

***ADVANCED PRODUCTION SYSTEMS – DEVELOPING  
CONTEXT-ORIENTED METHOD AND ADAPTATION  
CAPABILITIES FOR ENHANCED SUPPLY NETWORK***

**DISSERTATION**

zur Erlangung des akademischen Grades

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von Master Industrial -Ing. Idris Zehrudin Muhammed

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**Dissertation**

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**Doktoringenieur (Dr.-Ing.)**

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## Kurzfassung

Als Reaktion auf die stetige Herausbildung neuer Methoden, gesteigener Qualitätsansprüche, dem zunehmenden globalen Wettbewerb in Verbindung mit der Einführung neuer Technologien und Werkstoffe unterliegen auch Produktionssysteme einer stetigen Weiterentwicklung.

Derartige Produktionssysteme müssen den aktuellen Anforderungen aus konjunkturbedingten Marktentwicklungen und verstärkten Nachfrageschwankungen infolge der voranschreitenden Globalisierung entsprechen. Ganzheitliche und zuverlässige Produktionssysteme werden nicht nur vom Kunden eines Unternehmens erwartet, auch dessen Teilhaber sehen eine Abhängigkeit zwischen dem unternehmerischen Erfolg und der Nutzung bewährter Methoden sowie deren kontinuierlicher Verbesserung. Darauf basierend setzen Unternehmen verstärkt auf den Einsatz sog. Lean-Production-Methoden, um ihre interne und externe Leistungsfähigkeit zu verbessern. Im Mittelpunkt von Lean Production Systems (LPS) steht der Mehrwert für den Kunden

Die unternehmerische Leistung als Mehrwert für den Kunden steht im Mittelpunkt von LPS, um den Wertschöpfungsprozess effizient zu gestalten und weiterzuentwickeln. Während die Grundprinzipien der Schlanken Produktion in Form von Wertschöpfungsorientierung und Vermeidung von Verschwendungen (sog. Lean principles) allseits bekannt und akzeptiert sind, ist der zielführende Einsatz von Lean-Production-Methoden in unterschiedlichen sozio-technischen Systemen genauer zu untersuchen.

Bestehende Implementierungsmodelle auf den Weg zur Schlanken Produktion berücksichtigen nicht oder nur ungenügend den fokussierten Kulturkreis, in dem Lean-Production-Methoden zum Einsatz kommen sollen. Aus eben jener Diskrepanz zwischen vorfindbaren Einsatzbedingungen und notwendiger Anwendungsvoraussetzungen resultiert deren eher geringe Erfolgsquote und nachhaltige Anwendung.

Die vorliegende Arbeit untersucht die Probleme bei der Implementierung von Lean Production Systems (LPS), um für den notwendigen Anpassungsprozess ein geeignetes Methodeninstrumentarium zu entwickeln. Das primäre Ziel ist die Entwicklung eines kontextorientierten Adaptionmodells für Lean Production Systems (LPS) erweitert um indigene Methoden, welche eine bessere Anwendung im fokussierten Kulturkreis

ermöglichen. Um diesem Ziel zu entsprechen, erfolgt zunächst eine wissenschaftliche Diskussion über das Paradigma der Schlanke Produktion. Auf Basis von schriftlicher Interviews und Online-Umfragen wurden zwei unterschiedliche Kulturkreise untersucht. Anhand ausgewählter Unternehmen aus Deutschland und Äthiopien erfolgt die statistische Auswertung der erhobenen Ergebnisse.

Daran schließt sich die Entwicklung des kontextorientierten Adaptionsmodells für Lean Production Systems (LPS) an, welches die Anwendung indigener Methoden, den Umgang mit kulturellen Unterschieden, die Organisationsfähigkeit und Umsetzungsstrategien auf dem Weg zur Schlanke Produktion berücksichtigt.

Die wesentlichen Erkenntnisse betonen den starken Zusammenhang des Erfolgs von LPS mit dem jeweiligen Unternehmenskontext sowie dem Unterschied der Leistungssteigerungen bei unterschiedlichem Kontext. Die aus einer strukturierten Befragung gewonnenen Erkenntnisse unterstreichen die Schlüsselrolle der Fähigkeiterweiterung in Richtung des Anpassungsvermögens der Hauptmethoden, wie sie bei Lean Production angewandt werden.

Kontext- und Kulturabhängigkeit der Transfer- und Anpassungsfähigkeit von Methoden eröffnen Spielräume für den Einsatz indogener kultureller Elemente in die Lean Production Lösungen. Die umfassende Gesamtheit aller Einflussparameter, Kontextbezüge sowie der Einflussgrößen auf die Entwicklung von Kernfähigkeiten lassen sich zu einem umfassenden Prozess zur Anpassung von Methoden in Richtung einer Lernenden Organisation zusammenfassen. Diese auch als Lean Journey angesprochene Entwicklungssicht eröffnet bislang wenig bekannte Möglichkeiten zur Einführung effizienter Produktionen in Schwellenländern mit grossen Aussichten auf den Eintritt in globale Lieferantennetzwerke.

Der Prozess wird an einem virtuellen Unternehmen nochmals exemplarisch gespiegelt. Daraus leiten sich Ausblicke für die weitere Forschung, der Nutzen zur Verbesserung von Regierungshandeln sowie Methodenerweiterung die Industrien selbst ab, was in einem abschließenden Kapitel zusammengefasst ist.

## Abstract

In response to emergence of new methods, high quality standards, escalating global competition in conjunction with introduction of new technologies and materials, production systems (PS) are subjected to continuous development. Such production systems must meet the current requirements of globalized market trends and increased demand fluctuations. Comprehensive and reliable production systems are not only expected by the immediate customers but also by partners requiring best practices adaptation. Based on this scenario, companies are increasingly looking to so-called lean production methods to improve their internal and external capabilities.

As a result, the generic Lean production principles of eliminating waste and maximizing value for the customer become essential for industries. However, the adaptation methodologies of Lean principles in various socio-technical backgrounds need more investigation. The existing transfer and implementation approaches do not consider production system contextualization, exploitation of indigenous methods and adaptation capabilities. Consequently, incompatibility of context with the requirements of the new methods obscures the sustainability and the success levels of adapted PS approaches.

