowledge. For example, Gupta and Govindarajan (2000) provide evidence of its negative impact on knowledge inflows to foreign subsidiaries, considering data from 374 subsidiaries within 75 MNCs headquartered in the U.S., Europe, and Japan. Absorptive capacity is largely a function of pre-existing stock of knowledge of an organization; it acts as a filter through which more relevant information are distinguished from less important one, thus determining the organization’s ability to internalize and assimilate more valued signals (Cohen and Levinthal, 1990).

As suggested by Szulanski (1996), the expertise of a *source* unit is a major factor influencing knowledge transfer difficulty. For example, when a source is not recognized as knowledgeable, its attempts to transfer practices are likely to be resisted (Walton, 1975). Conversely, a skilled source that has experienced a successful implementation of a specific set of practices can effectively support their application in other factories (Maritan and Brush, 2003).

In other to overcome transfer problems, some authors recommended to strongly adapt the source’s practices and solutions (e.g., Prahalad and Doz, 1987; Ghoshal and Bartlett, 1988;

Kostova, 1999). According to Ansari et al. (2010), in fact adaptation allows to create a better fit between transferred practices and the recipient's particular needs, thus increasing their acceptance. In a similar way, Lozeau et al. (2002) suggested that the shape of the change should be socially reconstructed with recipient's employees, even though this process inevitably creates hybrid solutions and modification of the source's practices. However, this transfer approach is not supported by all scholars; in fact, there are researchers who, on the contrary, suggested to adapt with care (Zaheer, 1995; Jensen and Szulanski, 2004). According to Jensen and Szulanski (2004), in fact adaptation significantly increases the difficulty of cross-border knowledge transfer. In addition, Zaheer (1995) suggested to follow the source's original template rather than embark on full adaptation, since the first approach is a more risk-free way to proceed. Literature is still characterized by a considerable debate on the most suitable level of adaptation.

Consistently with previous arguments, this thesis considers both organizational culture and societal culture values when dealing with transferability of successful lean systems across dispersed manufacturing factories within MNCs (Sub-section 2.4.2, Chapter 4 and 5, and thus Section 6.2). Since the level of knowledge of the parties can also affect the effectiveness of transfer projects, we control for such characteristics when selecting source and recipients units (see Sub-section 4.1.1 and 5.1.1).

2.3 Lean management

Lean management descended from Toyota Production System (TPS). TPS was developed by the Japanese automotive firm Toyota as an alternative to the capital-intensive mass production systems used in the U.S., on the basis of experiments and initiatives occurred over a period of three decades under the supervision of Taiichi Ohno (Shah and Ward, 2007; Herron and Hicks, 2008). As a result of lean implementation, Toyota achieved significant benefits such as important reductions in inventory and lead-times, improvements in delivery performance and in space and resource utilization, and enhanced productivity and quality (Pavnaskar et al., 2003).

In 1984 General Motors established a joint venture with Toyota – also known as NUMMI – to learn about such a new managerial approach, thus replicating improvements in operational performance (Shook, 2010).

In 1990 Womack et al. wrote the book of "The Machine That Changed the World". This work introduced the term "lean production" and provided a first detailed description of a lean system (Shah and Ward, 2007). Moreover, it played a key role in disseminating such methodology outside Japan (Holweg, 2007). Indeed, starting from its publication a

growing number of firms worldwide have started lean projects. In addition, during mid 1990s numerous academic contributions also focused on this topic.

During the past two decades, several firms in various industries and located in different countries have successfully implemented lean management. Given the benefits obtained by the headquarters and other local and historical factories, a growing number of MNCs have then transferred lean practices to foreign subsidiaries seeking similar advantages. Beside Toyota, Mercedes, Caterpillar, John Deere, Scania, Bosch, Du Pont, Jotun, Hydro, Siemens, Ecco, Whirlpool, Swedwood, Lego and Volvo are few recent examples (Netland and Aspelund, 2013).

2.3.1 Lean management: description and operationalization

Lean management was studied according to two main perspectives, which are strictly related each other. As stated by Womack and Jones (1996), lean is a philosophy that follows five principles – value, value stream, flow, pull, and perfection – to eliminate every source of waste from the production processes. Using a more concrete perspective, Shah and Ward (2007) translated such philosophy and defined lean as an integrated socio-technical system of practices which allows to reduce internal and external process variability.

Flynn et al. (1995), Cua et al. (2001), Shah and Ward (2003), and Shah and Ward (2007) are among the most relevant and complete works in the lean literature which provide an operationalization of lean management. They identified the relevant bundles of practices that compose a lean system. Just-In-Time, Total Quality Management, Human Resource Management, and Total Preventive Maintenance are commonly considered important bundles, but also supplier relationships, management support, manufacturing and continuous improvement strategies are recognized as crucial factors in lean implementation. Another interesting classification is the distinction between hard and soft practices (Samson and Terziovski, 1999; Rahman and Bullock, 2005; Fotopoulos and Psomas, 2009).

Table 2 summarizes the lean practices usually considered in lean contributions and how they can be classified into hard and soft according to the literature. Even though it is impossible to find a perfect correspondence across all the contributions on the hard and soft practices considered, scholars applied a similar criterion in defining the characteristics and differences of these two bundles. In line with previous contributions, we argue that the technical and analytical tools which aim to improve production systems represent the hard practices (e.g., process control or kanban) while the practices that are related to principles, managerial concepts, people, relations, and strategy are soft (e.g., continuous improvement, top management leadership, customer and supplier involvement). Some lean practices, such as

autonomous maintenance and cleanliness and organization, were not classified by previous studies as hard or soft practices. According to the definitions above, in this study, they will be considered hard practices.

Table 2: The culture dimensions considered (organizational level in italics)

| Practice | Lean literature | Literature on hard/soft practices | Hard/Soft lean practice |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Setup time reduction | Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2003); Shah and Ward (2007); Mackelprang and Nair (2010); Matsui (2007) | Rahman and Bullock (2005) | Hard lean practice |
| Just-In-Time delivery by suppliers | Cua et al. (2001); McKone et al. (2001); Shah and Ward (2007); Mackelprang and Nair (2010); Matsui (2007) | Rahman and Bullock (2005) | Hard lean practice |
| Daily schedule adherence | Flynn et al. (1995); McKone et al. (2001); Cua et al. (2001); Matsui (2007) | Rahman and Bullock (2005) | Hard lean practice |
| Equipment layout | Cua et al. (2001); McKone et al. (2001); Shah and Ward (2003); Shah and Ward (2007); Mackelprang and Nair (2010); Matsui (2007) | Rahman and Bullock (2005) | Hard lean practice |
| Kanban | Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2003); Shah and Ward (2007); Mackelprang and Nair (2010); Matsui (2007) | Rahman and Bullock (2005) | Hard lean practice |
| Process control | Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2003); Shah and Ward (2007); Matsui (2007) | Samson and Terziovski (1999); Rahman and Bullock (2005); Taylor and Wright (2006); Fotopoulos and Psomas (2009) | Hard lean practice |
| Autonomous maintenance | Cua et al. (2001); McKone <i>et al.</i> , 2001; Shah and Ward (2003); Shah and Ward (2007); Mackelprang and Nair (2010); Matsui (2007); Matsui (2007) | - | Hard lean practice |
| Cleanliness and organization | Snell and Dean (1992); Flynn et al. (1995); Challis et al. (2005); Mackelprang and Nair (2010); Matsui (2007) | - | Hard lean practice |
| Small group problem solving | Snell and Dean (1992); Flynn et al. (1995); Challis et al. (2005); Shah and Ward (2007); Matsui (2007) | Samson and Terziovski (1999); Lagrosen and Lagrosen (2005); Prajogo and McDermott (2005); Rahman and Bullock (2005); Taylor and Wright (2006); Fotopoulos and Psomas (2009) | Soft lean practice |
| Training employees | Snell and Dean (1992); Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2003); Shah and Ward (2007); Matsui (2007) | Samson and Terziovski (1999); Lagrosen and Lagrosen (2005); Prajogo and McDermott (2005); Rahman and Bullock (2005); Taylor and Wright (2006); Fotopoulos and Psomas (2009) | Soft lean practice |
| Top management leadership for quality | Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Matsui (2007) | Samson and Terziovski (1999); Lagrosen and Lagrosen (2005); Prajogo and McDermott (2005); Taylor and Wright (2006); Fotopoulos and Psomas (2009) | Soft lean practice |
| Supplier partnership | Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2007); Matsui (2007) | Rahman and Bullock (2005); Fotopoulos and Psomas (2009) | Soft lean practice |
| Customer involvement | Flynn et al. (1995); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2007); Matsui (2007) | Samson and Terziovski (1999); Prajogo and McDermott (2005); Rahman and Bullock (2005); Taylor and Wright (2006); Fotopoulos and Psomas (2009) | Soft lean practice |
| Continuous Improvement | Hayes and Wheelwright (1988); Ahire and Dreyfus (2000); Shah and Ward (2003); Shah and Ward (2007); Matsui (2007) | Samson and Terziovski (1999); Lagrosen and Lagrosen (2005); Fotopoulos and Psomas (2009) | Soft lean practice |
| Manufacturing-business strategy linkage | Flynn et al. (1995); Ahire and Dreyfus (2000); Cua et al. (2001); McKone et al. (2001); Shah and Ward (2003); Swink et al. (2005); Shah and Ward (2007); Matsui (2007) | Samson and Terziovski (1999); Lagrosen and Lagrosen (2005); Prajogo and McDermott (2005); Rahman and Bullock (2005); Fotopoulos and Psomas (2009) | Soft lean practice |

2.3.2 Lean management impact on factory performance

The vast majority of the empirical works support the overall positive impact of lean on a firm's operational performance. The main benefits consist in a reduction of process variability, scraps and rework time, which in turn, reduce production costs and lead times, and increase process flexibility and quality conformance.

Cua et al. (2001) stressed the importance of the simultaneous use of Just-In-Time, Total Quality Management and Total Preventive Maintenance when implementing lean. Moreover, Total Preventive Maintenance tools, together with 5S practices (or cleanliness of the organization), play a strategic role not only in directly gaining a better performance, but also in preparing the right environment for an efficient adoption of Just-In-Time and Total Quality Management techniques (McKone et al., 2001; Mackelprang and Nair, 2010). The importance of these so-called hard practices is highlighted also in Taylor and Wright's (2006) study. As a matter of fact, the authors empirically proved that the hard part of the Total Quality Management methodology is a strong predictor of manufacturing performance improvements. Nevertheless, the efficacy of the hard practices is magnified especially when they are coherently accompanied by intangible and soft practices, linked to Human Resource Management (Matsui, 2007), management leadership and support (Danny Samson and Terziovski, 1999; Matsui, 2007), customer and supplier involvement (Rahman and Bullock, 2005; Matsui, 2007) and manufacturing strategy (Lagrosen and Lagrosen, 2005; Matsui, 2007). The effectiveness of the joint implementation of hard and soft lean practices was also proved by the results of Shah and Ward's (2003; 2007) contributions, where the authors depicted lean success as the result of a complex system of interrelated socio-technical practices.

However, in the literature there are also some examples of lean failures. The lack of significant performance gains is typically imputed to the complexity of lean implementation due to possible negative synergies between Just-In-Time tools and techniques (Mackelprang and Nair, 2010), the implementation of Just-In-Time without adequate consideration for other OM practices and a coherent long-term manufacturing strategy (Matsui, 2007; Agarwal et al., 2013) or difficulties in adapting Just-In-Time to particular contexts (e.g., non repetitive-contexts, Lander and Liker, 2007).

Anyhow, Just-In-Time cannot not be viewed as the one and only source of lean failure. In particular, there is evidence pointing to organizational culture as a key determinant of lean success or failure (Prajogo and McDermott, 2005). In fact, lean is a complex transformation which involves employees and managers operating at different levels and often radically changes their way of working. The organizational culture can favor or hinder this change

(Lee et al., 2013). Therefore, Sub-section 2.3.1 focuses on the role of organizational culture in lean implementation.

2.4 Culture and lean management

The second phase of the literature review concerned a deep analysis of studies exploring the role of culture in lean implementation. I examined contributions considering a wide set of lean practices as well as those focusing on one or more relevant bundles of lean practices, such as Total Quality Management, Just-In-Time, Human Resource Management, and Total Preventive Maintenance. Sub-section 2.4.1 focuses on contribution on lean implementation within a single manufacturing factory. Section 2.4.2 considers studies on lean knowledge transfer projects between dyads in MNCs.

2.4.1 Lean implementation within a manufacturing unit: the role of organizational culture

Starting from the nineties to the present day, scholars and managers has intensely studied Toyota's approach to manufacturing in order to understand its success in obtaining superior operational performance. Seeking to achieve similar benefits, many firms worldwide have attempted to transform their production system and replicate TPS implementing tools and techniques such as Just-In-Time (Liker, 2004). However, as explained in Section 2.3.2, most of these lean projects resulted in poor performance improvements or even failed to realize any benefits. According to leading scholars of lean, a main cause of these failures is companies' fairly superficial approach in adopting lean, i.e. focus on more evident elements of the TPS, such as hard practices, and little attention paid to deeper aspects related to this system, such as soft practices and especially to organizational culture (Liker, 2004; Liker and Rother, 2011). By contrast, the "Toyota Way" has succeeded in gaining operational excellence and superior performance thanks to continuous investments on people and the establishment of an organizational culture consistent to Toyota's principles and practices (Liker, 2004).

Due to the critical role of organizational culture in lean adoption, there have been a number of attempts by scholars to formalize behaviors and values characterizing the "*ideal culture*" for lean, i.e., an organizational culture consistent with lean practices and principles and conducive to superior performance. In particular, some scholars focused their study on TPS, since they recognized the superior performance achieved by Toyota compared to other companies that adopt lean trying to merely replicate tools and practices. For example, Spear

(1999) codified “the DNA of TPS” as five “Rules-in-Use”, i.e. principles that guide the design, operation, and improvement of all activity, connection, and pathway for every product and service in Toyota (Spear and Bowen, 1999). More recently, Liker (2004) described the “Toyota way” according to 14 principles on which Toyota based its organizational culture, while Rother (2009) carried out a detailed analysis of the two more relevant Toyota’s organizational routines, i.e. patterns of thinking and behavior also called “kata”. Although these contributions provided some relevant hints on behaviors and values consistent with lean, such as promotion of continuous improvement and long-term decision making, they focused on TPS and didn’t formalize the organizational culture according to well-established models in the organizational culture literature.

On the other hand, some contributions tested the relationships between organizational culture, lean practices, and performance examining a specific or a narrow sub-group of practices (e.g., time-base manufacturing practices, Human Resource Management, and Total Quality Management). Nahm et al. (2004) investigated time-base manufacturing practices – i.e., reengineering set-ups, cellular manufacturing, quality improvement efforts, preventive maintenance and pull production – and their relationships with organizational culture as defined by Schein (1992). Patel and Cardon (2010) proved that the interaction between organizational culture and Human Resource Management practices leads to an improvement in labor productivity.

To date, the majority of the contributions and the most advanced results concern the Total Quality Management bundle (Bright and Cooper, 1993; Watson and Korukonda, 1995; Tata and Prasad, 1998; Detert et al., 2000; Naor et al., 2008). In particular, several authors tried to identify the “ideal culture” for Total Quality Management implementation (Tata and Prasad, 1998; Detert et al., 2000).

Few studies explicitly analyzed the role of organizational culture as an antecedent of Total Quality Management practices. For instance, using two alternative models of fit (i.e., mediation and moderation), Naor et al. (2008) investigated the relationships between the cultural dimensions developed by Quinn and Rohrbaugh (1983), quality management practices and manufacturing performance – i.e., cost, quality, delivery and flexibility. Lately Baird et al. (2011) confirmed the direct impact of some organizational culture dimensions – i.e., teamwork, respect for people, outcome orientation and innovation – as identified by O’Reilly et al. (1991) on the level of Total Quality Management implementation. This in turn affects quality and inventory performance.

Other authors highlighted that the relationship between organizational culture and Total Quality Management is not straightforward because they can interact and influence each other in a recursive way. For instance, Prajogo and McDermott (2005) explored the

relationship between Total Quality Management practices – i.e., the Malcolm Baldrige National Quality Award operationalization developed by Samson and Terziovski, 1999 – and Denison and Spreitzer's (1991) dimensions of organizational culture. The results, based on a survey including 194 Australian organizations, confirm that organizational culture is an antecedent of Total Quality Management practices. However, the authors also suggested an additional recursive impact of Total Quality Management on culture.

Although contributions in this second stream of research provide additional, relevant hints on the relations between organizational culture, lean practices and performance, they are limited by non-consideration of a complete set of hard and soft lean bundles.

Therefore, from the above discussion I concluded that:

- Previous studies considering the relation between organizational culture, lean, and performance converge on the existence of a certain fit between organizational culture and lean practices that can determine a firm's superior performance. This means that companies which successfully implement lean should reveal a certain organizational culture profile, because a certain fit between organizational culture and lean can determine the best conditions for significant performance improvements;
- Some authors provide evidence supporting that the relationship between organizational culture and lean practices is not straightforward because they can interact and influence each other in a recursive way;
- Previous research examining the relation between organizational culture, lean, and performance is fragmented and there lacks a holistic framework – i.e., a model based on well-established dimensions of culture, a wide set of both soft and hard lean practices and most important operational performance.

According to discussion above, the first main aim of this thesis is to investigate whether the successful implementation of lean is related to a certain organizational culture profile and to the adoption of soft lean practices.

The following first set of research questions was defined:

RQ1 Do successful lean manufacturing units show a peculiar organizational culture?

RQ1a What is the ideal organizational culture profile for lean?

RQ1b Do successful lean factories adopt soft lean practices more extensively compared to unsuccessful lean factories?

A survey methodology is employed to explore this topic. Levering on a holistic model on relations between lean practices, organizational culture, and performance, in Section 3.1 I

will develop two hypotheses considering the distinctive characteristics of successful lean factories. Moreover, Section 3.2 provides methodological insights and Section 3.3 summarizes the findings, which will be discussed in Section 6.1.

2.4.2 Lean knowledge transfer in MNCs: the role of culture

During the past two decades a growing number of manufacturing firms have been engaged in developing lean factories in foreign countries. Toyota itself has faced the challenge of transferring lean knowledge to non-Japanese manufacturing units since the mid-eighties, when it established the joint venture with the American General Motors (see also Section 2.3). As these cases demonstrated, implementing lean in environments different from the parent's one is particularly difficult and requires that managers cope with the *heterogeneity between contexts*, in addition to traditional issues characterizing lean adoption within a single factory. This is one of the main reasons why lean knowledge transfer deserves a specific investigation.

This thesis focuses on internal lean implementation; accordingly, it considers lean knowledge transfer projects between dispersed factories belonging to the same organization. Unlike lean implementation within a single unit, the analysis of lean knowledge transfer projects in MNCs has received little attention from scholars. In general, as revealed by Netland and Aspelund's (2014) systematic literature review on lean knowledge transfer, a number of topics have been insufficiently addressed and need future research attention. As studies in the broader field of knowledge and practice transfer within MNCs underline, and specific works on lean knowledge transfer confirm (e.g., Lee and Jo, 2007; Maritan and Brush, 2003), it is important to fill this gap because knowledge transfer can be a source of competitive advantage but is a challenging process.

A major contribution on lean knowledge transfer is Maritan and Brush's (2003) empirical study on lean adoption in multiple manufacturing units of a large diversified US-based MNC. Drawing on the process view suggested by Szulanski (2000), the authors empirically investigated whether and how (i) peculiarities of lean knowledge and (ii) characteristics of the parties and their relations – overall referred to as *heterogeneity* – affect lean knowledge transfer projects.

First of all, their findings confirm the relevance of devoting specific research to lean knowledge transfer. Indeed, the study underlines how lean transfer projects are particularly difficult due to the high level of complexity and the broad scope of the knowledge that must be transferred. Second, basing on Szulanski's seminal works (1996; 2000) and evidences from four case studies, an ideal process model unveiling critical phases and activities in lean

transfer projects was empirically developed. Third, the use of a process view allowed to recognize that not only initial starting conditions (i.e., characteristics of the parties and their relations at the beginning of the transfer project) matter. Indeed, also heterogeneity created during the process, such as change of the source characteristics due to decision of transferring knowledge from a different unit, can affect results of transfer programmes and cause problems which manifest, for example, in delays in scheduled activities, regressions to an earlier stage of the transfer process, or difficulty in obtaining target performance.

Although Maritan and Brush's (2003) study provided insightful findings, it does not considered the impact of *societal level factors*, having the authors considered all factories located in the same country of the headquarters. However, societal factors such as societal culture are recognized to be among the major issues of knowledge transfer projects in MNCs (Kostova, 1999). Moreover, even though this contribution represents an important framework for guiding lean knowledge transfer across MNCs' units, Maritan and Brush's description stays on an abstract level and provides little indications on how to fulfill each activity.

Consistent with Maritan and Brush (2003), other scholars observed that *organizational level factors* – e.g., firm's strategy, organizational culture values – can contribute to create a barren or a fertile context for lean knowledge transfer projects (e.g., Kerrin, 1999; Colotla et al., 2003; Lee and Jo, 2007; Browning and Heath, 2009). Although considered only by few studies on lean knowledge transfer, among the various factors, *organizational culture values* it is likely to affect lean transfer project success. Indeed, considering the broader literature on internal lean implementation, it is possible to note that organizational culture values are indicated by several scholars as crucial for effective lean implementation (see Sub-section 2.3.1 and, for example, Liker, 2004; Liker and Rother, 2011). In addition, more general studies on knowledge transfer in MNCs stressed the relevance of creating common organizational culture values units within MNCs – e.g., values promoting communication, cultural orientation toward learning, innovation, and change, trust in the parent – for keeping multi-factory firms together (e.g., Kostova, 1999; Gupta and Govindarajan, 2000; Hofstede, 1994; see Sub-section 2.1.1).

For what concerns *socio-cultural peculiarities*, the broader field of international studies indicates factors such as attitudes toward managers, perceptions of authority, inter-organizational cooperation, attitudes toward achievement and work, class structure and individual mobility, attitudes toward wealth and material gain, attitudes toward scientific management, attitudes toward risk, societal ideology, beliefs about foreigners, and the nature and extent of nationalism, as major sources of variability in practice implementation across countries (Oliff et al., 1989). Accordingly, several authors claimed the necessity of defining human resource development and management policies according to socio-cultural

characteristics of firm's environment (Hofstede, 1980; Tata and Prasad, 1998). Previous studies on lean (e.g., Maheshwari and Zhao, 1994; Zhao et al., 1995; Kull et al., 2014) showed that country's socio-cultural characteristics can also affect the way lean is implemented by a factory and the success of its lean journey. Similarly, some studies on lean knowledge transfer provide evidence of the influence of societal level factors in general, and societal culture in particular, on transfer projects (e.g., Wallace, 2004; Jun et al., 2006).