This dissertation investigates Lean transformation incidents with the aim of improving the adaptation methodology in different contexts. The primary objective is to develop a context-oriented production system enriched by indigenous methods and adaptation capabilities that can enable better exploitations of opportunities in the contemporary supply network environment. The primary research approaches followed include review of literatures related to modern production system adaptation approaches and influencing contexts, survey of selected industries in two different contexts, from Germany and Ethiopia, using structured questionnaire and interview and statistical analysis of the survey results.

This is followed by the development of context-oriented adaptation model for Lean journey, which takes into account the application of indigenous methods, observing cultural differences and adaptation capabilities.

The main findings emphasize the strong link of LPS success with the respective corporate context as well as capabilities. The result from the structured survey underlines that best practice adaptation becomes common as applied to LPS. The context-based approaches to

exploit indigenous methods and culture dynamics harmonize the incompatibilities of context with the new method.

The features of influencing factors, the context-oriented PS approach and the required adaptation capabilities are synthesized to a comprehensive adaptation method leading towards learning organization. This is referred to as Lean journey with a perspective of introducing efficient PS in emerging markets with a prospect of entry to global supply network. The process is mirrored and examined in a virtual company. Outlook for further research, the benefits in improving government policy and enhancing adaptation method for industries are summarized in the last section. The proposed methodical procedure stresses on considering organizational circumstances, adapting the modern PS package (i.e. LPS), developing indigenous methods and managing emerging systems while simultaneously developing the required adaptation capabilities.

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## Abbreviations

5S	five Japanese - Seiri, Seiton, Seiso, Seiketsu, and Shitsuke
5S	English - sort, simplify, shine, standardize/ sustain and self-discipline.
CVF	competing value framework
DC	Dynamic Capability
EME	Extended Manufacturing
Ethio	Ethiopia
eVSM	Extended Value Stream Map
FLS	Flexible labour system
HD	Habitual Domain
HR	Human Resource
IMS	Intelligent manufacturing systems
JIT	Just in Time
LPS	Lean Production System
PDCA	Plan-Do-Check-Act
PMPP	post-mass production paradigm
PS	Production System
QFCD	quality function deployment
RBV	Resource Based View
SMED	Single minute exchange of die
SN	Supply Network
SPC	Statistical Process Control
TPM	Total Productive Maintenance
TQC	Total Quality Control
TQM	Total Quality Management
TTL	operations transition-to-Lean
VSM	Value Stream Map

# 1. Introduction

## 1.1. Background and Motivation

Production systems have evolved over the years in response to many drivers including the constant evolution of new methods, quality, escalating global competition as well as the introduction of new technologies and materials, [29]. It is still advancing to match different challenges of business fluctuations, demand variety and operational environments. For industries, to remain competitive and retain market share, adapting continuous improvement methods has become essential more than ever. Competition and continuously increasing standards of customer satisfaction are the endless drives of production system (PS) approaches, [108]. Companies in the value chain also look for better production methods in partner firms to establish better cooperation agreements, [122]. Conversely, firms need to mesh with the globalized production network planetary gear, as there is no single company operating in isolation. Hence, the survival of industries increasingly becomes dependent on adapting and improving advanced production methods and/ or developing customized PS.

Among numerous ‘post mass production paradigms’ Toyota Production System (TPS) approach has much recognition for decades as advanced comprehensive production system. TPS or Lean production system (LPS), as often called, focuses on specifying value from the customer perspective and attempting to make the value stream flow efficiently. It promptly seeks to eliminate non-value adding operations in the value chain by applying well-established scientific tools to solve problems in a never-ending continuous process improvement (CPI). Besides improving the internal process capability, Lean-based supply network orientation lend themselves for collaborative organizational phenomena in the value chain constellation. As a result, ‘Lean Thinking’ has been accepted frameworks in gaining and maintaining fitting positions in the increasingly globalized business network, [66], [39].

Consequently, TPS has spread from Toyota to different industries across the globe. Its benefit in building competitive capability is accepted by industries both in developed countries like North America, Europe and developing countries such as Vietnam, India, Indonesia, Singapore, Ethiopia ...etc. While this contemporary paradigm appropriateness is gaining popularity worldwide, the effective transferability and its adaptation methods to various socio-technical situations often pose difficulties. The methods and principles get into conflict

or become little compatible with various organizational backgrounds challenging the transfer and sustainability of the methods. It is assumed that the production system development, execution and improvement as a whole is affected by different factors such as external influences (i.e. history, trends, globalization, structures); strategies and attitudes (philosophy, culture, experiences); and actual options (i.e. technology, management and organization), [13]. In today's business environment, these factors become very dynamic requiring PS adaptability for specific contextual influences. Even though there is much work on procedural implementation approaches, there is no sufficient work with respect to PS adaptation in different socio-technical backgrounds. The existing approaches do not explicitly consider contextual factors and hence, the stereotype methods are taken from literature or consultant cookbooks without contextualizing to specific conditions. The capabilities required for adaptation are not specified either. Contextual compatibility and better methodologies remain a research concern for industries and academia [5], [126].

Such challenges raise speculations on the transferability of modern PS to other contexts, which become a research debate in perspectives and inconsistent empirical works, [5], [22], [112], [115]. Even if the transfer of Lean methods are practical, fully enforcing these methods in an organization disregards the innovative potentials embedded in industry-specific and indigenous methods that may enrich new systems and evolve to competitive alternative methods, [15]. Companies, like Toyota and Ford could have the capability and motivation to develop distinctive method for their own competitive advantage or contribute to universal production methods. Thus, in order to achieve the best out of PS implementation effort, more robust methodical approaches tuned to the contexts of organizations is required. To enhance the research with practical evidences, survey has been conducted addressing industries experiences in the adaptation of such methods in different setups. Hence, the motivation of this study is to develop modes of contextualized methodologies and capabilities to acclimatize and sustain advanced PS techniques.

## **1.2. Research Objectives**

In line with the PS theme, this study revolves around research concerns related to: spectra of production systems paradigms, modern PS constituent elements, PS transfer, methods, impact of context and organizational capability and devising mechanisms for context-based adaptation. Hence, the primary objective is to develop context-oriented PS adaptation

framework and method with required capabilities that enable better implementation through the logical exploitations of contextual factors. The specific objectives are:

- Shedding light on spectra of contemporary PS and their constituent elements
- Examining context influence on PS transferability and adaptation
- Surveying industries experiences' with LPS implementation
- Analysing existing Lean adaptation approaches and their limitation
- Developing PS adaptation capabilities
- Developing context-oriented PS adaptation method that guides the Lean journey

### **1.3. Research Approaches**

To tackle the stated research objectives, the research methodologies include reviews of related works, industry survey and developing schemes. The production system concepts, paradigms with respect to the principles, bundles of tools and their aggregate impact on competitiveness and supply chain implications are mirrored using relevant literature. The transfer perspectives, the features of adaptation approaches and its relations with organizational capability along with empirical works on transferability in the exiting literature are also analyzed. To reinforce the research with experiences of industries and extracting opinions from experts, online and paper-based surveys were made in groups of industries from Germany and Ethiopia that are currently implementing Lean approaches. The survey result is analyzed using scales of common statistical methods and the resulting inferences are discussed through cross-referencing the findings from the two environments. The main themes of the survey were: the transformation approaches, Lean notions, utilization of tools and techniques, supply network practices, attained performance improvements, specific contextual factors on implementation and gathering practitioners' opinion on critical hindering factors and constructive improvement ideas. Finally, a PS adaptation framework that captures influential PS contexts and shows evolutionary trajectories is developed. To guide the journey to Leanness, a context-oriented PS approach is developed, based on the Lean principles, indigenous method framework, organizational capabilities and culture dynamics phenomena. Besides, based on the analysis of the relation between dynamic capabilities (DC) and best practice adaptation and their vitality to capture opportunities from supply network (SN), the required appropriate adaptation capabilities are outlined. The general research schemes are depicted in Fig 1.1.

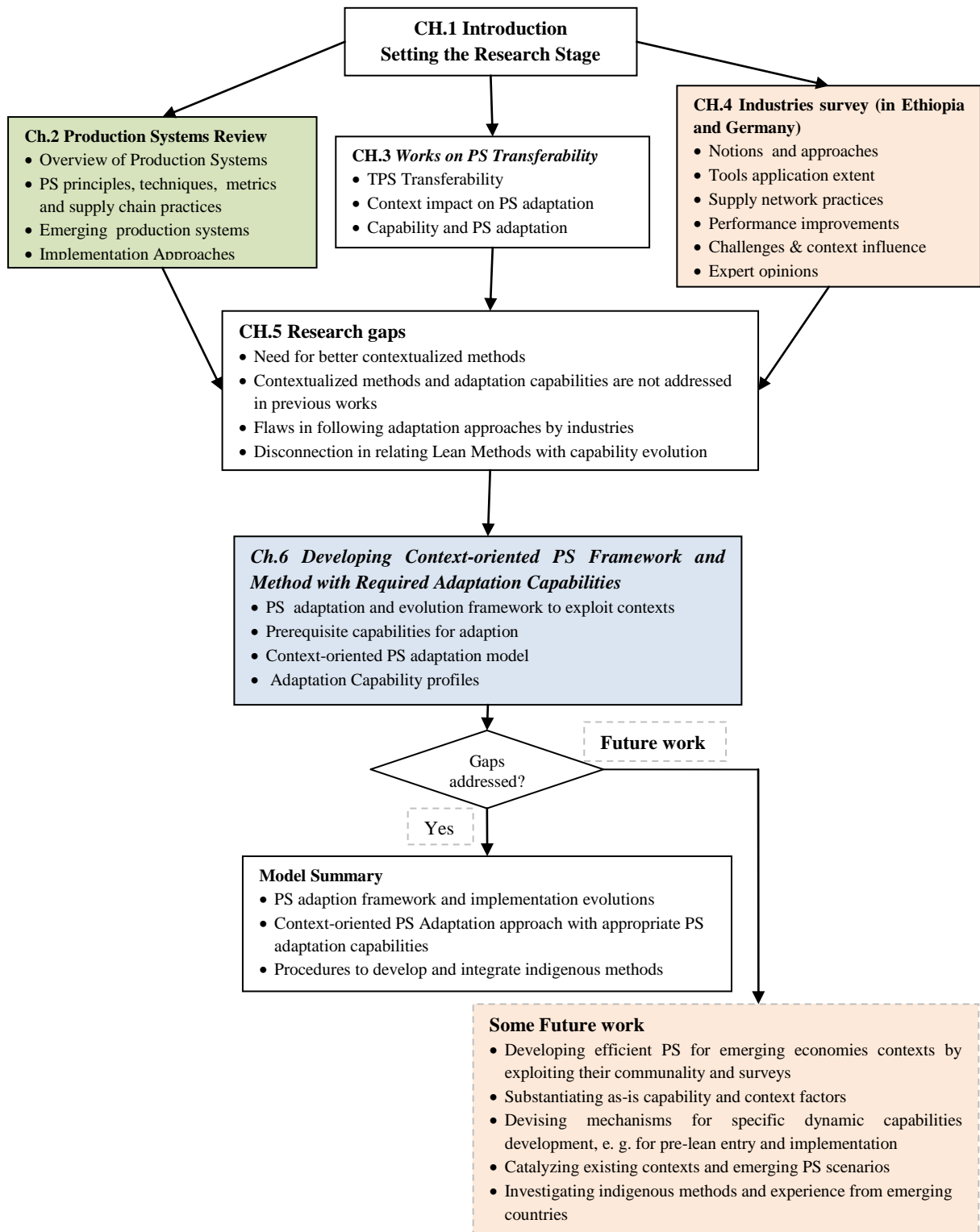


Fig.1. 1 Outlines of research design and methodologies in developing this Thesis



## 1.4. Significance of the Study

The research has dealt with advanced PSs and adaptation approaches with the influencing factors, which is one of the most important organizational improvement issues in the contemporary business. The main recurring theme in this research is that companies should consider the contextual organizational culture, adapt the standard production system package (i.e. LPS), incubate indigenous methods and manage emerging systems while simultaneously developing the required adaptation capabilities.