Although the majority of the studies have focused on the impact of cultural characteristics of the recipient unit, *peculiarities of a source unit* can also influence a knowledge transfer project and its overall success. Szulanski (1996) explained that source's characteristics can affect especially the early stages of a transfer project, since the knowledge owner entity has a major role in conducting the initiative. In particular, the *source's organizational culture* is likely to affect choices in planning and implementation activities in knowledge transfers as well as external managers' behaviors in foreign site. Indeed, as pointed out by Koufteros et al. (2007) considering the broader relevant literature on culture, organizational culture is a coping mechanism used by organizational members to deal with problems, has far reaching impact on decisions, and, more generally, shapes employees behaviors.

Overall, previous studies provide empirical evidence on criticalities faced by firms when transferring lean abroad. In addition, scholars give some indications on how overcoming a number of criticalities (e.g., Aoki, 2008). With regard to countermeasures, as in case of more general literature on knowledge transfer (Section 2.2), level of adaptation is a main issue discussed by researchers. On the one hand, some scholars support strong adaptation (e.g., Wallace, 2004; Lee and Jo, 2007). On the contrary, others consider faithful replication of the original knowledge and solutions of the source a more effective approach (e.g., Ferdows, 2006). As a consequence, literature is still lacking to conclude which level of adaptation is most suitable in case of lean transfer projects.

Therefore, from the above discussion I concluded that:

- Although in the last two decades many firms have launched initiatives to transfer lean to overseas subsidiaries, literature exploring lean knowledge transfer between factories of MNCs is scarce, and in particular needs further contribution to better analyze the role of culture in lean knowledge transfer projects;
- Previous studies show that cultural characteristics of a recipient unit, in terms of both the extent of source-recipient difference and the presence of recipient's distinctive features, can affect lean knowledge transfer, for example determining problems in lean practice implementation;

- Previous studies show that characteristic of the source unit can also influence knowledge transfer within MNCs. Therefore, in order to develop a deeper understanding of the impact of culture on lean knowledge transfer projects, it is important to study such projects from a broad perspective which simultaneously considers cultural characteristics of the recipient as well as of the source unit;
- Although the majority of previous studies explored the influence of contextual factors on lean knowledge transfer in a general way, a process view, which distinguishes between the different phases of a transfer project, is indicated as more appropriate to provide a deep understanding of such relation (Szulanski, 2000; Maritan and Brush, 2003). A detailed analysis of the impact of culture on lean knowledge transfer is still lacking; thus, in order to develop a deeper understanding, it is important to distinguish the impact of culture on the different phases of the lean knowledge transfer process;
- Previous studies discussing problems in lean knowledge transfer failed to relate problems to culture conditions of different contexts, although it is recognized that culture can hinder lean knowledge transfer;
- In the literature there is a debate on the most effective approach to transfer lean knowledge; although cultural characteristics of source and recipient are recognized to affect lean knowledge transfer, previous studies failed to relate level of adaptation to cultural peculiarities of a dyad.

This thesis intends to provide a twofold contribution to the research stream on lean knowledge transfer within MNCs:

- A) Providing a deep examination of the impact of cultural differences between an Italian MNC and its Chinese subsidiary on lean knowledge transfer process and effectiveness of different transfer approaches;
- B) Explaining how effectively managing lean knowledge across a number of lean knowledge owners and recipients in MNCs.

Along with these points, problems in transferring lean knowledge across factories in different countries and countermeasures adopted by MNCs to cope with such problems will be considered.

According to these aims, two sets of research questions were defined.

RQ2 *How do cultural differences between an Italian unit (lean source in a MNC) and a Chinese subsidiary (non-lean recipient) influence the transfer of lean management?*

RQ2a *How do cultural differences influence the effectiveness of lean knowledge transfer approach? Why do different lean knowledge transfer approaches lead to different outcomes?*

RQ2b *How should an Italian factory adapt its lean system to fit peculiarities of a Chinese subsidiary?*

An in-depth case study is conducted to fulfill the first purpose. Chapter 4 describes the methodology used, provides a description of the case, and summarized key lessons learned, while Section 6.2 discusses the findings.

RQ3 *How can MNCs handle factories' cultural differences in cross-border lean knowledge transfer projects?*

RQ3a *How do cultural contexts of the source and recipient influence cross-border lean knowledge transfer projects within MNCs?*

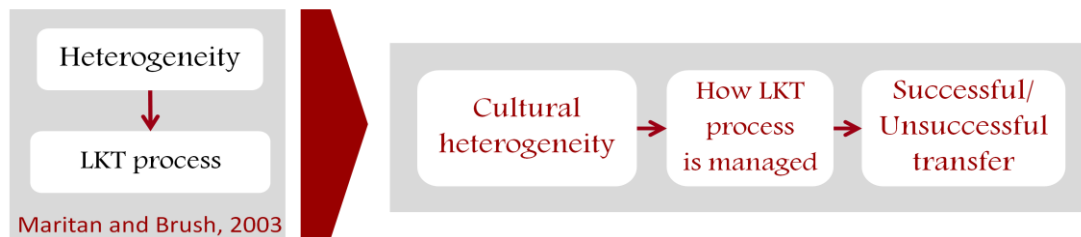
RQ3b *What are the main variables differentiating cross-border lean knowledge transfer projects within MNCs?*

A multiple case study methodology is employed to fulfill the second aim. Chapter 5 describes the methodology used and provides the analysis, while Section 6.2 discusses the findings.

Framework

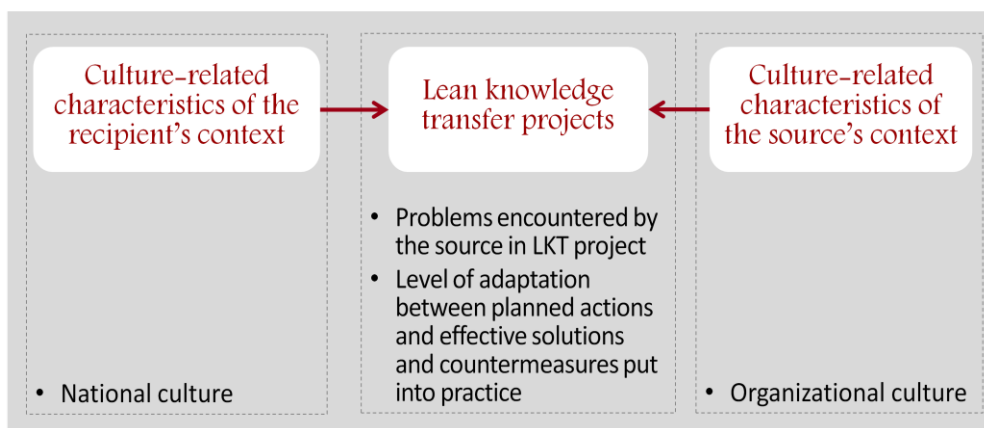
Drawing on both lean literature and the field of knowledge transfer, I developed two frameworks to guide my empirical research on lean knowledge transfer projects within MNCs. Framework A (**Figure 2**) was defined to guide the longitudinal study of the lean knowledge transfer process between the Italian source and Chinese subsidiary. Consistent with Maritan and Brush's (2003) study on the impact of heterogeneity on a lean knowledge transfer (LKT) process, Framework A relates *cultural heterogeneity* between the source's and the recipient's contexts to the *way in which the various phases in the transfer process are managed* (e.g., the roles of source's and recipient's management and adaptations needed to make effective the headquarters' lean system), and *success of the project* (i.e., institutionalization of lean practices, Kostova ,1999).

Figure 2: Framework A



Framework B (**Figure 3**) was defined to guide the study of different cross-border lean knowledge transfer projects of different MNCs. As schematized, this work considers not only the cultural characteristic of a recipient's context (i.e., societal culture peculiarities and extent of difference from the source), but also the characteristic of a recipient's context (i.e., organizational culture values), and their impact on a lean knowledge transfer project (i.e., problems encountered by the source in a transfer project, and level of adaptation between planned actions and effective solutions and countermeasures put into practice).

Figure 3: Framework B



Similar to some previous studies (Browning and Heath, 2009; Mollenkopf et al., 2011), these frameworks are not intended to be “proven” as in case of hypothesis testing, but rather to provide the necessary focus to research while I started field work (Stuart et al., 2002; Yin, 2003).

3. Lean implementation in a manufacturing unit: the role of organizational culture and soft lean practices

3.1 Research hypotheses

The review of the literature on organizational culture and lean proves the important role of organizational culture in determining an effective lean implementation. In particular, managerial belief encouraging intra-firm and inter-firm collective actions as teamwork and integration, typical of organizational culture characterized by high-level institutional collectivism, was proved to be necessary to obtain an higher performance when applying such lean practices as time-based practices (e.g., Nahm et al., 2004), Human Resource Management (e.g., Patel and Cardon, 2010; Lee et al., 2013), and Total Quality Management (e.g., Baird et al., 2011). In addition, Karlsson and Åhlström (1996) observed that in several cases lean requires that suggestions for process improvements and changes come from the shop floor employees and middle managers who directly experience problems on the production lines. Accordingly, firms that strive to effectively implement lean are usually characterized by a lower power distance. Similarly, Lee et al. (2013) argued that the attributes that positively link team working and operational performance are organizational support, the extensive use of teams for problem solving, a performance orientation and a collaborative climate, whereas coercive influence and adaptation difficulty of the workers represent negative attributes. Thus, high-level institutional collectivism and human orientation, together with low assertiveness seem to be necessary ingredients in order to create an organizational climate that fosters collaboration and employee involvement in decision making.

On the basis of an extensive literature review, Detert et al. (2000) proposed that the ideal organizational culture for firms involved in Total Quality Management programs should be characterized by a long-term orientation and strategic approach to management, and stressed the importance of these values to obtain successful results in the long run. As observed by Flynn et al. (1994), a culture high in future orientation supports continuous improvement, which in turn enhances the firm's performance. Scholars also provided some preliminary evidence for the importance of performance orientation when adopting lean. Baird et al. (2011), for instance, found that the extent of Total Quality Management implementation is higher for companies which were competitive, focused on results with high performance expectations, which correlated with performance as well. Accordingly, organizations that show high levels of future and performance orientation are expected to achieve better performance through lean.

Finally, an organizational culture characterized by a high level of uncertainty avoidance also fosters lean effectiveness, since it fits practices allowing control of processes (e.g., process control), and composed by detailed work procedures (e.g., daily schedule adherence). Indeed, employees threatened by risks incidental to unpredictable events are attracted by and support norms and practices that allow work standardization and control. Conversely, people not interested in reducing/avoiding uncertainty consider these procedures costly, time-consuming and unnecessary. Hence, different workforce motivation in uncertainty avoidance is expected to influence the efforts on the part of employees in implementing lean practices. Hence, I can safely say that a firm's organizational culture plays an important role in determining lean success for several reasons. Therefore, I can posit that:

Hypothesis 1: *High-performance lean manufacturing factories differ from low-performance lean manufacturing factories in terms of organizational culture.*

On the one hand, the literature suggests that a certain level of organizational culture dimensions can favor the successful implementation of lean. On the other hand, and in accordance with the convergence hypothesis of organizational culture stated above, the lean literature clearly suggests that the adoption of soft practices can help to build the right environment for an effective lean implementation. As stated in Section 2.4.1, it can be argued that organizational culture and soft practices mutually interact, as certain organizational culture dimensions are undoubtedly correlated with soft lean practices - related to work organization, management leadership, people, relationships (collaboration with customers and suppliers) and the firm's strategy (Detert et al., 2000; Naor et al., 2008; Patel and Cardon, 2010; Baird et al., 2011).

The importance of soft lean practices in achieving high performance is commonly accepted (Shah and Ward, 2003; Lagrosen and Lagrosen, 2005; Matsui, 2007; Shah and Ward, 2007; Fotopoulos and Psomas, 2009). Moreover, some authors empirically proved that while soft practices are strongly related to performance, hard practices are not in all cases (e.g., Samson and Terziovski, 1999). The introduction of Human Resource Management practices to favor inter-functional teams and to train employees to perform multiple tasks, a common strategy shared and supported by managers, customers and suppliers in line with a continuous improvement philosophy, and collaborative relationships with customers and suppliers, are all fundamental for effective lean implementation (Flynn et al., 1995; Schmenner and Swink, 1998; Matsui, 2007). In fact, Matsui (2007) argued that hard practices, as Just-In-Time, have only a marginal effect on operational performance when soft

practices are not fully employed, since Human Resource Management and manufacturing strategy have a higher effect on competitive performance compared to Just-In-Time. The importance of collaboration with suppliers in a lean environment is strongly suggested by Hsu et al. (2009) and Romano and Formentini (2012) as without supplier assistance, continuous improvement is not supported and hard lean practices cannot be successful. Moreover, Flynn et al. (1995) highlighted that management support and strategy are vital if a company wants to improve its operational performance through lean because they help to direct lean efforts toward the expected results.

To conclude, the use of soft practices makes it possible to avoid the resistance to change by the actors involved in lean implementation, which is frequent in lean projects and typically leads to lean failure. In fact, the utilization of these practices contributes to prepare the right environment in which implementing the hard lean tools, by educating managers, employees, customers and suppliers about the importance of changing the production system according to a lean perspective, and the benefits for both the firm and employees. Thus, I postulate that:

Hypothesis 2: *High-performance lean manufacturing factories differ from low-performance lean manufacturing factories in terms of the extent of adopting soft practices.*

3.2 Methodology

3.2.1 Data collection and sample

To test the research hypotheses, I used the High Performance Manufacturing (HPM) database. HPM is an international research project set out to analyze the relationships between a firm's practices and performance. HPM sample includes manufacturing factories operating in mechanical, electronics, and transportation equipment sectors (SIC codes: 35, 36 and 37, respectively) and located in ten countries, i.e., Austria, China, Finland, Germany, Italy, Japan, South Korea, Spain, Sweden, and the US. In each country, data are collected by local HPM research teams, responsible for selecting factories, contacting them, distributing the questionnaires, and providing assistance to the respondents, so as to ensure that the information gathered was both complete and correct. The factories are randomly selected from a master list of manufacturing factories (i.e., using Dun's Industrial Guide, JETRO database, etc.). In each country, the local HPM research team had to include an approximately equal number of high performing and traditional manufacturing units, in order

to build a sample with factories that use advanced practices in their industry, i.e., world class manufacturing factories, as well as traditional (i.e. not world class manufacturing) ones. Finally, all factories had to represent different parent corporations and have at least 100 employees. Approximately, 65 percent of factories contacted agreed to administer the survey and filled the questionnaires. Data from 317 factories were returned. **Table 3** reports additional information about the sample distribution for country and industry.

Each factory participating in the HPM project received a batch of 23 separate questionnaires, distributed by individual visits or by post to different respondents, considered the best informed about the topic of each of the 23 questionnaires. **Table 4** provides the list of selected recipients for each factory.

Table 3: Sample distribution

| Country | Industry | | |
|---------------|-------------|-----------|----------------|
| | Electronics | Machinery | Transportation |
| Austria | 10 | 7 | 4 |
| China | 21 | 16 | 14 |
| Finland | 14 | 6 | 10 |
| Germany | 9 | 13 | 19 |
| Italy | 10 | 10 | 7 |
| Japan | 10 | 12 | 13 |
| South Korea | 10 | 10 | 11 |
| Spain | 9 | 9 | 10 |
| Sweden | 7 | 10 | 7 |
| United States | 9 | 11 | 9 |

Table 4: Respondents for each factory

| Recipient of the questionnaire | Number of respondents per factory |
|------------------------------------|-----------------------------------|
| Plant accounting manager | 1 |
| Direct labor | 10 |
| Human resources manager | 1 |
| Information systems manager | 1 |
| Production control manager | 1 |
| Inventory manager | 1 |
| Member of product development team | 1 |
| Process engineer | 1 |
| Plant manager | 1 |
| Quality manager | 1 |
| Supervisor | 3 |
| Plant superintendent | 1 |

In order to reduce the problem of common method bias, whenever possible, the same item was administered to different respondents within the same factory. Then, to conduct factory level analysis, for each item I aggregated individual informant responses to the factory level by taking the average of within-factory responses.

Each questionnaire consists of both perceptual scales and objective items. In particular, it included a mix of item types and some reversed scales to further reduce the possibility of common method variance. The questionnaires were originally developed in English and then were translated into the language of participating countries by a local member of the HPM team. They were then back-translated into English by a different local HPM researcher to assure accuracy in translation.

3.2.2 Variables and scales

The present work uses only a portion of the questionnaires of the whole HPM survey. HPM scales are based on existing literature and previously used measurement scales. In addition, at the beginning of the HPM project, the content validity of each scale was checked through interviews with experts and managers. As a result, in this study I adapted scales validated in past works and extensively used in the OM literature.

A measurement of the multidimensional concept of organizational culture is based on and adapted to the eight multi-item scales conceived by Naor et al. (2010) – i.e., power distance, institutional collectivism, in-group collectivism, future orientation, performance orientation, assertiveness, uncertainty avoidance, humane orientation. The items used to measure these scales targeted shop floor employees, supervisors and human resource managers. Respondents were asked to provide their opinions on different aspects of the organizational culture by using Likert-scaled perceptual items, with values ranging from 1 (i.e., strongly disagree) to 7 (i.e., strongly agree) (see Appendix). For each item addressed to multiple respondents within the same factory, I checked the inter-rater agreement by measuring the interclass correlation (ICC) index. I found that all the ICC indexes are greater than 0.70, indicating an acceptable concordance among the different informants (James et al., 1984).

As regards the lean concept, given its configurational nature, first of all I identified the lean practices which are usually included in the literature to characterize lean. Secondly, in line with previous Operations Management studies, I classified the practices into soft and hard. **Table 2** reports some well-known and largely cited works on lean and highlights, for each practice (on the lines), the studies that consider it to measure lean, as well as those that classify it as a soft or hard practice (see Sub-section 2.3.1). As a result, eight multi-item perceptual scales were considered for hard practices – i.e., set up time reduction, Just-In-

Time deliveries by suppliers, daily schedule adherence, equipment layout, kanban, process control, autonomous maintenance, and cleanliness and organization – and seven for the soft ones – i.e., small group problem solving, training employees, top management leadership for quality, supplier partnership, customer involvement, continuous improvement, manufacturing-business strategy linkage. Appendix reports the complete list of items used to measure each scale. All the items were evaluated with a seven-point Likert-scale (1 is for “strongly disagree” and 7 is for “strongly agree”).

Since several different respondents were involved, such as quality and human resource managers, and direct labors, I tested the inter-rater agreement validity, as was done for the organizational culture part of the questionnaire.

As well as measuring the adoption of the different lean practices through a set of multi-item perceptual scales, the HPM questionnaire also includes a question concerning the overall level of lean manufacturing application in the factory compared to competitors on a five-point Likert scale (1 is for “poor, low” and 5 is for “superior”). This item targeted the quality manager. In this study this variable was used to distinguish in the sample between lean implementers and non lean implementers (see section Sub-section 3.2.4). It can obviously be expected that lean implementers are those that extensively adopt the lean practices reported in **Table 2**. However, since managers’ perceptions of what implementing lean exactly means sometimes differ, I checked whether there are differences between lean implementers and non lean implementers in terms of hard and soft lean practices. On the one hand, this can help to avoid potential biases in classifying a factory as a lean implementer. On the other hand, it can help to examine whether lean implementers give equal importance to the implementation of hard and soft practices. In fact, as assumed by hypothesis 2, this can influence the successful implementation of lean.

Finally, to measure factory performance, I considered four dimensions, i.e. cost, quality, delivery, and flexibility, in terms of perceptual and relative measures of performance (e.g., Cua et al., 2001; Bozarth et al., 2009). In particular, the respondents were asked to compare their performance with that of competitors on a 5-point Likert scale (from 1 indicating “poor, low” to 5 “superior”), in terms of unit cost of manufacturing, quality conformance, on-time delivery performance, fast delivery, flexibility to change product mix and flexibility to change product volume. I computed an overall measure of factory performance by calculating the mean of these six items and used this value to distinguish between high and low performers in the sample (see section 3.2.4). This choice is coherent with the widespread view that lean allows to improve at the same time different performance dimensions, as it allows to overcome the trade-offs that usually characterize a factory’s competitive capabilities (Schmenner and Swink, 1998).

3.2.3 Measurement scale assessment

An iterative modification process based on Confirmatory Factor Analysis (CFA) was run using LISREL 8.80 in order to refine the organizational culture and lean scales and assess the unidimensionality of the constructs under study. In particular, for each construct, I developed a single-factor CFA model and checked that the model parameters fell within the recommended limits. Whenever such a condition was not fulfilled, I refined the model by deleting one item at a time, and repeated this procedure until the model parameters were acceptable (Jöreskog and Sörbom, 1989). In the case of constructs made up of less than four items, a two-construct model was considered in order to have sufficient degrees of freedom to compute fit statistics (Li et al., 2005).

Then, I tested three CFA models. The first model concerns the organizational culture and includes eight latent variables. The second and the third models regard hard and soft lean practices and include six and nine latent variables respectively. **Tables 5, 6, and 7** report the CFA results generated from these measurement models.

The overall fit of each CFA model was judged to be satisfactory. In fact, the relative χ^2 is between 1 and 3, CFI value is greater than 0.90, RMSEA is lower than 0.08, and in particular the lower and upper limits of confidence interval for RMSEA are lower than 0.05 and 0.08 respectively (Hair et al., 2006). Thus I can conclude that the overall fit of the measurement models investigated is acceptable.

In each CFA model, all the standardized estimates of the observed variables exceeded 0.500 and all the corresponding t-values were statistically significant (t-values statistically significant at $p < 0.001$). The significant and substantial item loadings provide statistical evidence of convergent validity. Taken together, the convergence of items to the factors they are intended to measure with significant positive loadings and a good overall model fit demonstrates the unidimensionality of our scales (Hair et al., 2006).

In addition, for each latent variable, I checked that the composite reliability was greater than 0.7, indicating high reliability. Finally, to assess discriminant validity I performed a series of delta χ^2 tests. Specifically, for each possible pair of latent variables, I compared two nested models: (1) the model with free correlation between the two constructs and (2) the nested-model with the correlation set to 1. In accordance with the method used by Huang et al. (2008), if the delta χ^2 is statistically significant, the two latent variables are distinct. Discriminant validity is confirmed for our constructs since all the χ^2 differences resulted statistically significant ($p < 0.001$).

Table 5: Results of CFA for organizational culture model

| Construct | Item ^a | Factor loading | t-value |
|----------------------------------------------------------------|-------------------|----------------|---------|
| Power distance | OC01 | 0.647 | - |
| | OC02 | 0.553 | 8.027 |
| | OC03 | 0.655 | 9.155 |
| | OC04 | 0.570 | 7.648 |
| Institutional collectivism | OC05 | 0.661 | - |
| | OC06 | 0.615 | 9.152 |
| | OC07 | 0.500 | 7.211 |
| | OC08 | 0.522 | 7.473 |
| | OC09 | 0.549 | 8.307 |
| In-group collectivism | OC10 | 0.861 | - |
| | OC11 | 0.889 | 20.873 |
| | OC12 | 0.864 | 19.927 |
| | OC13 | 0.817 | 18.117 |
| Future orientation | OC14 | 0.646 | - |
| | OC15 | 0.825 | 11.681 |
| | OC16 | 0.620 | 9.414 |
| | OC17 | 0.838 | 11.779 |
| Performance orientation | OC18 | 0.843 | - |
| | OC19 | 0.943 | 19.340 |
| | OC20 | 0.754 | 15.568 |
| Assertiveness | OC21 | 0.599 | - |
| | OC22 | 0.758 | 10.128 |
| | OC23 | 0.773 | 10.247 |
| | OC24 | 0.768 | 10.204 |
| Uncertainty avoidance | OC25 | 0.522 | - |
| | OC26 | 0.549 | 4.392 |
| | OC27 | 0.889 | 4.496 |
| Humane orientation | OC28 | 0.500 | - |
| | OC29 | 0.800 | 6.353 |
| | OC30 | 0.501 | 5.490 |
| | OC31 | 0.712 | 6.258 |
| $\chi^2=862.238$ (406); RMSEA=0.0619 [0.0565; 0.0674] CFI=0.90 | | | |

^a In order to control for industry effects, I standardized the individual items by industry

Table 6: Results of CFA for hard lean practices model

| Construct | Item^a | Factor loading | t-value |
|----------------------------------------------------------------|-------------------------|-----------------------|----------------|
| Daily schedule adherence | HLM01 | 0.896 | - |
| | HLM02 | 0.588 | 11.200 |
| | HLM03 | 0.855 | 18.561 |
| | HLM04 | 0.557 | 10.462 |
| Equipment layout | HLM05 | 0.722 | - |
| | HLM06 | 0.811 | 12.973 |
| | HLM07 | 0.770 | 12.443 |
| | HLM08 | 0.642 | 10.489 |
| Just in time delivery by suppliers | HLM09 | 0.711 | - |
| | HLM10 | 0.570 | 8.978 |
| | HLM11 | 0.658 | 10.233 |
| | HLM12 | 0.536 | 8.478 |
| | HLM13 | 0.566 | 8.925 |
| Kanban | HLM14 | 0.682 | - |
| | HLM15 | 0.851 | 12.669 |
| | HLM16 | 0.858 | 12.669 |
| Setup time reduction | HLM17 | 0.673 | - |
| | HLM18 | 0.655 | 9.857 |
| | HLM19 | 0.676 | 10.108 |
| | HLM20 | 0.568 | 8.712 |
| Process control | HLM21 | 0.848 | - |
| | HLM22 | 0.881 | 20.003 |
| | HLM23 | 0.655 | 12.875 |
| | HLM24 | 0.915 | 21.009 |
| Cleanliness and organization | HLM25 | 0.626 | - |
| | HLM26 | 0.866 | 12.283 |
| | HLM27 | 0.919 | 12.684 |
| | HLM28 | 0.793 | 11.569 |
| Autonomous maintenance | HLM29 | 0.699 | - |
| | HLM30 | 0.544 | 8.311 |
| | HLM31 | 0.686 | 10.122 |
| | HLM32 | 0.732 | 10.595 |
| $\chi^2=973.782$ (436); RMSEA=0.0655 [0.0604; 0.0707] CFI=0.91 | | | |

^a In order to control for industry effects, I standardized the individual items by industry

Table 7: Results of CFA for soft-lean practices model

| Construct | Item^a | Factor loading | t-value |
|-----------------------------------------------------------------|-------------------------|-----------------------|----------------|
| Top management leadership for quality | SLM01 | 0.664 | - |
| | SLM02 | 0.825 | 12.336 |
| | SLM03 | 0.642 | 10.052 |
| | SLM04 | 0.811 | 12.184 |
| | SLM05 | 0.745 | 11.397 |
| Supplier partnership | SLM06 | 0.720 | - |
| | SLM07 | 0.470 | 7.280 |
| | SLM08 | 0.760 | 10.77 |
| | SLM09 | 0.596 | 9.049 |
| Small group problem solving | SLM10 | 0.613 | - |
| | SLM11 | 0.813 | 11.366 |
| | SLM12 | 0.813 | 11.367 |
| | SLM13 | 0.835 | 11.565 |
| | SLM14 | 0.613 | 9.243 |
| | SLM15 | 0.699 | 10.219 |
| Continuous Improvement | SLM16 | 0.737 | - |
| | SLM17 | 0.462 | 7.733 |
| | SLM18 | 0.713 | 12.006 |
| | SLM19 | 0.591 | 9.932 |
| | SLM20 | 0.726 | 12.240 |
| Training employees | SLM21 | 0.758 | - |
| | SLM22 | 0.863 | 14.895 |
| | SLM23 | 0.456 | 7.737 |
| | SLM24 | 0.786 | 13.746 |
| | SLM25 | 0.622 | 10.724 |
| Manufacturing-Business Strategy Linkage | SLM26 | 0.604 | - |
| | SLM27 | 0.779 | 10.120 |
| | SLM28 | 0.786 | 10.165 |
| | SLM29 | 0.554 | 8.009 |
| | SLM30 | 0.510 | 7.496 |
| Customer involvement | SLM31 | 0.692 | - |
| | SLM32 | 0.678 | 10.496 |
| | SLM33 | 0.757 | 11.492 |
| | SLM34 | 0.669 | 10.373 |
| $\chi^2=1135.974$ (506); RMSEA=0.0664 [0.0617; 0.0713] CFI=0.90 | | | |

^a In order to control for industry effects, I standardized the individual items by industry

3.2.4 Multi-group analysis

In order to investigate the research hypotheses I used the multi-group analysis method using LISREL 8.80 (Sorbom, 1974). The aim was to test for differences between high-performance and low-performance lean factories in terms of organizational culture dimensions and application of lean practices. Numerous researchers attested the advantages of Sorbom's (1974) method compared to the traditional general linear models (e.g., Lubke et al., 2003; Raykov, 2001). These advantages are linked to the possibility of estimating the parameters for all groups simultaneously. As a matter of fact, this approach facilitates a comparison of different theoretical models to determine the one that best fits the data. Furthermore, it allows to evaluate latent mean differences, taking into account measurement error variance, thus obtaining more precise and accurate results compared to methods, such as the t-test or ANOVA (Martinez-Costa et al., 2009).

In order to perform the analysis, four a-priori groups were preliminary formed. First of all, I split our sample into lean vs. non-lean adopters, by using the question on the level of lean application in the factory (see section 3.2.2). After having computed the statistical median score of this single-item scale, I assigned a high lean (HL) or low lean (LL) implementation value to the factories having a score above or below the median respectively. Secondly, I followed the same procedure to assign a high performer (HP) and low performer (LP) score to factories in our sample, where a HP value refers to the factories with a performance score above the median, while a LP value to the factories with a performance score below the median (see Appendix for further details). Finally, by crossing these two dummy variables, I formed four groups of factories, as shown in **Table 8**. This study focuses on factories characterized by a high level of lean implementation and high performance (HLHP) and those with a high level of lean implementation and low performance (HLLP).

Table 8: Number of factories for the a-priori groups

| GROUP | Lean implementation score | Performance score | Number of factories |
|---------------------------------------------------|---------------------------|-------------------|---------------------|
| HLHP (High lean implementers and high performers) | HL (high) | HP (high) | 95 |
| HLLP (High lean implementers and low performers) | HL (high) | LP (low) | 63 |
| LLHP (Low lean implementers and high performers) | LL (low) | HP (high) | 63 |
| LLLL (Low lean implementers and low performers) | LL (low) | LP (low) | 96 |

The measurement invariance assessment between groups represents the first step for testing group-mean differences. To determine evidence of invariance, an iterative process was run assessing the absence of significant differences in χ^2 values (delta χ^2) between each pair of nested-models, developed from a baseline model by forcing increasingly-stringent constraints on the parameters (Byrne, 1998). Since no significant differences were detected in our measurement models, I assured that HLHP and HLLP groups are configural, metric and scalar invariant, and thus I can conclude that it is possible to compare relevant latent variable means of the two groups by performing delta χ^2 tests.

3.3 Multi-group analysis results

As for organizational culture, the multi-group analysis results indicate that, among the eight dimensions of organizational culture, institutional collectivism, future orientation, assertiveness, and humane orientation are significantly different between high-performance and low-performance lean factories, providing support to hypothesis H1. Instead, no significant differences between the two groups were found for power distance, in-group collectivism, performance orientation, and uncertainty avoidance dimensions.

In order to better comprehend the role of organizational culture in lean implementation, I also analyzed the differences between lean vs. non-lean adopters in terms of organizational culture dimensions. Thus, I performed a second multi-group analysis considering factories with a high and low level of lean implementation (HL and LL). Outcomes reveal significant differences between these groups in the three dimensions of in-group collectivism, future orientation and uncertainty avoidance.

For each organizational culture dimension, **Table 9** reports the latent variable means of the groups considered and differences in χ^2 values (delta χ^2) between HLHP and HLLP, and HL and LL (in the fourth and seventh columns respectively).

Particularly interesting is the comparison between the delta χ^2 values which prove that both HLHP and HLLP, and HL and LL are significantly different for the future orientation dimension and not so for power distance and performance orientation. Instead they show contrasting results if I consider the other organizational culture dimensions. This comparison is very useful in order to better interpret and comprehend the role of the different organizational culture dimensions in lean implementation (see Sub-section 6.1.1). In fact, in-group collectivism and uncertainty avoidance are significantly different in HL and LL factories, but not in HLHP and HLLP factories. This suggests that they may favor the implementation of lean, and thus assume different values in lean and non-lean adopters, but alone do not guarantee the achievement of superior performance through lean. Conversely,

institutional collectivism and humane orientation are significantly different in HLHP and HLLP factories, and not significantly different in HL and LL factories. Thus they do not differentiate a lean and non-lean adopter, but make the difference in the successful implementation of lean.

Table 9: Multi-group analysis results for organizational culture dimensions

| OC dimension | HLHP | HLLP | Delta χ^2 | HL | LL | Delta χ^2 |
|----------------------------|--------|--------|----------------|--------|--------|----------------|
| Power distance | -0.167 | 0.011 | 1.724 | -0.166 | 0.167 | 3.291 |
| Institutional collectivism | 0.275 | -0.057 | 4.156* | 0.174 | -0.196 | 3.393 |
| In-group collectivism | 0.309 | 0.018 | 3.107 | 0.172 | -0.170 | 5.216* |
| Future orientation | 0.245 | -0.231 | 8.623* | 0.126 | -0.102 | 6.447* |
| Performance orientation | 0.154 | 0.011 | 2.859 | 0.087 | -0.086 | 3.083 |
| Assertiveness | -0.228 | 0.040 | 4.011* | -0.115 | 0.115 | 2.280 |
| Uncertainty avoidance | 0.026 | -0.070 | 1.698 | 0.117 | -0.094 | 4.363* |
| Humane orientation | 0.118 | -0.028 | 3.931* | 0.090 | -0.085 | 1.952 |

In order to test hypothesis H2, a further multi-group analysis was run including hard and soft lean practices (**Table 10**). Results indicate that HLHP and HLLP factories fail to show significant differences for none of the hard dimensions considered – i.e., set up time reduction, Just-In-Time deliveries by suppliers, daily schedule adherence, equipment layout, kanban, process control, autonomous maintenance, and cleanliness and organization. Instead, the two groups significantly differ in the adoption of almost all soft lean practices – except for top management leadership for quality – namely small group problem solving, training employees, supplier partnership, customer involvement, continuous improvement, manufacturing-business strategy linkage, providing support to hypothesis H2. Thus, I can conclude that what really makes the difference in the successful implementation of lean is the adoption of soft, rather than hard, practices.

Again, further details were obtained by running an additional multi-group analysis comparing lean and non-lean adopters (HL and LL). Significant differences were found for all the hard dimensions considered. This means that in several cases, managers who were asked to evaluate their overall level of lean application in the factory compared to competitors, considered it “high” because of the implementation of hard practices. However, our analysis demonstrates that these practices are not enough for the successful implementation of lean, and factories which failed to achieve a superior performance (HLLP factories) underestimate the importance of soft practices.

Table 10: Multi-group analysis results for lean dimensions

| Lean dimension | HLHP | HLLP | Delta χ^2 | HL | LL | Delta χ^2 |
|-----------------------------------------|-------|--------|----------------|-------|--------|----------------|
| <i>Soft lean practices</i> | | | | | | |
| Continuous Improvement | 0.365 | -0.036 | 4.239* | 0.153 | -0.148 | 3.465 |
| Training employees | 0.389 | -0.001 | 7.317* | 0.138 | -0.176 | 2.533 |
| Manufacturing-Business Strategy Linkage | 0.416 | -0.037 | 5.789* | 0.113 | -0.132 | 2.957 |
| Top management leadership for quality | 0.278 | -0.028 | 2.031 | 0.110 | -0.101 | 2.952 |
| Small group problem solving | 0.290 | -0.096 | 4.208* | 0.113 | -0.077 | 2.900 |
| Supplier partnership | 0.297 | -0.051 | 3.919* | 0.035 | -0.001 | 2.134 |
| Customer involvement | 0.291 | -0.137 | 3.929* | 0.124 | -0.089 | 3.165 |
| <i>Hard lean practices</i> | | | | | | |
| Autonomous maintenance | 0.266 | -0.002 | 1.528 | 0.130 | -0.132 | 3.859* |
| Cleanliness and organization | 0.243 | -0.026 | 2.031 | 0.092 | -0.099 | 4.656* |
| Kanban | 0.315 | 0.097 | 2.960 | 0.165 | -0.181 | 4.922* |
| Equipment layout | 0.244 | 0.064 | 2.028 | 0.184 | -0.183 | 5.426* |
| Process control | 0.246 | -0.022 | 1.975 | 0.165 | -0.161 | 4.359* |
| Just in time delivery by suppliers | 0.282 | -0.061 | 2.467 | 0.166 | -0.167 | 3.818* |
| Daily schedule adherence | 0.298 | -0.049 | 2.458 | 0.186 | -0.197 | 5.995* |
| Setup time reduction | 0.286 | -0.065 | 2.708 | 0.126 | -0.114 | 7.604* |

3.3.1 Additional analyses

HPM database involves manufacturing units located in different countries. In order to control for potential influence of societal culture, I run an additional analysis. Similarly to procedure adopted by Naor et al. (2010), I divided the database between Western and Eastern units and verified the presence of different organizational culture values. The results show that the two groups are different in terms of in-group collectivism, future orientation, and performance orientation, confirming findings of Naor et al. (2010). These evidences suggest that there can be an interplay between societal culture and organizational culture.

Secondly, I looked for differences in organizational culture values as well as in use of soft practices between the successful lean firms located in Western vs. Eastern countries. This allows to control if there are differences between successful lean units across the two regions in terms of organizational culture values or adoption of soft lean practices. I didn't find significant differences among these two groups.

These findings suggest that societal culture does not influence the organizational culture and soft practices of successful lean firms. Moreover, they suggest opportunities for future research. In particular, an interesting investigation should be conducted in order to determine whether and to what extent the differences in organizational culture found between Western and Eastern units play a role in facilitating or inhibiting the early phases of lean adoption.

4. Cross-border transfer of a lean system in a MNC: from an Italian unit to a Chinese subsidiary

4.1 Methodology

An in-depth case study methodology was adopted to address the research objectives since it allows to deeply analyze the process under examination and to provide detailed insights on how transferring activities are affected by socio-cultural differences between a source and recipient unit (Voss et al., 2002). As highlighted by Netland and Aspelund's (2014), literature on lean knowledge transfer is scarce and several issues are still open. Yin (1989) suggested in-depth case when little prior research has been conducted.

4.1.1 Case selection

The theoretical sampling approach guided the selection of the case study (Eisenhardt, 1989). My aim was to identify a case that would have guaranteed a transparent description of the transfer process in a setting characterized by a high cultural difference. Since my research focuses on early phases of a lean implementation project, I chose a MNC that have recently launched lean knowledge transfer initiatives towards a *non-lean* subsidiary. In particular, the dyad considered involves a Chinese manufacturing factory and its Italian headquarters.

I verified that the source unit has attested experience in lean, and that the lean knowledge transfer project provides successful results, i.e., lean knowledge transferred was routinized and lean practices persisted within the recipient factory, and the source monitored the status of lean implementation over time through KPIs and audits (e.g., number of standard works/procedures developed over time, audits on 5S).

Given the sensitivity of the data under investigation, confidentiality was a key factor in ensuring "open and honest" dialogue between the researcher and the MNC. Therefore, I don't disclose the MNC's identity.

The MNC selected is a leading Italian manufacturing firm realizing heating, ventilation, and air conditioning products. About a thousand employees work in production and sales facilities located in all the five continents. **Table 11** provides further general information on the headquarters and the site under study.

Table 11: General information on the headquarters and the Chinese subsidiary

| | Headquarters | Chinese subsidiary |
|-------------------------------------|---------------------|---------------------------|
| Factory establishment (Year) | 1973 | 2005 |
| Target market (Countries) | West-Central Europe | APAC |
| Employees (Number) | 450 | 200 |
| Lean implementation (Year) | 2007 | 2009 |

4.1.2 Data collection and analyses

A research protocol was created to enhance the reliability and validity of the case study (Yin, 1994). The literature review on organizational practice transfer in MNCs and lean management guided the selection of sections and issues to involve in such protocol. In particular, main sections and issues concern phases and activities in the transfer process, ways in which they were implemented and transfer approach, main problems found and countermeasures used, role of the source and recipient in performing activities, cultural peculiarities of the Chinese recipient.

Such research protocol was a based to collecting data through semi-structured interviews. I collected about 10 hours of data by interviewing headquarters' managers personally involved in the design and implementation of the lean transfer project. When necessary, additional data was gathered involving other employees. Face to face interviews were conducted by at least two researchers, were recorded, and painstakingly transcribed. Telephone conversations were also held to gather additional data and to validate previous interviews. Moreover, guided-tours of the Italian factory allowed direct observations. As recommended by McCutcheon and Meredith (1993), I triangulated data from semi-structured interviews with information gathered with other methods (e.g., analysis of MNC' documents and intranet) to increase the research reliability. Moreover, I closely supervised a master student who performed his master project (7 months of work) in the company. Data were collected primarily between March 2013 and April 2014.

Data analysis relied on an iterative approach, which involved frequent steps back and forth among the data during the process of concept development. This is also a result of frequent preliminary analysis' discussion among the researcher and MNC's managers involved in the transfer.

4.2 The case study

This section provides a detailed description of activities undertaken during the early phases of the lean transfer project towards the Chinese factory. Two consecutive initiatives were launched by the Italian MNC which basically resulted in (1) abandon of lean management – i.e. unsuccessful initiative – and (2) routinization of the lean knowledge transferred – i.e. successful initiatives –, respectively. The two initiatives are presented simultaneously so as to bring out differences that led to opposite results. For each initiative, activities are disclosed in chronological order and grouped into phases according to Maritan and Brush's (2003, p. 949) model of lean transfer: (1) project initiation, (2) train factory management, (3) redesign processes, (4) disseminate training and buy-in, (5) initiate implementation, and (6) stabilize and consolidate. I relabeled the first phase as “project initiation” instead of “assess factory endowment” since in my case it was widely beyond the assessment of factory endowment, comprehending planning activities. Moreover, I don't consider subsequent phases, which characterize more mature initiatives and thus are out of this study scope. **Table 12** schematizes findings from the case description.

Project initiation

The analysis of recipient's initial conditions and the design and deployment of lean transfer project's activities characterize the initiation phase. A cross-functional team was created in the headquarters and performed most of this phase, while the Chinese management supported it in specifying the starting situation.

From the technical point of view, the Chinese factory had been shaped following the headquarters' layout, and the same equipments had been used. Since its foundation, the factory has been managed in a quite autonomous way by local personnel according to a traditional non-lean managerial approach. In order to strengthen inter-unit relations and support the launch of the lean transfer project, the source team organized a factory guided tour of the Italian unit and some meetings with main representatives of Chinese factory explaining the importance of a greater coordination between units and benefits of lean practice sharing; these occasions were also used by the headquarters to acquire additional information about the recipient.

In all these preliminary activities the Chinese management appears to favorably accept lean implementation as well as to agree with the following implementation proposal advanced by the headquarters.

The Italian unit's experience was used as a basis for lean transfer project design. The source team's effort was primarily directed to codify the headquarters' lean knowledge and unveiling steps leading it to a successful lean implementation so as to replicate them in the Chinese subsidiary. Some minor modifications to the Italian lean system were allowed so as to make it more effective for the Chinese environment (e.g., replacement of text with photos to overcome high illiteracy rate of Chinese operators in work instructions as well as in documents to be posted in the cell boards). Exemplary successful cases of lean implementation in China documented in books were also analyzed to comprehend main peculiarities of such country.

A greater attention to social culture peculiarities of the Chinese context distinguished the second initiative. Indeed, the cause-and-effect analysis carried out at the beginning of such initiative pointed out socio-cultural differences between source and recipient as the major cause of unsuccessful transfer. Coherently, the factory assessment was integrated with additional and deepened information on local personnel's values and behaviors; previous on-field experience was the main data source. Such information also supported the definition of countermeasures to problems faced in transferring lean, which were defined by the source external managers in collaboration with the recipient workers.

Training

The recipient management was trained by some Italian lean experts who moved for a limited period of time to the Chinese factory.

Some theoretical lessons were planned so as to transfer basic concepts of lean philosophy and introduce the first set of best practices, i.e. value stream mapping, 5S, and preventive maintenance. All the class sections also involved ample space for exercises, thought to improve understanding of theoretical concepts and as a mean to verify effective knowledge acquisition. Learning-by-doing sessions followed. Through this approach the source team believed it could effectively overcome criticalities of the training phase, such as possible misunderstandings due to different meanings associated with a term (e.g., waste or standard) and risk of illusory consensus (i.e., "yes" answers that don't really mean "yes"; Davies, 2006, p. 129). However, the analysis preceding the second initiative revealed that these problems were more critical than expected. As a countermeasure, external managers agreed in anticipating actions in the gemba. Indeed, learning-by-doing would have considerably limited misunderstandings, since external managers could have concretely showed what lean practices meant, and allowed to gather truthful feedbacks, by verifying recipient's actual behaviors.

Redesign processes

A team involving both headquarters' and subsidiary's managers is created so as to redesign Chinese factory's processes according to lean principles. In this way, concepts learned by the Chinese management during training phase could be deepened and fixed according to a learning-by-doing approach.