This context-enriched adaptation framework and methodical procedure with the required capability bear paramount importance in simplifying the efforts for importing new methods, for exploiting the positives of contexts and for exploring the dynamics of implementation evolution. It helps companies in robustly adapting, improving and redesigning a promising PS by a better methodical approach that addresses most contextual factors. The developed methods give a new perspective on the importance of exploiting indigenous methods for enhanced competitiveness.

The main findings are

1. The current advanced PS adaptation techniques do not consider contextual factors such as culture, capability and indigenous methods.
2. There are observable differences in performance improvements among different context cases but with surprising similarity in trend line of tool usage, performance improvements and challenges. The differences are attributed mainly to organizational capabilities.
3. While national culture may have an influence on imported PS implementation, the culture dynamics of globalization and management practices have the potential to lessen the adverse effect of contextual incompatibility.
4. Indigenous methods can facilitate and enrich new PS's adaptation as well as influence the trajectories of implementation evolution of context-specific PSs or universal methods.
5. The PS adaptation model of the future should consider organizational domains (culture, adaptation capabilities, and available best PS packages), indigenous methods and manage system emergence during implementation.
6. The simultaneous development of both organizational capability and Lean maturity mutually support each other and enable to play a great role in a relevant SN and accelerate the pace to competitiveness.

## 1.5. Thesis Structure

The structure of the dissertation follows the schematic diagram depicted in Fig. 1.1. This chapter intends to introduce the background and motivation of the research; it sets the scene, objectives, specifies research approach and the significance of the findings.

Chapter 2 reviews the literature on the production system in general and further discusses the constituent elements of LPS such as principles, techniques, performance metrics, Lean supply chain, adaptation approaches as well as short briefs of other emerging PSs.

In chapter 3, perspectives on transferability and empirical work on their diffusion, influence of contexts, role of indigenous methods and relation of PS adaptation with organizational capability are analyzed.

Chapter 4 deals with practical industry surveys (German and Ethiopian). It presents research approaches in the survey and statistical analysis and discusses the results by cross-referencing the information gathered from the two survey contexts.

Chapter 5 articulates the limitations and methodical gaps in the existing PS approaches based on relevant literature, empirical work and implication of the industries' survey results.

In chapter 6, PS adaptation framework that involves indigenous method and significant contexts is developed and discussed. Further, DC relations with best practice adaptation and its link with supply network (SN) operations is analysed and required PS capabilities adaptation are developed. This chapter also presents and explains how context-oriented adaptation approaches can be supported by developing indigenous methods and manipulating culture dynamics. The evolution process of the Lean package with contextualized method over time and the appropriate contextualization degree of for varying contexts is projected. Section 6.9 puts together the main supporting framework and the developed approaches are summarized and synthesized to show the complete solution package.

Lastly, a conclusion chapter 8 presents the conclusion on the entire thesis and sight future work. The main issues of the thesis are summarized in relation to stated objectives and the main contribution to different research beneficiaries are indicated. Further works are also identified that require additional investigation as well as future outlooks in related themes.

## **2. Production System Paradigms**

### **2.1. Chapter Introduction**

Production systems have advanced over the years in response to many drivers including constant evolution, innovation of new methods and technologies, scarcity of production resources, competition, and introduction of new materials as well as research efforts. PS evolution witnesses humans' individual and collective effort to meet timely needs by amending natural resources, processes, organizations and other technical circumstances, [13].

This chapter reviews the underlying PS theories and representative paradigms. The discussion starts with the PS theory and evolution followed by a more detailed discussion on contemporary LPS components such as the underlying principles, techniques and their appropriate applications, common Lean methods, performance measures (metrics), Lean supply chain and existing PS adaptation approaches. Moreover, the emerging PS approach and their proposition are also briefed.

### **2.2. Production System Theory and Evolution**

#### **2.2.1. Production System Theory**

Production can be seen as transformation system, emphasizing the importance of totality in a systemic perspective. This implies that consideration of technical, physical, humans and work organization are essential for increased understanding of the system. A production system model is usually represented as input-process-output relation. The major elements in input-to-output transformation model are processes, operands and operators with a defined goal of adding value to bring the operand from initial state to a desired state. The task of operators, technical system and active environment is driven and guided by the process [13], Fig 2.1. The operand gets added values through the uses of necessary processes, which could be (i.e. result or output) an input to another production system.

During its development and execution lifetime, PS is affected by external influences (i.e. history, trends, globalization, and company structures); strategies and fundamental attitudes (philosophy, culture, experiences); and actual options (i.e. technology, planning and control, work environment and organization), [13]. More detail issues on production system design framework and deployment addressed in [54], [119].

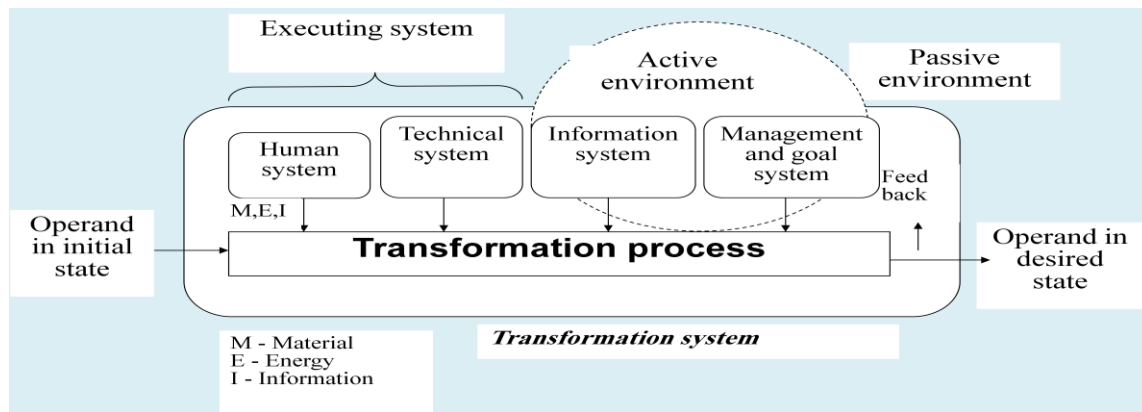


Fig.2. 1 A simplified model of the transformation system, [13]

With respect to contemporary PS situation, factors that influence current business context become more dynamic and frequently changing requiring further consideration of adaptability and sustainability on PS. Twisted with the challenges, however, there are numerous opportunities such as standard PS packages and increasingly networked operations, which provide embedded gains to improve internal processes, complement capability and contextual shortcomings, [122].

### 2.2.2. Evolutions of Production Systems

Human experience to produce demanded artefacts of particular period, has been always establishing a foundation for upgrading in the subsequent generation depending on the general socio technical circumstances and demands [29]. Several historical events and discoveries resulted in the development of today's PSs are outlined by, [13]. Since the industrial revolution, in 19<sup>th</sup> and 20<sup>th</sup>, the dominating PS philosophies can be generally grouped as craftsman, mass production and Lean. In supporting and facilitating the production systems on the shop floor, various organizational theories and principles have been also developed such as Scientific Management of Taylor (1856-1915), Administrative School of Fayol (1841–1925), Organizational Bureaucracy of Max Weber (1864–1920), Method Study of Gilbreth (1868-1924), HRM of Mayo (in 1927-1932) and hygiene factors (Herzberg 1950s), [13]. Fig 2.2 depicts these evolutions based on the type of technology to use, work organization, production solutions, handling of product variants and quality. Proofing its overall approach, the concept of LPS emerged as the contemporary paradigm since 1980.

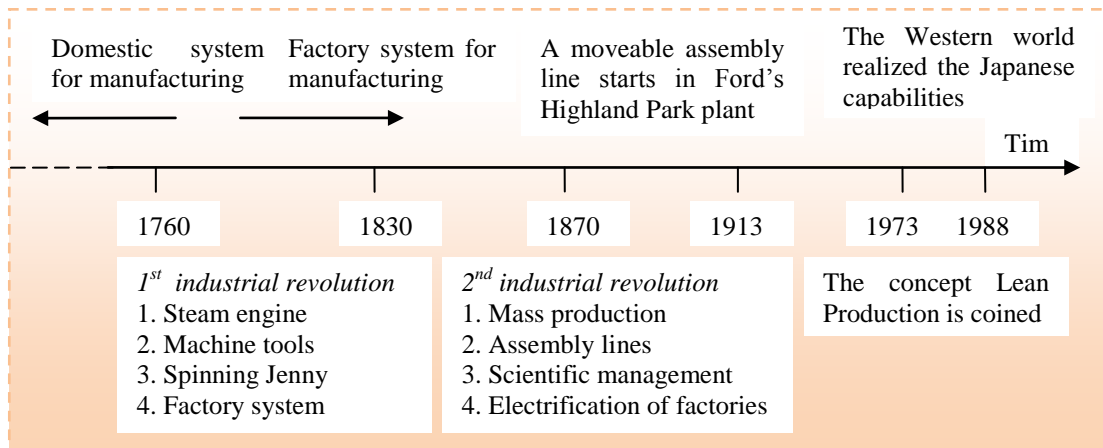


Fig.2. 2 Development of today's production system, [13]

More recently, attempts to operate globally as well as competition have changed views of the traditional isolated input-output transformation models into network-based operations. With this regard, factories have undergone various evolutions from the functional factory model to the production network model. The evolution towards production networks with the goal of quick responsiveness to market and innovation is illustrated by [29], Fig 2.3.

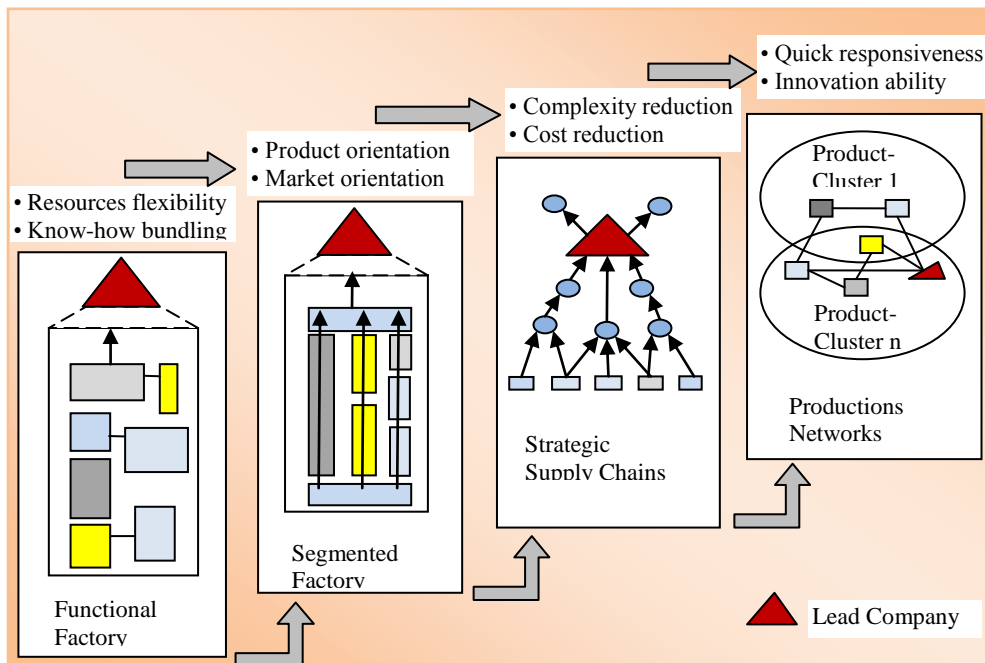


Fig.2. 3 Evolution of factories to production networks, [29]

Hence, the contemporary PS scope covers dispersed organizations in the form of cluster for promptly responding to the ever-changing business trends. Among numerous 'post mass production paradigms' Toyota Production System (TPS) approach has much popularity for

decades. TPS or Lean production system (LPS), as often called, focuses on specifying value from the customer perspective and attempting to make the value stream flow efficiently. Besides improving the internal process capability, Lean-based supply network orientations lend themselves for collaborative organizational phenomena in the value chain constellation. As a result, 'Lean Thinking' has proven powerful frameworks in gaining and maintaining fitting positions in the progressively more globalize business network, [66].