A major criticality was faced by external managers in redesigning processes. Although local managers had cleverly solved classroom exercises, they manifested a scarce attitude to propose solutions to face real problems (e.g., few proposals, wait for supervisors' instructions). As a consequence, headquarters' members performed most of this phase compensating Chinese management's inertia (e.g., provide specific solutions to redesign activities or to resolve problems), and finishing activities on time. Conversely, during the second initiative local employees were given more time to define personal proposals, while external representative supported local employees by providing guidelines and stimulating analysis. Indeed, the cause-and-effect analysis revealed that the lack of proactivity was linked to cultural reasons, rather than scarce abilities. In other words, the Chinese personnel were accustomed to wait and observe instructions from higher levels rather than providing solutions; in addition, they feared to present proposals with doubtful results. Since these attitudes were incompatible with lean practices and philosophy, but rooted in Chinese workers, it was essential to strongly contrast them right away, and to instill autonomy and proactiveness behaviors and values.

Disseminate training and buy-it

Once redesigned the processes, the source personnel charged Chinese managers with training operators on the new working method. In particular, leveraging on a learning-by-doing approach, the management had to show them how to perform workstation operations following headquarters' instructions as well as transfer lean principles and knowledge about 5S and preventive maintenance practices.

As pointed out by the Italian representatives, the choice of assigning training activities to local personnel was primarily due to language differences (i.e., Italian managers didn't speak Chinese, while local operators didn't understand English), which made communication very difficult. However, they supervised the activity development by occasionally going on and observing gemba.

The time external managers spent on the shopfloor significantly increased during the second initiative. Indeed, be in contact with local employees on a daily basis helped them to build trust and to gain knowledge about local peculiarities. As revealed by the cause-and-effect

analysis, these actions were fundamental to instill lean behaviors as well as to define appropriate adaptations, thus sustaining the lean implementation in the long run.

Initiate implementation

The implementation phase starts when transferred knowledge is used to perform everyday work, following the normal production level. External managers help local managers to solve problems, while gradually handing over factory management.

As in the case of process design, the major difficulties faced by the headquarters in implementation phase was the scarce autonomy of Chinese employees, especially concerning problem-solving activities, mistakes in applying standard works and misunderstandings of lean practices' content and aim (e.g., inadequate care of equipments, not well-organized workstations after 5s sections, mistakes in the table boards, incapacity of interpreting KPIs in the table boards, activities implemented and decisions taken without appropriate quantitative analyses on the as is situation, etc.). Such problems resulted in frequent interruptions of production activities. A great effort was made by the Italian managers to resolve production criticalities, thus sustaining lean transformation.

These problems appeared significantly reduced in the second initiative. As suggested by the source team, the different approach in conducting previous phases and the headquarters' increased awareness of recipient's peculiarities, which resulted in a greater capacity to define effective countermeasures, helped to increase Chinese workers' participation and autonomy, and to make them better understand lean practices.

Another major obstacle that undermined the implementation phase was the low loyalty to the organization of Chinese employees. The development of collaborative relations and the establishment of ad-hoc incentive mechanisms (e.g., retention plans for managers and team leaders, and better working conditions and creation of a learning program for operators) helped to contrast employees' layoffs.

Stabilize and consolidate

In this phase the use of the transferred knowledge should be gradually routinized. The recipient performs most of this phase, though both on-site and remote support and supervision by the headquarters can play a decisive role in preventing that the lean project regress.

As long as external managers were on-site they encountered difficulties similar to the previous phase (see implementation phase). When repatriated, the new obstacle they faced

concerned the factory assessment. Although the headquarters maintained constant communications with the overseas management, it was hard put to determine whether the subsidiary was progressing in lean implementation or if there were, for instance, a number of unresolved problems. Inter-firm communication was also hampered by the lack of objective parameters on certain aspects (e.g., overall factory's knowledge on lean management).

Concerning the second initiative, Italian managers observed that the development of strong and trustful relations besides the definition of ad-hoc KPIs increased communications' transparency and effectiveness, helping remote supervision and support.

Table 12: Case study findings

| Phase of the transfer process | First initiative | | | Second initiative | |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| | How activities are carried out | Roles of source and recipient | Main problems faced by the source | Main adaptations and ad-hoc solutions | Changes in roles |
| (1) Project initiation | Meetings between source and recipient representatives as a major mean to gather information about the recipient and to communicate change in manufacturing strategy Source's effort is primarily directed to codify the headquarters' lean practices and solutions; minor modifications to source's practices | A cross-functional team is created in the source and put in charge of the design of the transfer project Chinese management supports source's data gathering | No major problems | Recipient factory assessment is integrated with additional and deepened information on local personnel's values and behaviors Greater attention to social culture peculiarities of the Chinese context Previous on-field experience as the main source of data Strong adaptation of headquarters' lean practices and solutions | Recipient workers collaborate with source in defining countermeasures to problems |
| (2) Train factory management | Recipient management is trained by Italian lean experts assigned to the Chinese factory Theoretical lessons with ample space for exercises, followed by learning-by-doing sessions | Italian and Chinese managers as source and recipient of lean knowledge, respectively | Misunderstandings (different meanings associated with terms, e.g., waste or standard) Illusory consensus ("yes" that is not "yes") | Learning-by-doing sessions: <ul style="list-style-type: none"> concretely showing what lean practices mean source avoids misunderstandings verifying recipient's actual behaviors source gathers truthful feedbacks on training | Training as team work in gemba |
| (3) Redesign processes | Team work Activities finish according to scheduled time, but increased source's effort | Headquarters' managers have a major role in solving problems | Scarce participation to problem-solving and improving activities (e.g., few proposals, wait for instructions) | Local employees are given more time and are supported in defining personal proposals, instead of providing specific solutions | Recipient as a key solver of problems; source provides support |
| (4) Disseminate training and buy-in | Learning-by-doing approach Source supervises training activities by occasionally going on gemba | Chinese managers are in charge of training operators in lean practices | Different language (Italian managers didn't speak Chinese, while local operators didn't understand English) | External managers spend more time on the shopfloor: <ul style="list-style-type: none"> day-by-day contact helps to build trust between the parties source increases its knowledge about local peculiarities | Source and recipient spend more time together; external and local managers collaborate in training operators |

Table 12: (Continued)

| Phase of the transfer process | First initiative | | | Second initiative | |
|--------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| | How activities are carried out | Roles of source and recipient | Problems faced by the source | Adaptations and ad-hoc solutions | Changes in roles |
| (5) Initiate implementation | A great effort was made by the Italian managers to resolve production criticalities | Gradually hands over of factory's activities (from source to recipient) | Scarce autonomy in performing problem-solving and improvement activities Mistakes in applying standard works and misunderstandings of lean practices' content and aim Low loyalty to the organization | Scarce autonomy is contrasted by: <ul style="list-style-type: none"> defining adaptations and ad-hoc solutions in previous phases creating collaborative relations (previous phases) Low loyalty to the organization is contrasted by: <ul style="list-style-type: none"> creating collaborative relations (previous phases) defining ad-hoc incentive mechanisms (retention plans, better working conditions and learning program) | Recipient managers are more autonomous in implementing lean and control subsidiary's status |
| (6) Stabilize and consolidate | Constant communication between the parties | Recipient has a leading role Source is in charge of on-site and remote support and supervision | Scarce autonomy in performing problem-solving and improvement activities Low loyalty to the organization Difficulties in communicating, that in turn hinder remote subsidiary assessment | Difficulties in communicating and in assessing subsidiary status is contrasted by: <ul style="list-style-type: none"> creating collaborative relations (previous phases) defining ad-hoc control mechanisms (e.g., measure of the factory's knowledge on lean management) | - |

4.3 Key lessons learned

Basing on Maritan and Brush's (2003) process model and the initiatives conducted by an Italian MNC towards a Chinese subsidiary, I described activities needed to effectively *design* and *carry-out* a lean implementation project in an overseas non-lean unit. I observed that the main activities in the analyzed transfer project followed Maritan and Brush's (2003) process model. However, my case study also suggests that, besides implementation activities, planning activities play a crucial role in determining the effectiveness of the transfer project. Moreover, by contrasting the two initiatives, it emerges a significant difference in the way transferring activities were conducted by the headquarters (i.e., different replication approach and level of cooperation between source's managers and recipient employees), which is likely to explain different initiatives' outcomes. Consistent with the approach of some previous scholars (e.g., Narasimhan and Jayaram, 1998), I summarize key lessons learned from the experiences of the case study in the form of propositions.

With regard to *planning activities*, I observed that, at the beginning of both initiatives, a cross-functional team was put in charge of defining how the transfer project should have been implemented. The headquarters' experience served as a model for defining the transfer project. However, while in the first initiative the team opted for a *high fidelity approach* in replicating the source's lean practices and solutions, a *strong adaptation mode* was eventually selected as appropriate to fit the subsidiary's peculiarities. Indeed, the cause-and-effect analysis carried out before launching the second initiative clearly indicated that socio-cultural differences between the factories had hindered the correct implementation of source's lean practices and solutions, and that implementation problems could have been solved by introducing modifications and ad-hoc solutions. For example, misunderstandings during training sessions could have been reduced by anticipating activities on *gemba* and reducing/eliminating theoretical lessons. In addition, Chinese employees' participation could have been encouraged by giving more time to define personal proposals and creating trustful relations between workers. In line with some previous studies (e.g., Maritan and Brush, 2003; Wallace, 2004), these findings suggest that lean management leads to superior results when adapted to a firm's context, thus source managers have to consider and define specific solutions to fit recipient's peculiarities when designing a lean transfer project.

In addition, my case study demonstrates that *socio-cultural differences* can be particularly crucial when transferring lean overseas. On the one hand, when a source focuses on technical elements, underestimating socio-cultural characteristics, it is likely that external representatives will manage foreign employees in an unsuitable way. As in the first initiative, there can be resource shortage for some phases of the transfer process (e.g., insufficient time for process reengineering in order to stimulate recipient participation), incorrect priority

determination (e.g.; respect of scheduling rather than leaving time to subsidiary's management to provide its own proposals), and failures in selecting most effective solutions to handle transferring activities (e.g., training approach). On the other hand, a thorough contextual analysis of socio-cultural elements, in addition to technical ones, it is likely to enable a source team to define suitable solutions for managing people, such appropriate training methods and incentive mechanisms, which influence effectiveness of both hard and soft lean practices.

The following statements illustrate the relevance of properly understanding socio-culture differences to effectively transfer lean overseas.

"[During the first initiative] we hadn't fully understood what we should have done to make lean philosophy explicit for local workers. [...] When we launched 5S in the headquarters, employees discussed a lot to decide the most appropriate equipment arrangement. Conversely, there was a little discussion among Chinese workers. We noticed that sometime people in China placed their equipments in a "not-rational way", leaving far more used tools and vice versa [placing nearest those less frequently used]. [...] It seemed that they were acting in a "mechanical way"; acting as taught, but without understanding that the 5S practice was intended as a mean to improve their work. [...]"

The thoughtful analysis we made before launching the second initiative revealed us many important aspects of the Chinese context ... before, we had only partially understood them because of the great difference in the way of thinking, acting, etc.. Recognizing and adequately managing their peculiarities was essential to successfully implement lean."

Therefore, previous findings suggest that the transfer project design should be based on a *comprehensive analysis* of the subsidiary's initial conditions, which encompasses both technical and socio-cultural peculiarities. In addition, the case study suggests that field experience played an important role in properly managing adaptation. On the one hand, during the project initiation phase of the first initiative, source managers gathered data on foreign context by organizing meetings with recipient representatives, analyzing exemplary cases documented in books, etc.. However, even though some socio-cultural peculiarities were identified, headquarters managers weren't able to correctly estimate their consequences on lean implementation, as well as to define effective countermeasures to possible problems. Conversely, experience on the field and cause-and-effect analysis of first initiative supported problem identification and solution. For example, while during theoretical lessons occurred in the first initiative source managers had considered no request for clarification and ability to solve exercises as Chinese managers' proper understanding of

source's lean practices, during the second initiative they opted for learning-by-doing sessions to avoid misunderstandings and obtain truthful feedback by verifying actual behaviors. Therefore, in line with studies stressing the relevance of social mechanisms for knowledge transfer, such as assignments of source managers or expatriates (e.g., Riusala and Suutari, 2004; Inkpen, 2008), my findings suggest that source has to invest direct resources in the recipient factory to effectively transfer lean.

Based on these empirical evidences, I propose that the following proposition:

Proposition 1: *When a lean system is transferred between a source and recipient factories characterized by a high socio-cultural difference, the source has to carefully investigate socio-cultural peculiarities of the recipient, in addition to technical ones, and define adaptations accordingly. For this purpose, direct resources should be invested.*

With regard to *countermeasures*, my observations suggest that it is important to establish a collaborative relation between source representatives and recipient employees; to this aim, headquarters' management has to guarantee a strong presence on the recipient's gemba. As mentioned before, source managers' experience on the field was crucial for identifying recipient peculiarities and, in turn, defining adaptations. Moreover, gemba team-work was more effective than theoretical sessions in transferring lean knowledge (e.g., reducing misunderstandings and misleading feedbacks). In other words, it can be argued that the presence of headquarters' representatives on the shop-floor while collaborating with local employees allowed to create a sort of "double learning process".

Second, from the case emerged that the source's strong presence on the gemba helped to reduce or eliminate *incompatible behaviors*, i.e. behaviors in contrast with lean philosophy, such as low participation to problem-solving and process improvement, no open communication and illusory consensus, low loyalty to organization, etc.. For example, as long as the Italian management didn't vigorously promote workers' autonomy and participation by leaving more time to analyze problems and supporting workers asking for their views rather than providing solutions, local employees continued to wait for superiors' orders, fearing effects of not effective solutions or wrong choices. As stressed by Shook (2010), change what people do – i.e., reduce or eliminate *incompatible behaviors* – is the first step to instill a lean culture into an organization.

Finally, the creation of trust between the parties was also fostered by source and recipient work side by side, day after day. This was fundamental to stimulate openness and to maintain transparency in communications, also once Italian managers repatriated.

Another important countermeasures used to sustain lean implementation within the recipient are *incentive* and *control mechanisms*. *Incentive mechanisms*, such as retention plans for managers and team leaders, and better working conditions and creation of a learning program for operators, were defined to increase Chinese employees loyalty to the organization. With regard to *control mechanisms*, it was defined tools for assessing the overall level of lean knowledge within the factory and recipient employees' individual understanding of lean philosophy. During the first initiative the remote control of recipient factory's lean status was hindered by lack of objective measures, which can be notified unambiguously. Conversely, the definition of *control mechanisms* supported local managers in controlling the status of the lean implementation project by measuring a set of dimensions which were really critical in Chinese context. Moreover, it supported remote control by the source providing truthful and precise indications.

Previous empirical evidences are summarized through the following proposition:

Proposition 2: *When a lean system is transferred from an Italian source towards a Chinese recipient, the success of the project is subordinated to on-gemba collaboration between source's representatives and recipient's employees. It supports adaptation, allowing to define more effective solutions, helps to overcome non-lean behaviors and to create trust between the parties. Ad-hoc incentive and control mechanisms are also important to sustain lean implementation.*

5. Cross-border transfer of a lean system in MNCs: from European units to Chinese and US subsidiaries

5.1 Methodology

The objective of my research is to explore how cultural differences can affect the cross-border transfer of a lean system, in terms of problems faced by a source during the transfer project and solutions implemented to handle such criticalities. The study is explanatory as well as exploratory in its nature. Indeed, besides relating cultural differences to transfer problems and countermeasures, it also characterizes and operationalizes the main variables differentiating cross-border lean knowledge transfer projects within MNCs. Therefore, the multiple case-study methodology is adopted to address this research objective, since it is extremely valuable to identify and describe crucial variables and to discover links between them (Yin, 1994). I analyzed seven transfer projects at a dyadic level, i.e., projects between a source unit and a recipient factory of a MNC, which is regarded as an appropriate unit of analysis to explore transfer project within MNCs (Gupta and Govindarajan, 2000).

5.1.1 Case selection

Theoretical sampling guided the selection of the case studies (Eisenhardt, 1989). The process of selection involved two major phases. First, a list of lean MNCs was identified, considering MNCs which had collaborated in master courses/university workshops on lean management and/or member of lean clubs/associations (e.g., Lean Enterprise CLUB of CUOA Business School). Second, I gathered data on these MNCs and their lean projects so as to determine if a MNC could be interesting from my research's objective point of view. I focused on lean MNCs with headquarters in Europe that have recently transferred their lean systems to non-lean subsidiaries in China and U.S..

Data gathered on the field allowed me to select a sample which satisfies both literal and theoretical replication issues (Yin, 1984). In particular, I selected four cases in which the recipient is a Chinese factory and three cases in which the recipient is a U.S. factory. China and U.S. provide examples of polar types of societal cultures, thus are useful to explore how such variable can affect the transferability of a lean system (Eisenhardt, 1989). Moreover, I selected dyads involving sources with both similarities and differences in terms of organizational culture values. Indeed, although literature on lean knowledge transfer focuses on recipient cultural characteristics (either absolutely evaluated or relatively to the source), some clear differences between the cases emerged during data collection. In particular, such differences concern the level of power distance – i.e., “the degree to which members of an

organization (or society) expect and agree that power should be stratified and concentrated at higher levels of an organization” (House et al., 2004) – within a source, which reflected in the way external managers conducted a lean transfer project. Within some sources all employees, regardless of their role within the company, were strongly encouraged to collaborate in order to achieve company’s goal; the source’s senior management also vigorously promote face-to-face contact and communication between workers at different hierarchical levels. Accordingly, all lean knowledge transfer project’ actions designed by the source, even early actions such as training and creation of operation instructions, sought contact and involvement of all employees (e.g., source planned that learning-by-doing sections of training teams would have involved both local managers and employees as well as source representatives). In addition, external managers considered the constant presence of on the recipient’s gemba as a key means to create trustful relations. In the following, I will use the term “OC1” in order to refer to this type of cultural profile characterized by a low power distance.

Conversely, in other cases, even if the sources encouraged bottom-up participation of employees, lean implementation followed a directed top-down approach (e.g., everyone’ suggestions is valued and allows company’s continuous improvement, but specific targets are settled by senior management and derived level-by-level to guide all the initiatives). In a similar way, the source decided to focus external managers’ effort on local managers, while delegating them actions toward operators (e.g., external managers would have trained local managers and then they would have trained operators); audits similar to ones employed in the source would have been used to control effectiveness of local managers’ work. In the following, I will use the term “OC2” in order to refer to this type of cultural profile characterized by a high power distance.

My sample includes three cases in which the source is characterized by OC1 and four cases in which the source has an OC2. **Table 13** shows case study position according to the two sampling variables employed.

Table 13: Sampling matrix

| | | Country of lean knowledge recipients | |
|-----------------------------------------------|------|--------------------------------------|--------------------------|
| | | U.S. | China |
| OC of the European lean knowledge owner units | OC 1 | Delta U.S. | Beta China, Delta China |
| | OC 2 | Alpha U.S., Gamma U.S. | Alpha China, Gamma China |

Finally, my cases show some common characteristics which are useful to limit confounding effects when studying the link between variables as well as to set precise boundaries for the research. On the one hand, I focused on European MNCs with an attested experience in lean. It is worth noting that I considered different dyads with the same source, i.e., I analyzed dyads composed by the same source which had transferred lean both in China and in U.S. (see **Table 14**). On the other hand, the recipient factories are non-lean subsidiaries. Moreover, I verified that mainly local employees worked within the recipients at different level work, thus assuring that values and behaviors can go back up to the societal context of the recipient. Finally, I verified that lean knowledge transfer projects provided successful results, i.e., lean knowledge transferred was routinized. **Table 14** provides information for the seven cases selected.

Table 14: Overview of the cases

| Case | MNC | Dyad | | Interviewees |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | Source | Recipient | |
| Alfa China | <i>MNC 1</i> including five manufacturing factories in four continents (Asia, North America, South America and Europe); headquarters in Italy; products: humidification and control systems for heating, ventilation, air conditioning/refrigeration | <i>Source Alpha:</i> Italian manufacturing unit, which produces the whole range of products of the MNC | <i>Recipient Alpha China:</i> Subsidiary located in Suzhou (China) with about 200 employees, which makes products for APAC markets | The lean expert in charge of lean transfer project in the Chinese factory and its team members; Italian managers who supported lean transfer team; the chief group organization officer (i.e., supervisor of all lean projects in the organization) |
| Alfa U.S. | <i>MNC 1</i> | <i>Source Alpha</i> | <i>Recipient Alpha U.S.:</i> Subsidiary located in Pennsylvania (U.S.) with about 30 employees, which makes products for the North American market | The lean expert in charge of lean transfer project in the U.S. factory and its team members; the chief group organization officer |
| Beta China | <i>MNC 2</i> including nine manufacturing units in three continents (Asia, North America, and Europe); headquarters in France; products: critical power, power control and safety, energy efficiency, and solar power solutions | <i>Source Beta:</i> Italian subsidiary, which produces products and services relate to high-availability power supplies to critical applications | <i>Recipient Beta China:</i> Subsidiary located in Shanghai (China) with about 40 employees, which provides products and services relate to high-availability power supplies to critical applications for the Chinese market | Lean expert responsible for transferring lean to Chinese factory and its team members (e.g., Managing Director of critical power division); the lean expert responsible for lean projects within the Italian subsidiary; the the Managing Director of the Chinese subsidiary |

Table 14: (Continued)

| Case | MNC | Dyad | | Interviewees |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | Source | Recipient | |
| Gamma China | <i>MNC 3</i> including thirty-five manufacturing factories in four continents (Asia, North America, South America, and Europe); headquarters in U.K.; production: industrial, architectural, heat transfer fabrications, and renewable energy solutions and superconductors | <i>Source Gamma:</i> Italian subsidiary, which produces heat-transfer coils and coolers and related services for the European market; managers from the headquarters also collaborate | <i>Recipient Gamma China:</i> Subsidiary located in Wuxi (China) with about 250 employees, which realizes heat-transfer coils and coolers for the Chinese market | The lean expert in charge of the lean transfer project to the Chinese factory; the Italian factory's lean expert (i.e., manager in charge of lean projects within the excellent lean factory for the company's division realizing heat-transfer coils and coolers) |
| Gamma U.S. | <i>MNC 3</i> | <i>Source Gamma</i> | <i>Recipient Gamma U.S.:</i> Subsidiary located in Kentucky (U.S.) with about 250 employees, which realizes heat-transfer coils and coolers for the North America market | The lean expert in charge of the lean transfer project to the U.S. factory; the Italian factory's lean expert |
| Delta China | <i>MNC 4</i> including twenty-eight manufacturing units in four continents (Asia, North America, South America, and Europe); headquarters in Sweden; products: heat transfer, separation and fluid handling | <i>Source Delta:</i> Italian subsidiary, which produces air heat exchangers and related services for the European market; managers from the headquarters also collaborate | <i>Recipient Delta China:</i> Subsidiary located in Suzhou (China) with about 30 employees, which realizes air heat exchangers for Chinese market | The lean expert in charge of lean transfer to Chinese factory and its team members (e.g. the lean expert for air heat exchangers); the lean expert for air heat exchangers in European factories |
| Delta U.S. | <i>MNC 4</i> | <i>Source Delta</i> | <i>Recipient Delta U.S.:</i> Subsidiary located in Virginia (U.S.) with about 100 employees which realizes air heat exchangers for U.S. market | The lean expert in charge of lean transfer project to U.S. factory and its team members; the expert for air heat exchangers in European factories |

5.1.2 Data collection, reduction and analyses

A research protocol was created to enhance the reliability and validity of case study (Yin, 1994). It included four main sections derived from the literature review on knowledge transfer: (1) cultural characteristics of the recipient context (either absolutely evaluated or relatively to the source), (2) cultural peculiarities of the source, (3) problems faced by a source during the transfer project, and (4) solutions implemented to handle such criticalities. For each section of the research protocol, I defined some issues to be investigated so as to gather complete and useful information on the lean transfer project in each dyad.