### **2.3. Lean Production system (LPS) Paradigm**

There are plenty of literatures that commensurate the importance, principles, tools and the implementation approaches of this famous PS. Started and popularized by the book '*The Machine that Changed the World*' of [124] followed by 'Lean Thinking' [125], the implementation guideline of [70], Lean literature are abundant, [51], [100], [102], [123].

#### **2.3.1. Evolution of Lean Production System**

The Lean paradigm is originated from the innovative practices of the Japanese Toyota Motor Corporation since the 50<sup>th</sup>. In 1950s, a Japanese engineer Eiji Toyoda set out a three-month pilgrimage to a Ford's plant. After carefully studying every inch of the plant, he thought on the possibilities of customizing the mass production approaches into the Japanese context. Back at home, he and Taiichi Ohno concluded that the most worth adapting principle of Ford was the continuous flow assembly line. The 'TPS' and ultimately LPS began from this tentative start, [124]. Taiichi Ohno led the early conception of the initiative with the aim of alleviating the host of challenges related with the need of product variety, job security of employees, shortage of capital and threats of potential competition. Toyota practiced the new approach for engine manufacturing in 1950s, vehicle assembly in 1960, and then the wider supply chain in 1970s, [13], [124]. From 1980 onwards, the mass production is replaced with LPS as the contemporary paradigm. Time line markings in the critical phases of Lean progress, both in Japan and worldwide, are presented in [106]. The development is not restricted in the Toyota Company. Western emulators, researchers, and industrial consultants further enriched the approach, recommended and promoted the adaptation, [44].

## **2.3.2. Main Constituent Elements of Leanness**

### **2.3.2.1. Lean Philosophy**

The LPS paradigm followed the mass production system. Perhaps the most striking differences between mass and Lean production lie in their ultimate objectives. Mass producers set a 'good enough' goal, which translates into an acceptable number of defects, a maximum acceptable level of inventories and narrow range of standardized products. Lean producers, on the other hand, set their sights explicitly on perfection: continually declining costs, zero inventories, and endless product variety, [82], [123]. Lean thinking as principle of specifying value, identifying the value stream, making value to flow without interruptions, letting the customers to pull value and pursuing perfection is summarized in [13], [125].

Lean is defined as an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier and internal process variability, [106]. The underlying philosophy characterizing the LPS spirit is “thinking backward” in the sense of “establishing the real production and information flow from downstream to upstream. Each downstream location sends an instruction to the next stage. Production is dictated only by what is ordered and only when it is ordered. The value concept stretches from customer needs right back to raw material sources to include the up- and downstream partners, [96]. The *value stream* makes the production process steps to flow smoothly as per the rates of actual customer demand – *pull and Takt time*. “Getting value to flow faster always exposes waste (*muda*) in the value stream. Lean thinking maintains that there is no end to the improvement process. This never-ending improvement scheme is the mechanism that evokes the sustainable competitive advantage, [73], [96]. The primary elements of lean are categorized into five: flow, organization process control, metrics and logistics, [123].

### **2.3.2.2. Common Lean Methodologies**

Advanced PS methodologies consist of different adaptation schemes. Generally, there are many types of Lean approaches depending on particular problem domain and organizational preferences. The related collective methodologies include: Kaizen, TQM, Six Sigma, TPM, JIT, BPR and Lean Enterprise. There are significant similarities in terms of purpose among these approaches, [16], [106]. In reality, the approaches are families of governing principles with the overall objectives of value maximization for the customers, elimination of production wastes and continuous efforts for high quality products. They form a spectrum of largely

overlapping interacting themes complementing each other and sharing many tools and techniques. For example, Kaizen upon its emphasis for continuous improvement and workplace organization, calls for 5s, 7 muda, PDCA cycle, teamwork, JIT, quality function deployment (QFD) and others, [34]. Kaizen is also considered as an umbrella for the majority of Lean tools, [51]. The Six-sigma approach upon emphasis for defect free process capability and perfect product quality, calls for extensive use of SPC tools, TPM, quality circles, process standardization and so on, [102]. TPM concentrates on total quality control and effective resource utilization to attack production losses and requires the use of Kaizen, SMED, OEE, waste elimination, QFD, SPC tools and others, [57]. BPR, though it aims at dramatic improvement in the design stage, uses SPC tools, process flow, teamwork, and lastly it embraces Kaizen technology until the next system redesign. JIT is also a family of Lean concentrating on stockless production where internal and external logistics and productions activities align and deliver the right material at the right time and at the right place. JIT uses wastes elimination, zero inventory, flow, Takt time, process standardization and so on. TQM with the strategy of continuous improvement in the whole operation and extended Lean enterprise with the goal of extending the practices to the suppliers all utilize common techniques. All of the methods have positive contribution to the high-level metrics of flow, stakeholder satisfaction, quality-yield and resource utilization, Table 1.

Table 1. Fit among high level Lean metrics and families of Lean methods

High level Lean Matrix	Relative emphasis by the Families of Lean Methodologies						
	JIT	TPM	Kaizen	Six-sigma	Lean enterprise	BPR	TQM
Process Flow	x		x	x	x	x	
Quality yield	x	x	x	x	x		x
Stakeholder satisfaction	x	x		x	x	x	x
Resource utilization			x				x

### 2.3.2.3. Tools and Techniques for leanness

The various ingredients of leanness can be grouped into: human leanness, process and technoware leanness, operand and logistics leanness, context Leanness, timing leanness and metric Leanness. These Leanness schemes and their techniques are depicted in Fig. 2.4. This grouping emphasizes that leanness course covers all aspects of PS components and influencing organizational environment in which it resides. The presumption is that each constituent element is important on its own for sustainable lean while the significant impact comes from their integration. When initiatives focus on just the techniques (indicative of both flow and process control), the improvement becomes more about calculations and formulas



than it is about improving workforce capability through knowledge transfer, engaging all employees in a common goal and empowering them with clarified expectations, [123].