As defined in this research protocol, semi-structured interviews represent my main source of data. Managers in charge of lean knowledge transfer projects, their team members and other managers deeply involved in the transfer projects (e.g., supervisors of lean projects within the MNC, managers who supported lean transfer project planning or practice adaptation) were interviewed in the period between March 2013 and April 2014 (see **Table 14** for further details on interviewees). The interviews were conducted by at least two researchers, ranged from 90 to 160 minutes, and were recorded and painstakingly transcribed. In order to increase research reliability, I also analyzed information from other sources such as companies' documents (e.g., A3 documents on lean strategy deployment or company's X matrix, the handbook of lean standards, the standardized procedures for implementing each lean practice, etc) and web source, and triangulated these information with data from interviews (Eisenhardt, 1989). Finally, guided-tours of factories within each dyad allowed direct observations of lean practices implemented, and thus to verify the correctness of the data/information gathered during the interviews and from documents. Where data discrepancies were found, the aspects generating contradictions were thoroughly investigated.

Data reduction process was used to summarize the large amount of information resulted from data collection. It basically consisted in the characterization of each dyad based on the research variables of interest in this study – i.e., cultural context and lean knowledge transfer project. As reported in **Table 15**, every research variable was characterized by a set of items, and every item was classified by using a well-defined rule determined by comparing data across the cases and starting from the literature. I depicted the cultural context based on the cultural characteristics of the source organization and the country of the recipient unit. I selected these variables starting from the literature on lean and knowledge transfer (see Chapter 2) and after iterative cycles of axial coding based on cross-case comparison. In particular, from the cross-case analysis it emerged that, *ceteris paribus*, these were the variables that mainly affected a lean knowledge transfer project, in terms of problems in

performing transfer projects and/or level of adaptation between planned actions and effective solutions and countermeasures put into practice.

As mentioned before, literature on lean knowledge transfer focuses on recipient's cultural context (see Sub-section 5.1.1), and does not provide a common way to operationalize source organization's cultural characteristics. By comparing cases, I distinguished between OC1 – i.e., low power distance – and OC2 – i.e., high power distance – (see previous section and **Table 15**).

For what concerns the country of the recipient unit, I considered two polar types of recipients: U.S. and Chinese subsidiaries, as they differ for socio culture peculiarities, which are recognized as an influential variable in knowledge transfer projects (Kostova, 1999; Gupta and Govindarajan, 2000; Jensen and Szulanski, 2004) and in lean implementation (e.g., Hines et al. 2011; Wiengarten et al. 2011; Kull et al., 2014).

As regards lean knowledge transfer project, I focused on problems in transferring lean knowledge and level of adaptation between planned actions and effective solutions and countermeasures put into practice. In particular, my research focuses on the early phases of lean knowledge transfer projects, thus transfer projects were analyzed in the period between when the source contacted the recipient to inform it about the lean transfer opportunity, until the recipient proved to master lean practices. Main activities involved concerns so-called kickoff meetings and excellent factory visits, training of local employees, local managers' support and supervision in lean implementation in loco and, after the handover, in the distance. Consistent with some previous contributions (e.g., Szulanski, 1996; 2000; Jensen and Szulanski, 2004), I studied problems by distinguishing the phase of a knowledge transfer project in which problems occurred. Two main phases – i.e., introduction and implementation – can be distinguished in such period considering the nature of the problems encountered by dyads.

For what concerns the extent of adaptation between planned actions and effective solutions and countermeasures put into practice, I considered three intermediate levels between adoption and adaptation (Ansari et al., 2010; Netland and Aspelund, 2014): low, medium, and high level of adaptation, which concern decreasing fidelity in replicating the source's solutions.

Table 15: Data reduction

| Variable | Characterisation | Rating |
|------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cultural context | Source organization | <p><i>OC1 (low power distance):</i> Within the source factory, all workers, regardless of their role within the company, are strongly encouraged to collaborate in order to achieve company's goal; the source's senior management also vigorously promote face-to-face contact and communication between workers at different hierarchical levels. Accordingly, all lean knowledge transfer project' actions designed by the source, even early actions such as training and creation of operation instructions, sought contact and involvement of all employees (e.g., source managers participated to all training activities – i.e., not only taught foreign managers, but also closely supervised training sessions towards foreign operators –, standard works were jointly redefined, etc.); constant presence of external managers on the gemba as a key means to create trustful relations; in case of problems, source managers tended to provide guidelines instead of precise solutions, so as to stimulate the participation of the counterpart.</p> <p><i>OC2 (high power distance):</i> Although the company encourages bottom-up participation of employees, lean implementation within the source followed a directed top-down approach (e.g., everyone' suggestions is valued and allows company's continuous improvement, but specific targets are settled by senior management and derived level-by-level to guide all the initiatives). In a similar way, the source decided to focus external managers' effort on local managers, while delegating them actions toward operators (e.g., external managers would have trained local managers and then they would have trained operators); audits similar to ones employed in the source would have been used to control effectiveness of local managers' work; in case of problems, source managers tended to provide specific solutions.</p> |
| | Country of the recipient unit | <p><i>China:</i> High difference with European countries in terms of socio-cultural traits that results in the lack of a common language and differences in the meanings assigned to the artifacts of communication, which are accentuated by the high illiteracy rate; high power distance and high uncertainty avoidance, which reflect in high respect for hierarchies and fear in providing ideas as well as solutions with not clear results; group loyalty is a fundamental value underlying family relationships, not working ones.</p> <p><i>US:</i> Low difference with European countries resulting from similarities in the language systems and in the meanings assigned to the artifacts of communication and favored by low illiteracy rate; workers value tangible and short-term results (low pragmatism combined with high masculinity); freedom of expression and self initiative (low power distance combined with high individualism); group loyalty characterized some working relationships.</p> |

Table 15: (Continued)

| Variable | Characterisation | Rating |
|---------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lean knowledge transfer project | Problems in performing lean knowledge transfer project | <p><i>Introduction phase:</i> Source encountered problems in launching the project; recipient managers opposed to lean knowledge transfer project during initial meetings.</p> <p><i>Implementation phase:</i> Source encountered problems in performing training and in supporting and supervising recipient workers both in loco and in the distance; communications difficulties and several local employees' behaviors in contrast with the lean philosophy (e.g. no openness, no feedback on training, low participation at problem-solving activities, low autonomy, and low loyalty to the organization).</p> |
| Lean knowledge transfer project | Level of adaptation between planned actions and effective solutions and countermeasures put into practice | <p><i>High:</i> Some planned actions, such as training and gemba audits, proved ineffective, thus required a redesign; new tools, such as incentive or controlling mechanisms, needed to be created; the source invested considerable additional resources and made a huge effort to redesign and re-do activities, create new tools, and change behaviors while implementing planned actions, which resulted in significant delays in project' scheduling (several months).</p> <p><i>Medium:</i> Although no planned actions weren't redesigned, the source had to invest additional resources to encourage lean behaviors during implementation (e.g., training period was extend to fix some fundamental concept of lean philosophy, such as waste or standard, or stimulate openness among workers); creation of some new tools required few additional resources; project' scheduling was subject to some delays (few months).</p> <p><i>Low:</i> Project was essentially performed as planned; few additional resources were needed to overcome recipient's opposition to lean knowledge transfer project and introduce minor modifications to existing tools; project' scheduling was subject to minor delays (about a month).</p> |

The data analysis was done according to the two-step method suggested by Eisenhardt (1989). Firstly, the within-case analysis was performed by considering each case as a stand-alone entity and looking for unique patterns of each case (see Section 5.2). This allowed to become intimately familiar with every case, but also facilitated the comparison of the seven cases (Voss et al., 2002). The second step concerns cross-case analysis, where axial and selective coding techniques were adopted to make connections among categories so as to explain the phenomenon under study (see Section 5.3).

5.2 Within-case analysis

This section synthesizes the within-case analysis. In particular, main activities involved in each transfer project are briefly presented together with problems occurred in transferring lean and adaptations introduced to successfully implementing lean abroad.

Alfa China

The source initially organized a factory guided tour in the Italian unit (i.e., the exemplar lean factory within the MNC), followed by a presentation of the main steps of lean implementation in this factory and benefits achieved. The source eventually presented the lean transfer project and in that occasion the recipient approved to implement lean. The recipient's managers seemed to acknowledge lean as a powerful mean for improving the Chinese factory.

According to the approach used in the Italian factory, training on lean practices involved two main steps. First, local managers were trained by external lean experts in classroom lessons, then learning-by-doing activities on the shop floor; afterwards, local managers trained local operators through learning-by-doing sessions on the shop floor. In particular, Chinese managers trained operators quite independently, while source representatives occasionally controlled activities. The participation of Chinese employees to learning activities was low: no interaction with mentors, no questions for more details, few ideas during learning by doing sections, etc.. In addition, several problems occurred when lean activities began to be put into practice. As source's reports on periodical factory's audits highlight, there were numerous mistakes in applying standard works and misunderstandings of lean practice content and aim (e.g., not well-organized workstations after 5s sections, inadequate care of equipments, mistakes in the table boards, incapacity of interpreting KPIs in the table boards, activities implemented and decisions taken without appropriate quantitative analyses on the as is situation), which resulted in frequent interruptions of production activities and required intervention of the source managers for solving problems. Such problems severely prejudicated lean implementation. The low loyalty to organization also contributed in determined a rapid loss of the transferred knowledge.

After several months the source was in the Chinese factory, the headquarters' representatives decided to redo training; before launching a second initiative, activities were redesign. In order to limit misunderstandings and non lean behaviors, the source decided to lever on a team based learning-by-doing approach and to participate to training sessions with operators. Instead of providing detailed solutions to handle problems, this time recipient

managers were given only some guidelines and were asked to analyze and define how to perform activities (e.g., propose a sequence of steps and related timing for carrying out activities, analyze coherence between proposals and lean principles, define impacts on performance, etc.). In this way, the source partially adapted its best practices (e.g., cell meeting duration was extended to allow gathering suggestions for PDCA cycles, PDCA labels with pictures, more pictures and symbols instead of text in standard work instruction). As a result, the introduction of new knowledge was facilitated, and some problems, such as illiteracy issue, effectively overcame.

The source established highly-frequent contacts to control and support the recipient, also after the handover. In particular, the source committed local managers to using the source' audit system to monitor operational performance as well as operators' lean knowledge by asking precise and regular feedbacks; among measures constantly checked, the new KPI on training (i.e., the ration between the overall numbers of employees on ones properly taught). In order to address low loyalty issue, the headquarters also predisposed a list of employees in charge of training new workers (more experience and cooperative operators were selected) and defined a specific reward system (e.g., monetary rewards for workers who cooperated in lean implementation and were loyal to the company; better work conditions, such as more safety workstations, etc.).

Alfa U.S.

As in the case Alfa China, the source initially organized a tour of the Italian factory followed by a presentation. In that occasion, the recipients' managers asked several details about the lean tools implemented, the time dedicated to the lean project and results achieved, and postponed the decision about lean transfer project, in order to have more time to collect further information. Afterwards, the source organized some other meetings, in Europe and in the U.S., to painstakingly expose the characteristics of lean practices, standards, and tools and make all potential advantages more evident. Only some weeks later, the recipient agreed to participate to the lean transfer project.

Similar to the Chinese case, training included two main phases: local managers were trained in classroom lessons and learning-by-doing sessions, then local managers trained local operators quite independently through learning-by-doing sessions; source experts occasionally control activities. Training proceeded almost smoothly and accordingly to time scheduled. After training, recipient managers and operators actively began to implement lean practices, accordingly to source's lean standards (only minor modifications were introduced, such as in the case of "water spider" standard – i.e., the standard that regulates how

production lines have to be supplied with components and subsystems according to a milk-run logic and the presence of a dedicated operator –, which required a different solution due to low factory's production volumes that not justified the cost of a dedicated operator). They demonstrated a propensity towards using KPIs and quantitative analyses, which were prerequisite to lean implementation. The participation of managers and workers during practical sections and lean implementation on field was high, with several suggestions provided and PDCA opened. U.S. managers levered on acquired knowledge to generate new improvement initiatives also after the handover (e.g., actions to reduce WIP and buffer stocks, to improve the quality and/or reduce set-up time of some workstations). They replicated the headquarters' approach of fixing weekly appointments for allowing incremental advancements (i.e., production stopped for 20 minutes in a week to doing training activities, small group problem-solving, 5s sections etc). Also operators displayed a proactive behavior and displayed initiative in providing ideas for solving problems (e.g., high numbers of PDCA opened and closed after handover). As a result of increasing lean implementation, operational performance improved.

Beta China

The source arranged a meeting and a tour of its factory with key recipient managers (i.e., future factory manager, operations manager, quality manager, and R&D manager of the Chinese unit) to show how every-day work used to be done according to lean best practices. The lean transfer project was eventually presented. The recipient agreed to implement the proposal, and the next day training activities began in the source's factory.

The source organized some learning-by-doing sections to illustrate the principles and basic techniques underpinning lean management. After about a month, recipient key managers were charged with training other recipient employees, while source lean experts strictly control training activities by participating to all the training sessions. Especially at the beginning of lean transfer project, communication between the parties was hindered by the high cultural differences and high power distance of recipient employees. Chinese workers hard put to provide suggestions and make decisions since they feared negative impacts of wrong choices. The source encouraged recipient participation in leading up to lean transformation in different ways: redefining standard works (e.g., creating instructions more detailed than source's ones), questioning recipient's opinion on how to perform an activity according to lean principle and on possible solutions to solving a problem instead of giving predefined solutions, etc. Although this approach would have taken more time with respect to giving source's solutions, the source preferred to extend the training period of some weeks,

leaving time to Chinese workers to express their ideas instead of imposing headquarters' solutions.

However, Chinese managers faced difficulties in extending lean implementation to other factory's areas as well as in maintaining optimal performance in the redesigned cell due to low loyalty of employees (e.g., due to dismissals, there were few skilled workers who could teach new colleagues what to do, focus cannot be put only on new value streams, but also on replacing operators in redesigned one). Besides leveraging on multi-tasking training, the source cooperated with recipient workers so as to define specific solutions to overcome the problem. In particular, the source adopted its incentive system by creating a retention plan for managers (i.e., bonus payments was introduced for older employees) and allowed them overtimes to fulfill their need of higher salaries. Moreover, they created better work conditions by providing new/additional foods and introducing a shuttle to transport workers between flats and the factory; attraction as well as retention of employees were also favored by lean education programs activated by the company. In addition, the source's audit checklists were widened by introducing aspects on openness, participation, and proactivity so as to control that these behaviors were followed by operators, but also to remark their importance to managers, thus supporting cultural change.

Gamma China

At the beginning, the source organized a meeting with recipient's managers to display them the lean transfer project and illustrate the advantages of lean implementation; a tour of the more advanced lean factory in the MNC operating in the same division (i.e., heat-transfer solutions) also took place. The recipient's managers immediately agreed to launch the lean transfer project.

Source lean experts trained local managers, which in turn trained operators. Accordingly to MNC guidelines, both theoretical and practical sessions occurred in the first case, while only the learning-by-doing method was used in the case of operators. However, some misinterpretations of source's best practices occurred during training sessions. In fact, during subsequent control of transferring activities, the source reported numerous errors in the procedure implementations (e.g., assembly sequence defined in the standard work not respected by some operators, equipments arranged in an inconvenient or harmful way), employees' difficulty in recognizing muda (e.g., importance of reducing inventories, waste related to overproduction), and local employees tendency to not freely express their ideas with supervisors (e.g., few suggestions to resolve problems, no revelation of unsatisfactory aspects of their job before leaving it, always affirmative answers even in case of

disagreement). The source had to repeatedly interrupt production activities, while spending much time to correct errors. In addition, the source recalled some of the lean concepts previously introduced in new learning sessions. Instead of theoretical lessons, they opted for learning-by-doing method (e.g., concretely showing managers “what is waste” through its manifestation in recipient’s every-day-activities). Moreover they personally worked side-by-side with local employee following new training sessions, eliminating errors in practice implementation, and stimulating in all the activities the participation and team-work of both managers and operators. In order to increase the effectiveness of headquarters’ practices and overcome problems such as high illiteracy of recipient operators, the source also concede some adaptation to its lean standards and related tools (e.g., production scheduling with magnets on a board instead of electronic support, reduced number of operations for each workstation and more detailed and visual instructions).

Dismissal of some operators and of the operations manager caused severe knowledge drops, which reflected in temporary interruption or slowdown of some activities and deviations from lean standards (e.g., several improvement initiatives had been temporary stopped during training of the new operations manager, training focused on new operators instead of new lessons for more experienced employees). Especially newer workers manifested the tendency of not communicating problems and being risk-averse (e.g., no or few notifications of quality or process issues through Andon system or PDCA’s, no or few ideas for problem resolution); similarly managers shown low autonomy in managing the subsidiary (e.g., large amount of e-mail sent to European managers for asking support in decision-making). These problems in turn reflected on performance. As a countermeasure, the source introduced a self-assessment mechanism to stimulate teamwork, contributions to problem-solving activities, and communication across hierarchical levels; it also helped recipient managers to analyze employee knowledge about lean principles and practices. In addition, Gamma source fixed highly frequent calls to control KPIs as well as performance on this self-assessment mechanism and provide support to problem resolution. Moreover, a reward structure was developed for stimulating collaboration and acknowledging the efforts of more cooperative workers (e.g., financial incentive, more comfortable rest rooms).

Gamma U.S.

The source organized a meeting and a tour similar to those in the case Gamma China. Recipient’s managers disapproved the initiatives considering them time-consuming and in contrast with daily and weekly performance targets of the unit. The source had to handle a debate about the usefulness of introducing lean, and had to provide all the factory reports

available to support tangible evidences of a return in the long-term, even in the expense of an initial investment and a decrease of factory's productivity. However, few weeks later, after visits and meetings, the recipient's managers agreed to participate to the lean project.

As in the Chinese case, training involved two steps. First, source representative levered on theoretical and practical sessions to train managers, and then local mangers trained operators quite independently and by using learning-by-doing method. The participation of U.S. workers in both theoretical and practical sections was high (e.g., questions for clarifications or more information during classroom lessons, many ideas for solving problems and suggestions for redesigning activities and processes); in addition, lean implementation was facilitated by openness in communication and collaboration between task force members as well as accuracy in implementing standards.

Recipient managers proved to master lean practices, which were gradually diffused to other value streams in the factory. Even managers who had more vigorously opposed to the lean transfer project's launch, eventually thrived lean change (considerable improvements achieved by the unit during implementation stage helped to convince more skeptic managers); they recognized the critical role of lean as shown by their active participation to improvement initiatives (e.g., operator training, problem-solving support, incentive definition to stimulate operators' contribution, cooperation in providing reports and new ideas to the source).

Delta China

Chinese managers were invited to take part to firm's lean implementation strategy during a meeting; in that occasion, they manifested the intention to implement lean. After a short while, the source presented a proposal for lean transfer to the Chinese managers, who immediately agreed to start the project.

According to the company's guidelines, greenfield factories should be able to product at a predefine production level and use the fundamental elements of the company's production system (i.e., respect standard works, use the kanban pull system, do basic cleaning and lubrication of equipment, keep clean and organized workstations, use PDCA and work in team to continually improve aspects of products and processes) within a year and a half since the lean transfer project's started. At the beginning of the project key recipient managers were trained within the source's factory by participating to every-day activities for about a month and a half (i.e., a period deemed sufficient to make various production stages and related potential issues clear to recipient managers). Afterwards, these managers came back to China and, under the direct supervision of the source, trained other workers on

practical aspects, such as the use of equipments, as well as more complex elements, such as reading KPIs shown in cell boards. In order to increase clarity and recipient's participation, standard works were also jointly redefined. Moreover, all training activities followed a team based learning-by-doing approach, which was deemed particularly appropriate for the Chinese context (it would help to avoid consensus even when operators disagreeing to fulfill a task, improve the clarity of communication, etc.).

Training activities were thwarted by some problems related to Chinese employees' behaviors; for example, at the beginning operators were very reluctant to make any intervention, even the simplest, on equipments, didn't propose solutions to resolve problems to avoid the risk of failure, while sought consensus and support by managers in every work and decision. Thus, the source decided to extend the training period to allow to fix lean best practices and to stimulate the recipient's participation.

Best practice implementation was hindered by low loyalty to organization and low cooperation of some Chinese employees (especially less experience and/or older operators, for example, provided very few suggestions in problem-solving), which in turn decreased the performance. A number of countermeasures were defined by the source while collaborating with local employees to cope with low loyalty issue. In particular, financial rewards were defined for more cooperative workers (e.g., employees supporting training of newer operators, providing more suggestions for problem resolution) and work conditions were improved consistently with needs manifested by locals during production meetings.

Delta U.S.

A tour of the Italian factory and a presentation of its lean implementation project were organized by Delta source to invite the U.S. factory to join the firm's lean implementation strategy. However, the recipients' managers initially opposed to lean transfer proposal. The source had to organize some other meetings to answer recipient's several questions about lean tools implemented, the time dedicated to the lean project and results achieved. Data collection as well as analysis required more time than planned, thus the project started about a month later, after recipient agreement.

Following the company's indications, recipient key managers were trained by participating in the every-day activities in the source factory, while other recipient employees were trained within their factory according to a team based practical approach. Although local managers were put in charge of training local operators, source representative closely monitored activities' advancement. Similarly, standard works were created by the recipient under the

supervision of the source and best practices were gradually introduced.

Source managers didn't report major criticalities in these activities; operators were adequately trained by scheduled time, both managers and operators took an active part in process redefinition and problem resolution, as well as they were able to successfully implement fundamental lean practices and achieve performance targets six months after the lean transfer project started. Moreover, U.S. managers levered on acquired knowledge to redesign other production lines in the factory; they also asked for external support for introducing lean in other areas of the recipient unit (e.g., R&D).

KPIs improvement achieved through lean implementation were attested by the source unit and more than one production cells were certified (the MNC used to certify units and celebrate the achievement of important objectives).

5.3 Analysis and results

This section compares the seven cases so as to identify some possible links between the cultural context and problems occurred during the lean transfer projects as well as level of adaptation between planned actions and effective countermeasures put into practice. Data and information from individual cases were approached through two-variable matrices. First, the variable problems in performing lean knowledge transfer project is related to the country of the recipient unit. A second matrix relates the cultural context of the source organization with the country of the recipient unit, and classify the cases in terms of level of adaptation introduced. In fact, evidence from the cases and interviews suggested that interesting relations could be found between these variables. The cross-case analysis helped to make possible links among variables more evident and was useful to explain the meaning of the relations found. Results are summarized in the form of propositions.

5.3.1 Problems in transferring lean knowledge

From the within case analysis it emerges that in all the cases investigated the source had to face some major difficulties during the early phases of a lean knowledge transfer project. **Table 16** points out a classification of main problems in transferring lean knowledge overseas according to the phase of transfer project in which such problems occurred and the country of the recipient unit. As emerges from the visual pattern, it seems that when lean is transferred to U.S., main problems are present in the introduction phase. In contrast, when a lean transfer project involves a Chinese recipient, some major difficulties affect the implementation phase.

Table 16: Problems in performing lean knowledge transfer project

| | | Country of the recipient unit | |
|--------------------------------------------------------|----------------------|-------------------------------|---------------------------------------------------|
| | | U.S. | China |
| Problems in performing lean knowledge transfer project | Introduction phase | Alpha US, Gamma US, Delta US | |
| | Implementation phase | | Alpha China, Beta China, Gamma China, Delta China |

Evidence from the cases and interviews suggested that socio-cultural peculiarities of a recipient unit play a major role in determining problems in transferring lean knowledge. In particular, the U.S. context acted as a barrier for the *introduction phase* of a lean transfer project. Low level of pragmatism combined with high level of masculinity, which reflect in employees' focus on short-term and tangible performance as well as tendency of questioning new information and proposal to assess their validity, seems to explain managers' attitude against lean implementation at the beginning of the transfer project in cases Alpha U.S., Gamma U.S., and Delta U.S.. In case Gamma U.S., for example, managers basically opposed the source's proposal because of considerable time it would have taken to redesign production processes and to train employees in lean management, at the expense of worse daily- and weekly-sales KPIs.

Although lean transfer projects require an initial investment, they are expected to fulfill a sustainable competitive advantage for the entire organization; during initial meetings and factory tours, the sources Alpha, Gamma, and Delta provided several evidences on long-term advantages obtainable through lean implementation and standardization of production processes among subsidiaries. However, this wasn't enough to persuade U.S. managers to approve the proposal for lean transfer. Besides highlighting short-term disadvantages, in all the cases Alpha U.S., Gamma U.S., and Delta U.S., the U.S. top management asked for additional data that clearly proved tangible benefits of a lean project.

Conversely, the Chinese socio-cultural context acted as a facilitator for the introduction phase of a lean transfer project. In fact, in every project toward an eastern subsidiary – i.e., cases Alfa China, Beta China, Gamma China and Delta China –, high respect for hierarchies (i.e., high power distance) led managers to approved the source's proposal, which was perceived as a directive of the European headquarters that could not be questioned.

With regard to the *implementation phase*, differences between socio-cultural contexts are helpful in better understanding the presence or absence of relevant problems in Chinese and U.S. factories, respectively. On the one hand, the high power distance and uncertainty avoidance characterizing the Chinese society, which reflects in the high respect for

hierarchies and tendency of preferring orders issued by supervisors rather than to make decisions autonomously, seem to play a major role in determining employees' non-lean behaviors, such as passive participation to problem solving and continuous improvement activities and no open communication, in cases Alfa China, Beta China, Gamma China and Delta China. In addition, such cultural peculiarities combined with low loyalty towards organization seem to explain difficulties in extending or even maintaining the lean implementation status achieved by the subsidiaries in all Chinese cases. In cases Beta China and Delta China, for example, teamwork sessions were initially hindered by Chinese members' low participation. As emerged from interviews, local employees had difficulty providing ideas to solve problems because they feared to contradict supervisors. High respect for authorities also thwarted both Chinese operators and managers in giving simpler information, such as interacting with clarification requests in theoretical lessons (case Alfa China and Gamma China) or providing feedbacks on working conditions (cases Alfa China, Beta China, Gamma China and Delta China). As the source representative in charge of the lean transfer project in case Delta China remarked, source managers made a huge effort to reduce power distance and uncertainty avoidance levels and get the cooperation of Chinese workers:

"We have worked side-by-side, day-after-day for several weeks to overcome the strong hierarchical barriers, which prevented open communication among us [i.e., source's managers and local workers] and local workers' participation, and create trust".

In addition, compliance problem, misunderstandings, and several mistakes in practice implementation also occurred in all the Chinese cases. In case Alpha China, for example, differences in the meanings assigned to the artifacts of communication prevented Chinese managers from deeply understanding what is "muda", even if the source had hired people with good English skills (i.e., language selected for communications among managers) and provided numerous practical examples to increase the clarity of theoretical concepts. Chinese employees' tendency of hiding doubts and avoiding interaction hindered training in all the Chinese cases; especially in classroom lessons – case Alpha China and Gamma China –, the source was hard put to identify misunderstandings and fix problems. Chinese employees' doubts and misunderstandings also caused mistakes in lean practice implementation. For instance, in case Gamma China the variation in the way operators did production activities in respect to what specified in standard works (e.g., different assembly sequence of components) revealed a misunderstanding of the fundamental concept, and related objectives, of "standard". Moreover, local workers often took things literally and

skipped the procedures' steps which were not made explicit in standards, since considered obvious by the European counterpart.

For what concern extension/maintenance of the lean implementation status, in case Gamma China, for instance, only some weeks after the handover, the Chinese unit's productivity significantly declined because of the operation manager's dismissal in conjunction with two operators; cause-effect analysis clearly showed time for new employees' training and problems related with their acquisition of lean work method as major origins of the variance in factory's performance. Moreover, during the period in which new manager was taught, several improvement initiatives had to be temporarily stopped, thus precluding continuous improvement. Similarly, in the cases Alfa China, Beta China and Delta China the need of replacing dismissed operators forced managers to focus training on new workers, thus limiting initiatives in other areas of the manufacturing units or aiming at further developing lean skills of more-experienced employees. Moreover, in all the Chinese cases especially newer employees tended to not communicate problems to supervisors, provided low support to problem-solving, and manifested other aforementioned non-lean behaviors strictly dependent on high respect for hierarchies and risk aversions. In addition, Chinese managers' concern of making inappropriate decisions limited their autonomy in subsidiary management. In case Gamma China, for example, a large amount of e-mails for approval and support requests arrived to European managers after their repatriation.

Conversely, in cases Alfa U.S., Gamma U.S. and Delta U.S. the workers' values such as freedom of expression and self initiative, that reflect low power distance combined with high individualism, favored training activities and implementation of lean practices. During classroom lessons, for example, U.S. workers asked for clarifications or more information to resolve any unclear issues about lean practices (case Alpha U.S. and Gamma U.S.). For what concerns implementation, they played an active part in problem resolution and process redesign, providing many ideas and suggestions. U.S. workers' freedom of expression favored also the control of the subsidiary's lean implementation status (i.e., both on field and remote control). In addition, US workers' attitudes such as well as autonomy helped to smoothly move on towards following lean initiatives. Loyalty to the organization also contributed in making retention of acquired knowledge easier.

The following proposition summarizes what emerged from cross-case analysis and information collected during the interviews.

Proposition 1: *Major problems characterizing lean knowledge transfer are context-specific.*

Proposition 1a: *Problems in U.S. are related to the introduction phase of the lean knowledge transfer project.*

Proposition 1b: *Problems in China are related to the implementation phase of the lean knowledge transfer project.*

5.3.2 Adaptation of lean knowledge transfer projects

Table 17 schematizes relations between the cultural context of the source organization, the country of the recipient unit and level of adaptation between planned actions and effective solutions and countermeasures put into practice. It seems that when lean is transferred to U.S., a low level of adaptation is needed. In contrast, when a lean transfer project involves a Chinese recipient, the level of adaptation can be affected by the cultural characteristics of the source organization. Therefore, in general both variables have to be considered to explain the level of adaptation.

Table 16: Level of adaptation between planned actions and effective solutions and countermeasures put into practice

| | | Country of the recipient unit | |
|---------------------|-----------------------------|------------------------------------------------------------|-------------------------------------------------------------------|
| | | U.S. | China |
| Source organization | OC1: low power distance | Delta U.S. (Low adaptation) | Beta China (Medium adaptation) Delta China (Medium adaptation) |
| | OC2: high power distance | Alpha U.S. (Low adaptation) Gamma U.S. (Low adaptation) | Alpha China (High adaptation) Gamma China (High adaptation) |

Different socio-cultural characteristics of recipient factories are helpful in better understanding opposite level of adaptation between planned actions and effective solutions put into practice in U.S. and China (i.e., low adaptation versus high or medium adaptation, respectively). As clarified in sub-section 5.3.1, low level of pragmatism combined with high level of masculinity, which reflect in employees' focus on short-term and tangible performance as well as tendency of questioning new information and proposal to assess their validity, are likely to explain U.S. managers' attitude against lean implementation at the beginning of the transfer project in cases Alpha U.S., Gamma U.S. and Delta U.S.. Detailed reports on results and improvements obtained by more advanced lean factories in the MNC

had to be provided to demonstrate concrete benefits gained through lean, as well as insights about lean practices (e.g., lean standards) had to be given to reveal the utility of the lean transfer project for the recipient factory. For this purpose, Alpha, Gamma and Delta sources organized other meetings and visits, and allowed recipients some time to analyze the new information and documents collected (e.g., detailed reports on lean projects in other factories of the firm). As emerged from interviews, these countermeasures required few additional resources and caused minor delays in lean transfer project (i.e., a postponement of teaching sessions of about a month), but were necessary to convince U.S. managers to participate to the lean transfer project.

Conversely, values such as freedom of expression, self initiative and autonomy, which are related with low power distance combined with high individualism of U.S. society, favored training activities and the subsequent implementation of lean practices, as well as the control of the subsidiary's lean implementation status also after the handover. Since planned activities proceeded almost smoothly, time scheduled was respected and performance targets achieved without the need of additional performance. In case Delta U.S., for example, the effort and results of U.S. workers was acknowledged by the firm and certifying exemplar lean cells within the subsidiary. Only minor modifications to existing tools were introduced. For example, in Alfa U.S. the "water spider" standard, i.e., the standard that regulates how production lines have to be supplied with components and subsystems according to a milk-run logic and the presence of a dedicated operator, was adapted. In particular, Alfa source ordained that the U.S. factory's production volumes weren't enough to justify the cost of a dedicated operator, thus a different solution was used.

Therefore, the overall level of adaptation of each lean knowledge transfer project towards U.S. recipients was low.

On the other hand, cultural peculiarities of the Chinese society, such as high power distance and uncertainty avoidance, played a major role in determining employees' non-lean behaviors and compliance problem, while high cultural difference with European countries contributed in causing misunderstandings and mistakes in practice implementation in the cases Alfa China, Beta China, Gamma China and Delta China; in addition, low loyalty to the organization affected the difficulty in maintaining the recipient's lean implementation status or in extending lean (see Sub-section 5.3.1). In order to cope with such problems and successfully implementing lean, all the the sources – i.e., Alpha, Beta, Gamma and Delta sources – had to invest additional resources compared to what planned, and to introduce some new tools; as a consequence, projects' scheduling was subject to delays. For example, in all the cases towards Chinese recipients the incentive system was redesigned to promote loyalty, or training activities were extended so as to limit misunderstandings concerning lean

practice implementation and to reinforce lean behaviors. However, while in Alfa China and Gamma China dyads some planned actions proved ineffective, thus requiring considerable additional resources to be redesigned and re-done and determining significant delays (i.e., several months), in Beta China and Delta China cases some additional resources were required to encourage lean behaviors while implementing lean as planned, and resulted in few months of delay. Different cultural characteristics of the source units are helpful in better understanding the different level of adaptation between planned actions and effective solutions put into practice in dyads involving a Chinese recipient (i.e., high versus medium adaptation).

High power distance – OC2 – is an important distinctive characteristic of the cases Alfa China and Gamma China. Firstly, it reflected in external managers' focus on local management during the first transfer initiative. For example, in both Alfa China and Gamma China cases training sessions involved two subsequent steps: the external source representative trained local managers, which in turn then taught operators. Secondly, in line with solutions used in Alfa and Gamma source units, periodical audits were the main mechanism for controlling effectiveness of local managers' work; in case of errors, the sources often indicated how to solve problems (i.e., provided precise solutions). For example, in the case Gamma China an audit conducted by the source revealed a variation in the way Chinese operators did production activities in respect to what specified in the standard works (e.g., different assembly sequence of components). Such errors reveal a misunderstanding of the fundamental concept, and related objectives, of "standard", thus the source decided that a new training session was necessary to fix this concept.

Overall, the (initial) approach employed by Alfa and Gamma sources proved ineffective in handling misunderstandings and mistakes in lean practice implementation as well as non-lean behaviors and compliance problem. For example, delegation of training favored the transmission of doubts from local managers to operators, thus the spread of errors in lean practice implementation; consequently, during shop floor assessment tours, both Alfa and Gamma sources had to frequently interrupt production activities and spend much time to correct errors. Therefore, considerable additional resources were necessary to redesign as well as re-do some actions such as training.

Conversely, low power distance – OC1 – characterizes Beta and Delta sources. Firstly, it reflected in external managers' constant contact with both local managers and operators, even in the early actions of a lean transfer project such as training and creation of operation instructions. For example, in both Beta China and Delta China cases external managers participate in all training sessions. Secondly, Beta and Delta sources encouraged high involvement of all recipient employees. For instance, rather than providing solutions to

problems, external managers' closely worked with Chinese employees and stimulated their participation in providing ideas for overcoming obstacles. Accordingly, in Beta China case standard works were jointly redefined, creating more detailed instructions than in the source's factory. In addition, the constant presence of external managers on gemba favored the creation of trustful relations between the parties (see the quotation in Sub-section 5.3.1).

Overall the approach employed by Beta and Delta sources turned out to reduce misunderstandings and mistakes in practice implementation as well as non-lean behaviors and compliance problem. For example, the external managers' presence in all the training sessions allowed the early identification of local employees' misunderstandings, and their resolution before launching production activities (Beta China and Delta China). As suggested by Beta source's managers during interviews, by constantly verifying employees' behaviors, compliance problem could also be limited. In addition, the creation of trustful relations between the parties due to constant presence of external managers on gemba helped to reduce non-lean behaviors such as no openness in communication and low participation. Team work and collaboration between the parties also helped to define effective solutions to increase Chinese employees' loyalty to the organization (e.g., retention plan and overtimes for managers, better work conditions for all workers, etc.). In both Beta China and Delta China cases the sources slightly postponed the handover to more vigorously fix lean behaviors in recipient employees. As in case Beta China, the source representatives preferred to leave more time to Chinese workers to express their ideas instead of imposing headquarters' solutions. Although additional resources were necessary to create trust and encourage lean behaviors, and additional activities resulted in few months of delay, the lean transfer project was no subject to redesign and was essentially implemented as planned.

The following proposition summarized these evidences:

Proposition 2a: *The level of adaptation in cross-border lean knowledge transfer projects is low when lean is transferred to US, independently from the OC of the source.*

Proposition 2b: *The level of adaptation in cross-border lean knowledge transfer projects is high when lean is transferred to China in the cases of OC2. It is medium in the case of OC1.*

Finally, considering the activities and solutions in all lean transfer projects towards China in greater detail, it could be observed that, even if the cases are characterized by significant differences in the way transfer activities developed (e.g., presence/absence of transfer activity redesign, activities redone versus activities postponement), resources invested and

delays occurred in the lean transfer projects, thus in the overall level of adaptation of planned actions, there are some *similarities between effective solutions eventually implemented* by the four sources. Firstly, Beta and Delta sources levered on *constant contact* with both local managers and operators since the beginning of the transfer project; when redesigning transfer initiatives, also Alfa and Gamma sources decided that a greater collaboration with local employees should have been created to overcome transfer problems in China. During the second initiative, for example, also Alfa and Gamma sources participated in training sessions with operators. A *team-based practical method* was eventually preferred, and effectively implemented by the various sources. As emerged by the interviews, such method allowed to overcome communication difficulties as mentors could concretely show what they meant when explaining lean principles and standards. Moreover, the sources could verify recipient workers' understanding at once by observing their actions on gemba, thus avoiding compliance problem, as well as fixing possible mistakes in advance. In all the Chinese cases, extended cooperation in different activities, rather than "spot contacts" (as initially done by Alfa and Gamma), also favored the development of trust between source representatives and local employees; in turn trust was crucial for instilling lean behaviors such as openness, participation to continuous improvement activities and decision-making. Sources' effort into understanding and meeting local needs (e.g., adaptation of tools, definition of ad hoc incentive system, etc.) was appreciated by Chinese workers and also contributed in stimulating their participation in lean implementation (e.g., providing ideas and suggestions to solving problems, support training of new employees, actively participate in new lean initiatives).

Secondly, similar to Beta China and Delta China cases, during the second initiatives both Alfa and Gamma sources provided support to local employees in problem resolution by stimulating their participation and autonomy, instead of providing solutions used by the source. In other words, external managers helped local employees in defining and formalizing adapted solutions that better fit their needs.

Thirdly, all the sources introduced a number of countermeasures aiming at increasing the Chinese employees' loyalty to the organization. In particular, cooperation between source and recipient units was fundamental to adapt the incentive system to the specific needs of the recipient subsidiary. In case Beta China, for example, overtimes fulfilled local managers' need of higher salaries and retention plan rewarded their loyalty to the organization, while additional services were provided to operators (e.g. shuttle for moving between apartment and factory, greater quantity and quality of food). As emerged from interviews, in all the cases lean itself also contributed to contrasting low loyalty thanks to more safety work conditions and employee empowerment. It could be observed that the implementation on

some lean practices also helped to limit low loyalty's negative impacts. As in case Delta China, multitasking training ensured that operators could fill in for others in the event of dismissals. Tools like skill matrix supported identification of experienced workers, who can teach new operators by demonstrating what to do and help them in case of difficulties.

Finally, some solutions were defined to improve the control of lean implementation status of the subsidiaries after the handover. In all the cases the sources committed Chinese managers to lever on existing audit systems to check on the progress of the lean implementation; they themselves had to strictly monitor recipients' lean activities and status by asking locals precise and regular feedbacks before Chinese units become autonomous in lean implementation. However, new tools were also introduced. In case Alfa, for example, the source defined a KPI on operators' global knowledge, which consisted in the ratio between the numbers of employees properly taught upon the whole.

6 Discussion

This chapter discusses how the findings of my research relate to existing studies and contribute to the literature. In addition, I also shed light on contributions for managers. Finally, main limitations are recognized and discussed together with opportunities for future research. In particular, Section 6.1 focuses on lean implementation within a manufacturing unit, while Section 6.2 concerns lean knowledge transfer between units of MNCs.

6.1 Lean implementation in a manufacturing unit: contributions, limitations and future research

Starting from the GLOBE model of culture, a wide set of both soft and hard lean practices, and most important operational performance, I defined a comprehensive model to study the relations between organizational culture, lean practice, and performance of a manufacturing unit. I developed and tested two hypotheses considering the difference between successful and unsuccessful lean factories in terms of organizational culture and the extent of adoption of soft practices. The results of my research provide several academic and managerial contributions.

6.1.1 Theoretical contributions

The first contribution concerns the link between organizational culture and lean practices. My multi-group analysis confirms that they are related, thus supporting previous studies which debate the existence of a relationship (Nahm et al., 2004; Prajogo and McDermott, 2005; Naor et al., 2008; Baird et al., 2011). However, my results go further, investigating whether and how the different organizational culture values can determine the success or failure of lean implementation.

This study highlights some differences between lean adopters and firms that do not lever on lean. The first ones have a higher level of in-group collectivism (i.e., an individual's pride, loyalty, and cohesiveness in the organization), a greater future orientation (i.e., the propensity to invest and plan long term objectives), and a greater uncertainty avoidance (i.e., the willingness to reduce uncertainty through the use of regulations, bureaucracy, and techniques based on quantitative data). These characteristics can favor the implementation of lean practices, by influencing commitment on behalf of employees and managers to get involved in lean transformation. In fact, a high level of uncertainty avoidance usually leads managers to introduce practices able to limit unexpected process variability, such as process

quality control, work standardization, total preventive maintenance, and daily schedule adherence, while in general a high future orientation and in-group collectivism favor the propensity to introduce lean practices in order to improve processes.

However, the main aim of this study was to understand whether companies that successfully implement lean show a peculiar organizational culture profile. My data analysis shows that a higher level of in-group collectivism, future orientation, and uncertainty avoidance are not enough to guarantee the successful implementation of lean. In fact, when comparing the organizational culture profile of lean adopters with a high and low level of operational performance, I found that high-performance factories are characterized by greater institutional collectivism compared to low-performance lean factories. Besides, firms that achieved positive results through lean, not only have greater future orientation compared to non-lean adopters, but also to low lean performers. Finally, high-performance factories are characterized by a lower assertiveness and greater attention to the humane orientation.

An explanation for these results is that low assertiveness in combination with high humane orientation and institutional collectivism are fundamental to fuel an organizational culture that promotes collaboration within the company. In these contexts, employees feel free to search new solutions for possible process improvement, and share them in problem solving sections for lean with the top managers (Lee et al., 2013). Moreover, greater future orientation encourages employees to utilize new tools and methods, and promotes a philosophy for continuous improvement, which is typical of lean (Flynn et al., 1994; Agarwal, 2013). This can make the difference between high- and low-performance lean factories, since one of the major causes of lean failure is that at times people, after an initial adoption of lean practices, abandon the initiatives undertaken and return to their old ways of working (Bhasin, 2012). This organizational culture profile, characterized by low assertiveness, high humane orientation, institutional collectivism, and future orientation, is also recognized as a critical prerequisite for the development of external collaborative relationships with customers and suppliers, which are considered fundamental soft practices for the successful implementation of lean.

Thus, compared to previous studies on the link between lean practices and organizational culture (e.g., Tata and Prasad, 1998; Detert et al., 2000; Liker, 2004; Patel and Cardon, 2010), this research does not only confirm that there is a fit between a certain organizational culture profile and lean implementers but also that high performers show some additional fundamental organizational culture characteristics which make them different from low performers. This suggests that some organizational culture values are linked with the decision of whether to implement lean or not, while others influence the successful implementation of lean. Thus, the more a company is far from the ideal organizational culture

profile for lean – characterized by low assertiveness and high humane orientation, institutional collectivism, and future orientation – the less lean is effective in determining good performance. But how can a company build this organizational culture in order to succeed through lean? The results on differences between high and low performers concerning hard and soft lean practices adopted provide the basis for addressing this practical issue.

The analysis of **Table 10** points out that those factories that claim to have a high level of lean application extensively implement all the hard lean practices compared to non-lean adopters. Instead, focusing on lean factories, while high and low performers do not differ for hard practices, they are significantly different if I consider the adoption of soft practices, as high performers devote more attention to Human Resource Management, such as training employees and small group problem solving, develop long-term relationships with suppliers and customers, comprehend the importance of following a business strategy aligned with the manufacturing processes, and embrace a philosophy for continuous improvement. Thus, these findings demonstrate that the hard practices do not make a difference in achieving high operational performance results through lean. Even though lean hard practices remain insufficient per se, I am not arguing against their importance since they are necessary in order to be lean. What really differentiates high and low performers and leads to a competitive advantage is a greater utilization of soft practices.