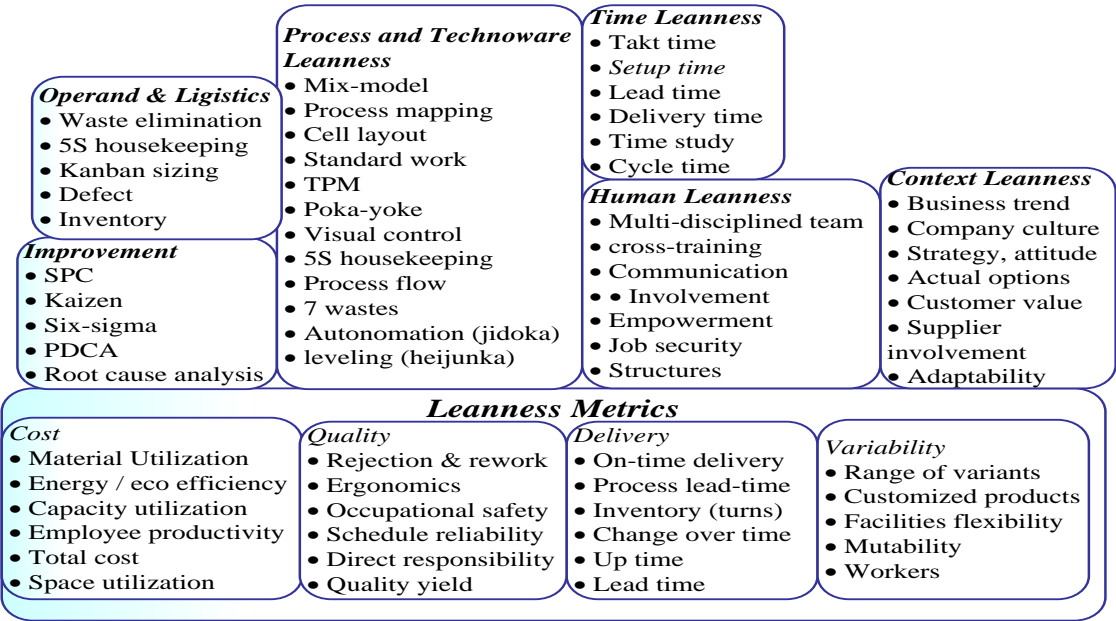


Fig.2. 4 Ingredients of Leanness grouped into various business factor indices [32], [106], [123].

A number of practical techniques are used to implement the value adding concepts that extend from shop floors to supply networks application. Literatures enlist a number of scientific bundles of Lean techniques grouping them under different themes such as strategies, characteristics and others depending on the problem domain, [3], [34], [38], [39], [57]. ‘Roadmap’, as a transition framework, has also been developed, [6], [70], [86].

Literatures may vary in the ways of categorization of tools into a particular application functions, majority of the techniques discussed serve multiple functions at different circumstances. Ten operational Lean constructs with 43 operational measures are outlined by [106]. According to [3], the main TPS toolbox includes 5s, flow and cellular Production, Takt time, production smoothing (Heijunka), SMED and Kanban pull system.

Based on the principles of eliminating production wastes, Fig 2.5 illustrates the seven wastes (muda) and multiple techniques to fight them. Each production waste can match to more than one appropriate tool. The presumption in Lean toolbox are that applying these tools and techniques eliminates muda, saves costs, makes the flow faster and more flexible to respond to changes. Incorrect application of the tools, on the other hand, leads to waste of an organization’s time and resources and to a reduction in employees’ confidence in Lean. The

utilization extent is also a Leanness measure such that the application intensity of these tools has a direct relation with performance, [38], [106]. The idea is termed as ‘total Lean utilization’ [70]. Hence, the significant impact and the sustainable performance improvement depend on consistent usage of various combinations of techniques.

<i>Wastes</i>	<i>Techniques</i>															
	Flow principle	Takt time	Pull system	Heijunka (production smoothing)	Poka-Yoke (error avoidance)	Andon	Systematic error rectification	Standard work	FLS** design	FLS** kaizen	Organization	Performance management system	Competence management	Built-in quality	Maintenance systems	Workplace organization
Overproduction	•	•	•	•	•	•		•	•	•		•			•	•
Waiting	•	•	•	•	•	•		•	•	•	•	•			•	•
Transportation	•		•						•	•						•
Over-processing								•					•	•	•	
Excess Motion	•				•	•		•	•							•
Errors and rework	•				•	•	•	•	•			•		•	•	
Process variability	•	•	•	•	•	•	•	•	•	•	•	•	•	•		

•Suitable techniques

Fig.2. 5 Impact matrices – the seven waste and the techniques to fight them ([2], [123])

#### 2.3.2.4. Quantitative Performance Indicators

To keep advanced PS implementation scientifically and rationally sound, competitive factors of flexibility, quality, delivery speed and cost must be sought, [123]. Along this line, the common Lean indicators can be analyzed under the headings of internal and external processes. Table 2 presents lists of indicators and their link with internal processes as well as external (customer and supplier) relations. The PS design framework decomposes the parameters from strategy to shop floor also indicates similar indicators, [8], [119]. The correlation among the factors of PS is also analyzed in [106].

The key performance indicators contributing to these factors with detail mathematical models are elaborated in [32], [120], [123]. The goal is to excel by broadening the competitive factors from the existing market performance to a wider frontier, Fig 2.6. It is clear that Lean application and production performances require strengthening of competitive capabilities throughout the overall value chain that extends from internal process to key suppliers as well as customers. This external link issue calls for the importance of Lean supply chain.