The implication for theory is twofold. Firstly, this study confirms those findings stressing the importance of adopting soft practices to reach a competitive advantage over competitors (e.g., Shah and Ward, 2003; Lagrosen and Lagrosen, 2005; Matsui, 2007; Shah and Ward, 2007; Fotopoulos and Psomas, 2009; Liker and Rother, 2011). What emerges is that hard practices are not distinctive since they are easily acquired and replicated. As a consequence, their extensive adoption does not guarantee the successful implementation of lean.

Secondly, the results on lean implementation appear in line with the convergence view of organizational culture supported by some scholars (Child and Kieser, 1979; Shenkar and Ronen, 1987). In fact, taken together the differences in soft practices adoption and organizational culture dimensions between high and low performers suggest that companies that successfully implement lean show a certain organizational culture profile and implement soft practices more extensively. As previously explained, a certain organizational culture profile can favor the implementation of such lean practices as the soft ones, but in a recursive way, it can also be argued that the adoption of soft practices may change the organizational culture profile of a company (Prajogo and McDermott, 2005; Narasimhan et al., 2012; Wincel and Kull, 2013). For instance, HRM practices – e.g., participating in small group problem solving, or employee training – and the exercise of continuous improvement, – are usually considered significant experiences by employees and managers alike, which

can change their behavior and beliefs. In addition, a manufacturing strategy consistent with corporate vision clearly favors a high future orientation, since it avoids spot and non-coordinated initiatives (Naor et al., 2010).

This perspective can contribute to tackling the practical question posed above on how to build the right organizational culture profile for lean.

In addition, from a theoretical point of view, it contributes to the debate on the importance of societal vs. organizational culture and their effects on performance. My findings support Naor et al.'s (2010) assumption on the predominance of organizational versus societal culture in predicting operational performance improvements, and provides empirical evidence to explain why societal culture should be considered less influential. In fact, my analysis highlights that, even though Western and Eastern units present difference in some organizational culture values – i.e., in-group collectivism, future orientation, and performance orientation – in general, successful lean firms located in the two areas don't show significant difference in organizational culture values as well in the use of soft lean practices (see Sub-section 3.2.6). Therefore, these findings suggest that societal culture does not influence the organizational culture and the extent of soft lean practices of successful lean firms, even though it may be relevant, for example, in facilitating or inhibiting the early phases of lean adoption. Finally, my research suggests that the use of specific soft practices can really alter an employee's value and behavior.

6.1.2 Managerial contributions

Results of my research on lean implementation within manufacturing units are important also for managers, because they can explain the reason why hard lean practices are not always the panacea for solving all manufacturing problems. Indeed, managers have to bear in mind that the success of lean is not related to the use of hard practices (e.g., kanban or SMED), since these practices are “order qualifier activities”, i.e., essential but not differentiating. Instead, soft practices must be viewed as “strategic order winner factors” which enable to achieve a better operational performance compared to competitors. From a managerial perspective, maximum attention should be placed on soft practices and organizational culture, which are linked. Indeed, my results show that firms which lever on soft practices and obtain a competitive advantage have a greater propensity towards an organizational system that values people, which encourages altruism and generosity to prevent despotic attitudes and aggressiveness and promotes future-oriented behavior in order to improve the resilience of the company. As a matter of fact, this culture is compatible with the use of lean soft practices. A certain organizational culture profile and lean soft practices not only favor

the collaboration with customers and suppliers, but also make employees collaborative with each other and loyal to the firm's vision without opportunistic pressures. Moreover, they permit to develop and maintain shared long-term objectives starting from the manufacturing level up to organizational strategy in following the lean philosophy of continuous improvement.

Thus managers, who experience difficulties in obtaining performance improvements through lean, do not have to invest resources to increase the level of hard practices implementation, instead they have to create the right environment that can make lean more effective. As my results demonstrate, most managers perceive lean as a set of hard practices to be implemented. When introducing lean, several managers usually firstly implement such lean hard practices as set up time reduction, layout redesigning, kanban etc. In a short time, they realize that these hard practices alone do not have the effect they expected on performance, but they are usually unable to recognize the cause of this failure, i.e., the lack of a rooted organizational culture consistent with lean. As a consequence, they tend to force non-culturally prepared actors (i.e., employees, customers, and suppliers) to use hard lean practices. Instead the right road to lean requires that managers first and foremost recognize when the organizational culture is far from the optimal organizational culture profile that makes lean effective. Then they should lever on soft lean practices, as well as hard ones. These soft practices, when assimilated into the organization, become routines and can decrease the gap between current and ideal cultural profile because they allow for a better interrelation and communication between actors, thus promoting collectivism, humane orientation, future-oriented vision, and reducing assertive behaviors. Finally, when the right organizational culture configuration is achieved, lean methodology becomes effective in improving operational performance.

6.1.3 Limitations and future research

Limitations should be considered along with my results. Firstly, the research setting could limit the generalizability of my findings since HPM sample includes only three manufacturing industries. A replication of the research in different sectors can represent an interesting opportunity for future research. For example, it might be interesting to understand if organizational culture dimensions have the same importance in other contexts. In fact it can be noted that in this study two organizational culture dimensions – power distance and performance orientation – are not significantly different in lean and non-lean adopters, and in high and low performers. Does this mean that these two dimensions do not represent a necessary condition for lean implementation and/or lean effectiveness, or in other industries they are related to lean?

A second limit is linked to the cross-sectional nature of the data. Starting from the analysis of the differences between lean adopters and high and low performers, I have formulated a theory on the interplay between soft lean practices and organizational culture, and on the role of various organizational culture dimensions in lean implementation. Future studies could extend and corroborate these results on the basis of longitudinal data providing evidence for possible causal relationships between organizational culture dimensions and lean practices. In particular, future empirical studies could address the following questions: can a certain organizational culture profile act as an antecedent of lean implementation? How can soft lean practices change organizational culture? I call for longitudinal case studies to fit this gap, substantiating possible causalities or mutuality between lean and organizational culture with rich data.

A further limit is linked to the focus of this study. I analyzed lean adoption within firms' boundaries and in the immediate supply network, since I considered internal lean adoption and the relationships with direct customers and suppliers. An interesting opportunity for future research lies in the exploration of the role of organizational and societal culture in relation to operations management and supply chain management practices involving the entire supply network, addressing unanswered questions about their impact on supply chain performance.

6.2 Lean system transfer between units of MNCs: contributions, limitations and future research

In order to enhance the understanding on how MNCs can efficaciously transfer a lean system in foreign countries characterized by different cultures, I conducted case study research. First, I examined the project launched by an Italian MNC to transfer lean to its non-lean Chinese subsidiary (Chapter 4). Basing on Maritan and Brush's (2003) process model of lean knowledge transfer, I deeply analyzed and contrasted two consecutive initiatives involved in such a project, which distinguish for the transfer approach used as well as for the outcome of the transfer initiative (i.e., unsuccessful versus successful implementation of lean practices). Results from this in-depth case study allow to clarify the impact of cultural differences between source and recipient factories on the lean transfer process and, in particular, on effectiveness of different lean knowledge transfer approaches.

Second, I conducted a multiple case study considering lean knowledge transfer projects successfully managed by a number of European MNCs towards overseas non-lean recipients (Chapter 5). In particular, the cases selected involve Chinese and U.S. recipients, which provide examples of polar types of societal cultures. Moreover, some clear differences

emerged between the cases regarding the organization culture characteristics of the source units; two different profiles were considered. Results from the cross-case analysis provide further evidence on the role of culture in influencing lean implementation within MNCs and, in particular, in determining problems and level of adaptation necessary to successfully transfer lean overseas.

Overall, these results on the transferability of lean systems provide several academic and managerial contributions.

6.2.1 Theoretical contributions

First of all, findings of both my in-depth and multiple case studies confirm the relevance of devoting specific research on cross-border transferability of lean systems in MNCs, especially with respect to impacts of culture on transfer projects' effectiveness. Although the more general literature on best practice transfer in MNCs underlines the influence of cultural differences in cross-border transfer projects (e.g., Kostova, 1999; Jensen and Szulanski, 2004) and studies on lean implementation show that culture can greatly affect lean effectiveness (e.g., Wincel and Kull, 2013; Liker and Rother, 2011), a little research has been focused on analyzing the role of culture in lean knowledge transfer projects. However, as pointed out by studies available, the transfer of a lean system between dispersed units of a MNC and its effectiveness are likely to be influenced by organizational and societal context conditions in general (e.g., Lee and Jo, 2007; Browning and Heath, 2009), and cultural characteristics in particular (Wallace, 2004; Jun et al., 2006; Aoki 2008). My in-depth case study shows that the first attempt to transfer lean undertaken by Italian managers failed despite the success of such lean system within the headquarters. Only after a second initiative, in which particular solutions to fit local culture peculiarities were put into practice, the foreign unit achieved the objective of maintaining the improvements obtained through lean. Similarly, the evidence from my multiple case study shows that all European MNCs had to overcome some problems in transferring lean, which were peculiar of the subsidiaries' cultural contexts, before the projects had succeed. In other words, findings from both my in-depth and multiple case studies support the necessity of dealing with *heterogeneity between contexts* besides traditional issues characterizing lean adoption – i.e., problems characterizing implementation within a manufacturing unit – when transferring a lean system overseas.

The impact of culture on lean implementation within MNCs

My research contributes to the literature by increasing the understanding of the impact of

culture on lean implementation within MNCs.

In line with more general literature on organizational practice transfer in MNCs (e.g., Kostova, 1999; Jensen and Szulanski, 2004), findings from my in-depth and multiple case studies demonstrate that *cultural differences*, in terms of both the extent of source-recipient difference and some distinctive features of a recipient unit, can be a major hurdle in the transfer of a lean system towards an overseas factory. In general, cultural differences can lead to various problems during the transfer projects, which sometimes can even preclude the success of implementation (Kostova, 1999; Jensen and Szulanski, 2004). Coherently, in the case of the project between the Italian and Chinese factories I observed that, for example, high socio-cultural differences resulting in lack of a common language and differences in the meanings assigned to the artifacts of communications led to misunderstandings during theoretical learning sessions and, in turn, to errors in lean practice implementation during subsequent phases of the transfer project. In addition, the high respect for hierarchies of the Chinese employees resulted in problems such as illusory consensus (i.e., “yes” that is not “yes”) and low participation to problem-solving activities. Therefore, the presence of various problems, which were not properly acknowledged and managed by the source, determined the initial unsuccessful transfer of the Italian lean system. These research findings are also in line with contributions on lean which suggest that, even though lean can be successfully adopted worldwide, societal culture peculiarities can play a relevant role in its implementation (Herron and Hicks, 2008; Kull et al., 2014). In particular, they confirm some previous studies on lean implementation in China, which suggest some societal culture characteristics such as high power distance and low loyalty to the organization as major obstacles for lean, especially for implementation of soft lean practices concerning employees involvement in problem solving and product/process improvement activities, suggestion programs, and cross-functional training (Rao et al., 1999; Zhao et al., 2006; Hofer et al., 2011).

In addition, my in-depth case study contributes to the literature by providing a detailed analysis of the impacts of cultural differences on a lean transfer project. The majority of previous studies explored the influence of contextual factors on lean knowledge transfer in a general way (e.g., Wallace, 2004; Jun et al., 2006; Ferdows, 2006); conversely, some scholars (Szulanski, 2000; Maritan and Brush, 2003) suggested that *a process view*, which distinguishes between the different phases of a transfer project, is more appropriate. In fact, for example Maritan and Brush (2003) found that not only initial starting conditions matters but also heterogeneity created during the process (e.g., change of the source characteristics due to decision of transferring knowledge from a different unit, etc.) can affect problems and results of a transfer project. Therefore, my in-depth case study levered on Maritan and

Brush's (2003) process model of lean knowledge transfer to analyze the impact of cultural differences on problems characterizing each phase of the transfer project. In that, my study represents a first contribution providing a detailed analysis of the impacts of cultural differences on a lean transfer project.

With regard to my multiple case study on lean transfer projects between European sources and Chinese and U.S. recipients in MNCs, findings provide further evidence on the relevance of cultural differences in affecting lean implementation, and in particular in determining major problems during cross-border transfer of lean. However, this research also found that main transfer problems are *context-specific* – i.e., similar within a context and different between China and U.S. – and can be effectively classified by considering the phase of lean knowledge transfer process in which they occur. On the one hand, I observed that main criticalities in U.S. are related with the introduction phase. Low level of pragmatism combined with high level of masculinity, which reflect in employees' focus on short-term and tangible performance as well as tendency of questioning new information and proposal to assess their validity, are recognized as cultural peculiarities of the U.S. context (Hofstede et al., 2010). In particular, I found that these characteristics are likely to explain managers' attitude against the transfer projects in the introduction phase of a lean transfer project. On the other hand, main problems in China are related with the implementation phase. High power distance and high uncertainty avoidance, which reflect in employees' high respect for hierarchies and tendency of preferring orders issued by supervisors rather than to make decisions autonomously, combined with low loyalty to the organization, which results in a high rate of dismissals, are some cultural characteristics of the Chinese context (Hofstede et al., 2010; Hofer et al., 2011). Such peculiarities are likely to explain employees' non lean behaviors such as low participation in problem solving activities and no open communication, and compliance problem (or illusory consensus, i.e., "yes" that is not "yes"); high cultural differences respect Europe countries seem to be a prominent reason for misunderstandings and errors in lean practice implementation during the implementation phase; low loyalty seems to explain difficulties in extending or even maintaining the lean implementation status achieved by the subsidiaries.

Besides considering the extent of source-recipient difference and distinctive features of recipient factories (i.e., cultural differences), in the multiple case study I also analyzed impacts of different *source units' organizational culture profiles* on lean knowledge transfer, thus providing a wider perspective of the influence of culture on cross-border lean transfer projects within MNCs. Although studies on lean implementation within MNCs don't pay adequate attention to this aspect, the more general literature on organizational practice transfer in MNCs clearly shows that organizational level factors such as organization culture

values promoting communication, cooperative relations and learning can affect transfer projects (e.g., Szulanski, 1996; Kostova, 1999; Gupta and Govindarajan, 2000). As explained in Sub-section 5.1.1, some clear differences regarding sources' organization culture characteristics, and in particular the level of power distance, emerged between the cases during data collection; thus, I considered source units showing two different organizational culture profiles OC1 and OC2, characterized by low versus high power distance, respectively. Although there was no evidence of impacts of this variable on major problems characterizing a lean transfer project, I found that source's organization culture characteristics can affect the level of adaptation needed to effectively transfer a lean system overseas. On the one hand, these findings provide further support for the context specificity of main problems characterizing transfer projects. On the other hand, they contribute to the debate on practice adaptation by identifying an important determinant of project adaptation in lean practice transfer, thus supporting definition of countermeasures needed to successfully transfer a lean system overseas. Next paragraph will discuss the impact of cultural differences and source units' organizational culture profiles on level of adaptation.

Transfer project adaptation: how to adapt

Findings from my in-depth and multiple case studies contribute to lean literature by providing a better understanding on *how* MNCs should *adapt* their projects to successfully transfer lean systems overseas.

First, from the analysis of the project launched by the Italian MNC towards its Chinese subsidiary, it emerges that *strong adaptation* is fundamental to effectively transfer a lean system when source and recipient are characterized by a *high socio-cultural difference*. The case examines two consecutive initiatives which differ for the transfer approach used as well as for the final outcome. In particular, the first initiative can be seen as an attempt to *faithfully replicate* the original lean system developed by the Italian headquarters, which resulted in an unsuccessful transfer. On the contrary, *significant modifications and ad-hoc solutions* were defined in the second initiative to fit peculiarities of the Chinese context; this approach turned out to be effective in order to maintain the improvements introduced into recipient factory through lean.

Results from my multiple case study provide further evidence on this point. The cross-case analysis confirms that the level of adaptation is influenced by socio-cultural differences, in terms of both the extent of source-recipient difference and some distinctive features of a recipient unit. However, it also demonstrates that *organizational culture characteristics of the source* can affect the level of adaptation. In fact, while all transfer projects toward U.S.

factories were essentially performed as planned, with few additional resources needed and minor delays in the scheduling (i.e., low adaptation), in case of China the level of adaptation required was high or medium depending on level of power distance characterizing the source's organizational culture (i.e., high and low power distance, respectively).

Therefore, overall these findings provide a relevant contribution to the debate on adaptation in transferring lean practices. From the literature review on lean transfer within MNCs it emerges that while some scholars support strong adaptation (e.g., Wallace, 2004; Lee and Jo, 2007), others consider faithful replication of the original knowledge and solutions of the source a more effective approach (e.g., Ferdows, 2006). My results suggest that, in general, transfer approach effectiveness depends on *cultural characteristics of the dyad* involved in a transfer project.

Transfer project adaptation: why adapt

Besides investigating how culture influences approach effectiveness, my research explores *reasons* underlying successful versus unsuccessful outcomes, clarifying why strong adaptation is important to effectively transfer a lean system in case of a high cultural difference between the source and recipient. To this aim, findings from the in-depth case study are interpreted in light of the "*compatibility perspective*" theorized by Lozeau et al. (2002).

As claimed by Lozeau et al. (2002), a misfit – i.e., so-called "*compatibility gap*" – between practices and recipient's characteristics occurs when practices are transferred across different contexts. In general, such gap can be filled according to four main approaches (i.e., "transformation", "customization", "loose-coupling", and "co-optation/corruption"). However, the probability that practices will be captured by and integrated into existing organizational dynamics – i.e., unsuccessful transfer – than that the practices will change these dynamics in a way consistent with their objectives – i.e., successful transfer – depends on the extent of the misfit. In particular, when there is a large compatibility gap, it is likely that a recipient will try to corrupt the transferred practices or maintain its own practices (i.e., "co-optation" and "loose-coupling", respectively).

Considering the case of the Italian MNC, it could be observed that *a large compatibility gap* rose due to significant socio-cultural differences between the headquarters' and Chinese unit's context. With regard to the transfer approach, using Lozeau et al.'s (2002) terminology, the replication strategy sought by the headquarters during the first initiative can be labeled as *transformation*. In fact, the source tried to move the subsidiary towards lean practices and solutions as defined for the Italian context, introducing only minor modification. However,

considering actual results of the initiative, it can be interpreted as an example of *loose-coupling*, which identifies a situation where a source attempts to faithfully transfer its practices, but they are superficially adopted by a recipient. For example, several misunderstandings and errors in using lean practices and presence of behaviors in contrast with lean, such as scarce participation in problem solving activities and no open communications, are an evidence of recipient's poor understanding and slight implementation of lean.

As suggested by Lozeau et al. (2002), it is likely that a recipient resists source's practices when there is a large gap between source and recipient contexts; a main reason can be the recipient's *lack of conceptual understanding* of the requirements underlying practices. In a similar way, Kostova and Roth (2002) observed that "ceremonial adoptions" occur when recipient subsidiaries use transferred practices to achieve legitimacy with their headquarters, but do not believe they are *valuable* for their organizations. The authors explained that this eventuality is likely to occur when practices are transferred across the world, since people can have *different social and cultural understanding* of practices and related benefits. Coherently, my case study provides evidence of problems related with Chinese employees' poor understanding of lean practices during the first initiative. For example, there were misunderstandings during theoretical lessons which were only partially recognized by Italian managers, thus inevitably resulted in mistakes in practice implementation. As emerged by the interviews, external managers noticed that sometimes Chinese employees used lean practices in a "mechanical way", i.e., they acted as taught but without properly understanding standards. In case of 5S standard, for example, they placed their equipments in a "non-rational way", leaving farther more used tools and vice versa placing nearest those less frequently used. As reported in documents on the cause-and-effect analysis the source did before launching the second initiative, the Italian managers eventually recognized the non-acquisition of values underlying transferred lean practices as a major cause of superficial implementation during the first initiative.

In contrast, the second initiatives launched by the Italian MNC followed a *customization* approach, i.e., the gap was closed by adapting source's practices and solutions (without destroying their aims) as well as adjusting recipient organization. On the one hand, in fact the case shows that local employees' behaviors gradually changed as the transfer process unfolded, becoming more consistent with the lean philosophy. For example, managers and operators actively contribute to problem-solving activities, communicate and cooperate even with employees of different hierarchical levels. As revealed by interviews, external managers also noted a significant shift in the recipient's way of thinking (e.g., recipient employees' understanding of the importance of lean behaviors such as participation to process

improvement initiatives with personal ideas and solutions, team work, etc.). Therefore, these results may be interpreted as a first major step toward the cultural change of the subsidiary – i.e., adjustment of the recipient’s organization. On the other hand, I found evidence of strong adaptations of source’s lean practices and solutions, such as adjustments of teaching method and time committed to problem-solving activities, modification of work instructions, definition of ad-hoc KPIs, etc..

According to Ansari et al. (2010), adaptation allows to create a better fit between transferred practices and the recipient’s particular needs, thus increasing their acceptance. In a similar way, Lozeau et al. (2002) suggested that the shape of the change should be socially reconstructed with recipient’s employees, even though this process inevitably creates hybrid solutions and modification of the source’s practices. Coherently, in my case study headquarters’ representatives acknowledged that modifications defined according to local contingencies (e.g., use of several photos in more detailed work instructions, longer time for production meetings to stimulate discussion, ad-hoc KPIs and reword system, etc.) were fundamental to stimulate recipient employees’ cooperation and make them deeply understand lean practices and potential benefits deriving from their implementation. In other word, adaptation was a prerequisite for organizational movement toward lean, thus for successful transfer of lean.

Although customization was eventually recognized as an effective approach for transferring lean knowledge, the first initiative, and its deep analysis, played an important role in its acknowledgment. This is in line with Inkpen’s (2008) observations about the NUMMI case. The author noted that the earlier initiatives in TPS transfer were characterized by a lack of understanding concerning the proper transfer approach, which in turn resulted in mistakes and poor knowledge transferred. However, the author highlighted that such an initial period of experimentation on the field was crucial for the definition of an effective process for lean knowledge transfer. Therefore, according to him, terming a first unsuccessful attempt to transfer lean “a failure” is too simplistic and ignores the challenge faced during the transfer process. As emerged from the case analysis, during the first initiative, the Italian managers struggled with recognizing or properly estimating the impacts that some Chinese employees’ behaviors and values could have had on lean implementation. For example, they underestimated the influence of the high power distance and related criticalities such as compliance problem. Only after the field experience and a thoroughly cause-and-effect analysis of problems leading to final unsuccessful outcome, they were able to identify main problems and estimate their criticality, thus defining effective countermeasures. In other words, problem evaluation and resolution required that source’s resources were assigned to

the recipient subsidiary, worked side-by-side with recipient employees, thus deeply investigating and understanding socio-cultural differences and defining adaptations to fit them. This is also consistent with studies on transfer projects which underline the relevance of personal mechanisms, thus of a strong presence of source representatives in recipient's unit, for effectively sharing organizational practices, especially those involving tacit/social dimensions such as soft lean practices (Kostova, 1999; Maritan and Brush, 2004).

6.2.2 Managerial contributions

My research on transferability of lean systems can also be of use to practitioners.

On the one hand, managers are provided with a thorough description and a classification of *main criticalities* affecting cross-border lean transfer projects. First of all, my findings stress the fact that main transfer problems are related not only to traditional issues characterizing lean implementation within a single factory, but are also due to *heterogeneity between contexts*. Therefore, managers should keep in mind that the success in lean implementation within the source is a necessary but not sufficient condition for success in lean knowledge transfer.

As emerged from the interviews, managers in charge of cross-border lean transfer projects are typically expert in lean. However, they frequently have little experience of recipient contexts; this can limit the ability of a source to appreciate and understand *cultural differences*, thus defining countermeasures to overcome problems related with such differences. In order to successfully transfer lean, my in-depth case study shows that it is crucial that the initial assessment of a recipient context is conducted by the source not only considering its technical specificities, but also carefully analyzing its *social peculiarities*. In addition, source managers should work side-by-side, day-after-day with recipient workers, especially when there is a high cultural difference; such close cooperation will help source recognize recipient's cultural peculiarities as well as to promptly define effective countermeasures to problems caused by cultural differences.

Moreover, my findings suggest that problems in lean knowledge transfer are *context specific* – i.e., similar within a context and different between various contexts –, and can affect *different phases* of a transfer project – i.e., introduction or implementation. These are important indications for managers in charge of transfer projects to overcome risks of failure associated with such initiatives. First of all, they warn MNCs to replicate solutions effective in a country in different subsidiaries without a deep analysis of recipients' specificities. Second, these findings provide hints on resources needed to implement the various phases of different lean transfer projects. Thus, they can be particularly useful for MNCs that have to

coordinate limited resources among simultaneous projects towards different countries.

On the other hand, another important managerial implication is that my research provides practitioners with a framework to understand the *changes* necessary in lean transfer projects, as they face different contexts. Solutions and lean practices that proved effective in the source context, or that have required small changes in some recipient contexts, can be ineffective for factories elsewhere. So as that lean implementation produces similar results in the various factories of a MNC, it is thus necessary to adapt source's practices and solutions to vary degrees. My cross-case analysis shows that in general the level of adaptation can be affected by the extent of source-recipient difference and distinctive features of a recipient unit, as well as by the organizational culture characteristics of the source. My results also suggest that different solutions can be necessary to fit cultural specificities of a recipient context, thus increasing recipient's understanding of the transferred practices and their values, and avoiding their superficial adoption. Effective countermeasures are offered to managers along with practical guidelines on critical elements upon which managers have to put emphasis and specific modifications necessary to adequate tools.

Overall, these results can support decision making in lean knowledge transfer projects towards non-lean manufacturing factories.

6.2.3 Limitations and future research

Although my research on transferability of lean systems contributes to both theory and practice, there are some limitations that must be recognized.

First, an important limitation is linked with the contexts analyzed. The in-depth case study focused on the initiatives launched by an Italian MNC to its Chinese subsidiary, while the multiple case study sample is limited to two types of recipient contexts – i.e., China and US – and only European sources. In order to increase the generalizability of the results, future studies should be directed towards testing my research findings within larger samples of firms, representative of a broader range of cultures. For example, future works can explore and compare problems as well as countermeasures used in polar versus more similar contexts.

A second limit concerns the use of retrospective data. Although steps were taken to improve the reliability of retrospective reports (e.g., multiple informants interviewed, comparison of data from interviews with reports developed in real time as the implementation unfolded), potential inaccuracies and biases can be present. Thus I recommend longitudinal studies based on real-time data.

Findings from the multiple case study are somewhat limited also by the use of a static perspective. Therefore, in order to increase the understanding of lean knowledge transfer project, I suggest that future studies will employ a process view.

Finally, my research focuses on the early phases of lean knowledge transfer evaluating transferring effectiveness in the short term. Instead, future research should extend the analysis to the following phases, evaluating the implications of early actions on subsequent initiatives and over a greater time frame.

7. Conclusions

This doctoral thesis analyzed the role of culture in determining lean systems effectiveness and in affecting their transferability across factories in MNCs. In particular, the thesis addresses three sets of research questions, which guided the empirical research in Chapters 3, 4, and 5. Chapter 6 discusses the findings, highlighting both academic and managerial contributions as well as presenting their limitations and opportunities for future research. In this chapter I will summarize the research questions and the answers to such questions based on the research findings, together with contributions.

Lean implementation in a manufacturing unit: the role of organizational culture and soft lean practices

Lean management is a managerial approach widely recognized as powerful in reducing waste and continuously improving production processes of a manufacturing unit (Shah and Ward, 2007). Many firms worldwide have implemented lean practices obtaining significant enhancement in operational performance. However, some lean projects failed to achieve such benefits (Liker and Rother, 2011). Over the years researchers have suggested several causes for lean projects failure; an inadequate organizational culture and the absence of lean soft practices are certainly among the most critical and widest acknowledged in the lean literature (e.g., Spear, 1999; Liker, 2004; Rother, 2009; Liker and Rother, 2011). Although scholars recognized that there is a relationship between lean, organizational culture and performance, and a significant amount of research has been conducted on such topic, the literature is lacking in providing a comprehensive analysis of the phenomenon.

Therefore, my research aimed to shed light on distinctive characteristics of successful lean factories, in terms of organizational culture dimensions and extent of use of soft versus hard lean practices. The following *first set of research questions* was empirically investigated:

RQ1 Do successful lean factories show a peculiar organizational culture?

RQ1a What is the ideal organizational culture profile for lean?

RQ1b Do successful lean factories adopt soft lean practices more extensively compared to unsuccessful lean factories?

Starting from the GLOBE model of culture, a wide set of both soft and hard lean practices (concerning people and relations versus technical and analytical tools, respectively), and most important operational performance, I defined a comprehensive model to analyze the role of culture and soft lean practices in successful lean implementation within a manufacturing unit. I developed and tested two hypotheses considering the difference

between successful and unsuccessful lean factories in terms of organizational culture values and the extent of adoption of soft practices. Data from the HPM research project, including 317 manufacturing factories in 3 sectors and 10 countries, was used to test hypotheses through multi-group analysis method.

Results indicate that successful and unsuccessful lean factories differ for some organizational culture dimensions, thus are characterized by a peculiar organizational culture. In particular, it emerges that while some organizational culture dimensions differ between lean adopters and non-lean adopters, thus are likely to influence the decision of whether to implement lean; others are peculiar only of successful lean factories, thus make the difference in the successful implementation of lean. More specifically, the ideal organizational culture profile for lean is characterized by higher institutional collectivism, future orientation and humane orientation, and lower assertiveness.

In addition, findings show that successful and unsuccessful lean factories also differ for the extent of soft practices adoption. In particular, it emerges that while the level of implementation of hard lean practices differ between lean adopters and non-lean adopters, successful lean factories distinguish from unsuccessful lean factories for a greater level of adoption of soft lean practices.

From a managerial perspective, the results indicate that, in order to implement lean successfully, practitioners have to go beyond lean technicalities by adopting soft practices and instilling appropriate organizational culture values in a factory.

A first limitation of the work is related to the research sample (i.e., only three industries); thus future research should replicate the study in other sectors. Another important limitation concerns the cross-sectional nature of the data; future longitudinal study should examine how organizational culture evolves and interacts with soft practices over time. Finally, I analyzed the role of culture and soft lean practices within firms' boundaries and in the immediate supply network, while future studies should extend the focus, involving the entire supply network.

Lean knowledge transfer in MNCs: the role of culture

In recent years a growing number of MNCs have sought to implement lean across factories located worldwide. The aim was to replicate benefits, such as waste reduction and production process improvement, achieved in headquarters and/or in historical local factories. However, the majority of cross-border lean transfer projects encountered problems, and some even failed. Indeed, lean knowledge transfer projects are particularly complex to be implemented; besides problems characterizing lean adoption within a factory, managers

have to deal with issues concerning the heterogeneity between contexts (Maritan and Brush, 2003). Unlike the literature on lean implementation within a manufacturing unit, research on lean knowledge transfer within MNCs is scarce (Netland and Aspelund, 2014). In particular, it lacks a detailed examination of the role of culture in successful transfer of lean knowledge among units of MNCs.

The aim of the thesis was to provide a twofold contribution to this research stream. First, I wanted to deeply examine the impact of cultural differences between an Italian MNC and its Chinese subsidiary on lean knowledge transfer process, and effectiveness of different transfer approaches. Second, I aimed to explain how effectively managing lean knowledge projects across a number of lean knowledge owners and recipients in MNCs. In particular, the following two sets of research questions were empirically investigated:

RQ2 How do cultural differences between an Italian factory (lean source in a MNC) and a Chinese subsidiary (non-lean recipient) influence the transfer of lean management?

RQ2a How do cultural differences influence the effectiveness of lean knowledge transfer approach? Why do different lean knowledge transfer approaches lead to different outcomes?

RQ2b How should an Italian factory adapt its lean system to fit peculiarities of a Chinese subsidiary?

RQ3 How can MNCs handle factories' cultural differences in cross-border lean knowledge transfer projects?

RQ3a How do cultural contexts of the source and recipient influence cross-border lean knowledge transfer projects within MNCs?

RQ3b What are the main variables differentiating cross-border lean knowledge transfer projects within MNCs?

In order to address the *second set of research questions* I conducted an in-depth case study. I examined a project recently launched by an Italian MNC to transfer lean to its non-lean Chinese subsidiary, which involved two consecutive initiatives: the first unsuccessful, and the second successful. Finally, I conducted a multiple case study to address the *third set of research questions*. I analyzed seven successful lean knowledge transfer projects at dyadic level. They concern four different European MNCs, and involved four different European sources together with their Chinese and U.S. non-lean recipients. Literal and theoretical

issues were assessed by ascertaining that similarities as well as differences regarding cultural characteristics of the sources as well as of the recipients.

Results of my in-depth case study confirm that cultural differences can be a major hurdle in transferring a lean system overseas, and contribute to the literature by providing a detailed examination of the impact of cultural differences on lean transfer process. In particular, I shed light on major problems occurred during each phase of the transfer process between the Italian source and Chinese recipient. I observed that, if not properly managed, cultural differences can even preclude the successful transfer of lean knowledge overseas. In fact, from the analysis of the transfer project between the Italian headquarters and Chinese subsidiary emerged that the approach used by the source to transfer lean knowledge played a crucial role in determining the success/failure of the transfer initiative. By interpreting findings in light of the “compatibility perspective” theorized by Lozeau et al. (2002), the research also contributes in clarifying reasons underlying successful versus unsuccessful outcomes in lean transfer projects. In particular, strong adaptation turned out to be fundamental to effectively transfer a lean system when source and recipient are characterized by a high socio-cultural difference. In line with Ansari et al. (2010), in fact I found that adaptation helped to avoid and overcome transfer problems, such as recipient’s lack of conceptual understanding of lean practices and non lean behaviors, by creating a better fit between transferred practices and recipient’s particular needs and peculiarities.

Findings from the lean transfer project between the Italian factory and Chinese subsidiary can also be useful for practitioners to overcome risks of failure associated with lean transfer initiatives. In particular, managers are advised to deeply analyze societal culture peculiarities of recipient, besides its technical specificities, when adapting a lean system. To this aim, source’s experience on the field while collaborating with recipient workers is important to properly identify criticalities due to cultural difference as well as define effective countermeasures to handle such problems. Moreover, the study offers specific solutions to overcome problems found.

Generalizability of the findings is limited by the use of a single case study. Therefore, further research could be directed towards testing research findings within larger samples of firms, and with subsidiaries in different cultural contexts. Another limitation concerns the use of retrospective data. Although steps were taken to improve the reliability of retrospective data, potential inaccuracies and biases can be present. Thus, I recommend longitudinal studies based on real-time data.

For what concerns my multiple case study, findings provide a further demonstration that cultural characteristics of a recipient country as well as the extent of cultural difference in

respect to the source (i.e., cultural differences) can be a major cause of problems in lean transfer projects. I found that main transfer problems are context-specific – i.e., similar within a context and different between China and U.S.. In addition, I suggested that problems can be effectively classified by considering the phase of the process in which they occurred. In particular, while main criticalities in U.S. are related with the introduction phase, main problems in China are related with implementation phase.

Multiple case study also analyzed the impact of different source units' organizational culture profiles on lean knowledge transfer, thus contributing to the literature by providing a wider perspective of the influence of culture on cross-border lean transfer projects within MNCs. My results show that source's organization culture characteristics can affect the level of adaptation needed to effectively transfer a lean system overseas. In particular, I found that all transfer projects toward U.S. factories were essentially performed as planned, with few additional resources needed and minor delays in the scheduling (i.e., low adaptation), while in case of China the level of adaptation required was high or medium depending on level of power distance characterizing source's organizational culture (i.e., high and low power distance, respectively). Therefore, my findings also contribute to the debate on practice adaptation by identifying an important determinant of project adaptation in lean practice transfer.

Overall, this research attempts to develop a set of propositions which contributes to create a theory on lean knowledge transfer across lean knowledge owners and recipients in MNCs. However, results can also be of use to practitioners. In fact, suggestions for effectively manage different contexts are also deduced to support managers in reducing the risk of failure when transferring lean.

Finally, it should be observed that my multiple case study is limited to a relatively small sample; only two types of recipient contexts and only European sources. Future studies should test research findings within larger samples of MNCs, representative of a broader range of cultural contexts. As in case of the in-depth case study, I used retrospective data. In order to avoid potential inaccuracies and biases due to the use of retrospective data, I recommend longitudinal studies based on real-time data. Finally, findings from the multiple case research are also somewhat limited by the use of a static perspective; thus, in order to increase the understanding of lean knowledge transfer project, I suggest that future studies will employ a process view.

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Appendix

Organizational culture

Please indicate to what extent you agree/disagree with the following - (circle one number): 1 – strongly disagree, 2 – disagree, 3 – slightly disagree, 4 – neutral, 5 – slightly agree, 6 – agree, and 7 – strongly agree

^a Reverse Code

Power distance

OC01 Managers in this plant believe in using a lot of face-to-face contact with shop floor employees.^a

OC02 This plant is a good place for a person who likes to make his own decisions.^a

OC03 My suggestions are never taken seriously around here.

OC04 Our organization structure is relatively flat.^a

Institutional collectivism

OC05 Generally, speaking, everyone in the plant works well together.

OC06 Our supervisors encourage the people who work for them to work as a team.

OC07 We work as a partner with our suppliers, rather than having an adversarial relationship.

OC08 We believe that cooperative relationships will lead to better performance than adversarial relationships.

OC09 We believe than an organization should work as a partner with its surrounding community.

In-group collectivism

OC10 I talk up this organization to my friends as a great organization to work for.

OC11 I am proud to tell others that I am part of this organization.

OC12 I am extremely glad that I chose this organization to work for, over others I was considering at the time I joined.

OC13 For me, this is the best of all organizations for which to work.

Future orientation

- OC14 We pursue long-range programs, in order to acquire manufacturing capabilities in advance of our needs.
 - OC15 We make an effort to anticipate the potential of new manufacturing practices and technologies.
 - OC16 Our plant stays on the leading edge of new technology in our industry.
 - OC17 We are constantly thinking of the next generation of manufacturing technology.
-

Performance orientation

- OC18 Our incentive system encourages us to vigorously pursue plant objectives.
 - OC19 The incentive system at this plant is fair at rewarding people who accomplish plant objectives.
 - OC20 Our reward system really recognizes the people who contribute the most to our plant.
-

Assertiveness

- OC21 Our business strategy is implemented without conflicts between functions.^a
 - OC22 The functions in our plant cooperate to solve conflicts between them, when they arise.^a
 - OC23 Our managers do a good job of solving inter-functional conflicts.^a
 - OC24 Our managers communicate effectively with managers in other functions.^a
-

Uncertainty avoidance

- OC25 I believe that the scientific method provides a better input to decision making than intuition or opinion.
 - OC26 In my view, organizations should use objective data as the basis for making decisions.
 - OC27 In this organization, management is based on facts, not on intuition or tradition.
-

Humane orientation

- OC28 I believe that our employees are good people.
 - OC29 In my view, most employees are more concerned with personal gain than with helping our organization accomplish its goals.^a
 - OC30 Although there may be a few "bad apples," most of our employees try to help our organization achieve its goals.
 - OC31 Some of our employees are probably only out to get what they can from this organization.^a
-

Hard-lean practices

Please indicate to what extent you agree/disagree with the following - (circle one number): 1 – strongly disagree, 2 – disagree, 3 – slightly disagree, 4 – neutral, 5 – slightly agree, 6 – agree, and 7 – strongly agree

^a Reverse Code

Daily schedule adherence

HLM01 We usually meet the production schedule each day.

HLM02 Our daily schedule is reasonable to complete on time.

HLM03 We usually complete our daily schedule as planned.

HLM04 We cannot adhere to our schedule on a daily basis.^a

Equipment layout

HLM05 We have laid out the shop floor so that processes and machines are in close proximity to each other.

HLM06 The layout of our shop floor facilitates low inventories and fast throughput.

HLM07 Our processes are located close together, so that material handling and part storage are minimized.

HLM08 We have located our machines to support JIT production flow.

Just in time delivery by suppliers

HLM09 Our suppliers deliver to us on a just-in-time basis.

HLM10 We receive daily shipments from most suppliers.

HLM11 We can depend upon on-time delivery from our suppliers.

HLM12 Our suppliers are linked with us by a pull system.

HLM13 Suppliers frequently deliver materials to us.

Kanban

HLM14 Our suppliers deliver to us in kanban containers, without the use of separate packaging.

HLM15 We use a kanban pull system for production control.

HLM16 We use kanban squares, containers or signals for production control.

Setup time reduction

- HLM17 We are aggressively working to lower setup times in our plant.
 - HLM18 We have converted most of our setup time to external time, while the machine is running.
 - HLM19 We have low setup times of equipment in our plant.
 - HLM20 Our crews practice setups, in order to reduce the time required.
-

Process control

- HLM21 A large percent of the processes on the shop floor are currently under statistical quality control.
 - HLM22 We make extensive use of statistical techniques to reduce variance in processes.
 - HLM23 We use charts to determine whether our manufacturing processes are in control.
 - HLM24 We monitor our processes using statistical process control.
-

Cleanliness and organization

- HLM25 Our plant emphasizes putting all tools and fixtures in their place.
 - HLM26 We take pride in keeping our plant neat and clean.
 - HLM27 Our plant is kept clean at all times.
 - HLM28 Our plant is disorganized and dirty.^a
-

Autonomous maintenance

- HLM29 Operators understand the cause and effect of equipment deterioration.
 - HLM30 Basic cleaning and lubrication of equipment is done by operators.
 - HLM31 Operators inspect and monitor the performance of their own equipment.
 - HLM32 Operators are able to detect and treat abnormal operating conditions of their equipment.
-

Soft-lean practices

Please indicate to what extent you agree/disagree with the following - (circle one number): 1 – strongly disagree, 2 – disagree, 3 – slightly disagree, 4 – neutral, 5 – slightly agree, 6 – agree, and 7 – strongly agree

^a Reverse Code

Top management leadership for quality

- SLM01 All major department heads within the plant accept their responsibility for quality.
 - SLM02 Plant management provides personal leadership for quality products and quality improvement.
 - SLM03 Our top management strongly encourages employee involvement in the production process.
 - SLM04 Our plant management creates and communicates a vision focused on quality improvement.
 - SLM05 Our plant management is personally involved in quality improvement projects.
-

Supplier partnership

- SLM06 We maintain cooperative relationships with our suppliers.
 - SLM07 We provide a fair return to our suppliers
 - SLM08 We help our suppliers to improve their quality.
 - SLM09 Our key suppliers provide input into our product development projects.
-

Small group problem solving

- SLM10 During problem solving sessions, we make an effort to get all team members' opinions and ideas before making a decision.
 - SLM11 Our plant forms teams to solve problems.
 - SLM12 In the past three years, many problems have been solved through small group sessions.
 - SLM13 Problem solving teams have helped improve manufacturing processes at this plant.
 - SLM14 Employee teams are encouraged to try to solve their own problems, as much as possible.
 - SLM15 We don't use problem solving teams much, in this plant.^a
-

Continuous improvement

- SLM16 We strive to continually improve all aspects of products and processes, rather than taking a static approach.
 - SLM17 If we aren't constantly improving and learning, our performance will suffer in the long term.
 - SLM18 Continuous improvement makes our performance a moving target, which is difficult for competitors to attack.
 - SLM19 We believe that improvement of a process is never complete; there is always room for more incremental improvement.
 - SLM20 Our organization is not a static entity, but engages in dynamically changing itself to better serve its customers.
-

Training employees

- SLM21 Our employees receive training to perform multiple tasks.
 - SLM22 Employees at this plant learn how to perform a variety of tasks.
 - SLM23 The longer an employee has been at this plant, the more tasks they learn to perform.
 - SLM24 Employees are cross-trained at this plant, so that they can fill in for others, if necessary.
 - SLM25 At this plant, each employee only learns how to do one job.^a
-

Manufacturing-business strategy linkage

- SLM26 Our business strategy is translated into manufacturing terms.
 - SLM27 Potential manufacturing investments are screened for consistency with our business strategy.
 - SLM28 At our plant, manufacturing is kept in step with our business strategy.
 - SLM29 Manufacturing management is not aware of our business strategy.^a
 - SLM30 Corporate decisions are often made without consideration of the manufacturing strategy.^a
-

Customer involvement

- SLM31 We frequently are in close contact with our customers.
 - SLM32 Our customers give us feedback on our quality and delivery performance.
 - SLM33 We strive to be highly responsive to our customers' needs.
 - SLM34 We regularly survey our customers' needs.
-

Level of lean manufacturing implementation in respect to competitors

Please circle the number that indicates your opinion about how your plant compares to its competition in your industry, on a global basis: 5 – superior, 4 – better than average, 3 – average or equal to the competition, 2 – below average, and 1 – poor or low

LEAN Lean manufacturing

Operational performance in respect to competitors

Please circle the number that indicates your opinion about how your plant compares to its competitors in your industry, on a global basis: 5 – superior, 4 – better than average, 3 – average or equal to the competition, 2 – below average, and 1 – poor or low

-
- PER1 Unit cost of manufacturing
 - PER2 Quality conformance
 - PER3 On time delivery performance
 - PER4 Fast delivery
 - PER5 Flexibility to change product mix
 - PER6 Flexibility to change volume
-

I used the following formula to compute the performance score:

$$\text{Eq. (A.1) PER} = (\text{PER1} + \text{PER2} + \text{PER3} + \text{PER4} + \text{PER5} + \text{PER6}) / 6$$