Table 2 Internal and external process indicators of Lean, [32]

<i>Internal Process Indicators</i>	<i>External process indicators</i>	
<i>Production Process</i>	<i>Supplier(s)</i>	<i>Customer Process</i>
<ul style="list-style-type: none"> <li>• Process Working Time (WTP)</li> <li>• Process Annual Piece No (PcsP)</li> <li>• Rework (€)</li> <li>• First Pass Yield (↑)</li> <li>• EPEI-Value (EPEI)</li> <li>• Cycle Time (CT)</li> <li>• Changeover Time (CO)</li> <li>• Lot Size (LS)</li> <li>• Number of Variants a Part (# Var)</li> <li>• Uptime (UP)</li> <li>• Processing Time (PT)</li> <li>• Process Quantity (PQ)</li> <li>• Number of Parts per Product (# P)</li> <li>• Process Takt Time (TTP )</li> <li>• Operation Time (OT)</li> <li>• #Employee</li> </ul>	<ul style="list-style-type: none"> <li>• Raw Material (RM)</li> <li>• Number of Types (# Typ)</li> <li>• Production Process with Shared Resources</li> <li>• Business Process</li> <li>• External Production Process</li> <li>• Error Rate (ER)</li> <li>• Delivery Reliability (DR)</li> <li>• Quantity Reliability (QR)</li> <li>• Replenishment Lead Time (RLT)</li> <li>• Process Through-Put Time ( TPT)</li> </ul>	<ul style="list-style-type: none"> <li>• Product Family (PF)</li> <li>• Number of Variants (# Var)</li> <li>• Representative (Rep)</li> <li>• Customer Takt Time (TT)</li> <li>• Factory Days (FD)</li> <li>• Working Time (WT)</li> <li>• Annual Piece Number (Pcs)</li> <li>• Delivery Time (DT)</li> <li>• Delivery Reliability (DR)</li> </ul>

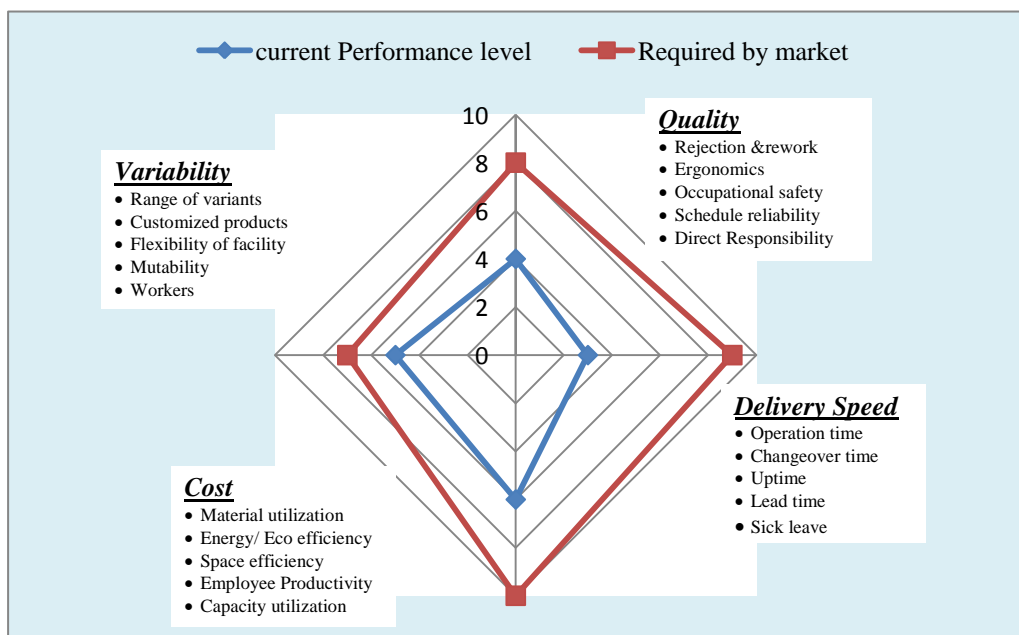


Fig.2. 6 Competitive factors, required targets by market and Lean indicators, based on [13], [95]

### 2.3.3. Lean Supply Chain

After implementing internally, the logical substantial improvement is to apply Lean to the supplier base, [28], [129], [130]. Hence, Lean supply chain is about making the entire value chain according to the governing principles and techniques of LPS to achieve the success across the entire supply chain. Therefore, the Lean supply chain is “a set of organizations directly linked by upstream and downstream flows of products, services, finances, and information that collaboratively work to reduce cost and waste by efficiently pulling what is needed to meet the customer needs,” [96].

The differences between Lean manufacturing practices and extended Lean (Lean supply chain) are the scale and basis of implementation. The manufacturing practices are inward and carried out based on expert-driven projects, whereas the supply chain practices are outward and carried out based on full collaborations. In this extended Lean, the current and future-state VSM is drawn for selected suppliers to set projects that must be undertaken by the members using Lean approaches, [28]. This brings opportunities for further improvements in each individual company as well as in the supply chain as a whole, [45], [123]. According to [96], the guidelines for Lean relationships are: reduced supplier base, level and nature of relationships and blurred organizational boundaries (i.e. sharing resources).

A Lean supply chain is an *integrated system*, which synchronizes a series of inter-related business processes such as material acquisition, value adding transformation, distribution and facilitation of information exchange among various business entities (e.g. suppliers, manufacturers, distributors, third-party logistics providers and retailers), [36]. The integration involves organizational routines developed among firms that create a distinctive coupling of capabilities. The synergy among companies and their unity of purpose helps to eliminate non-value-added activities in the overall value stream and to achieve enhanced performance in Lean measures, [13], [19], [96]. Accordingly, inter-firm integration can create combinations of unique skills, knowledge and joint capabilities.

The Lean supply chain maturity model is used to capture the evolution stages from a basic foundation to higher integration level. The five maturity stages are: ‘Ad Hoc’, ‘defined’, ‘linked’, ‘integrated’, ‘extended’ and represent groups of practices at different levels of process maturity, building upon each other to achieve excellent performance,[56], [60], [61], [62]. The continuous improvement maturity with marked milestones goes from “Reactive” or sporadic improvement stage to the “way of life” of extended Lean enterprise, [46], Fig.2.7. Predictability, capability, control, effectiveness and efficiency increases with each level of maturity, [60] [61].

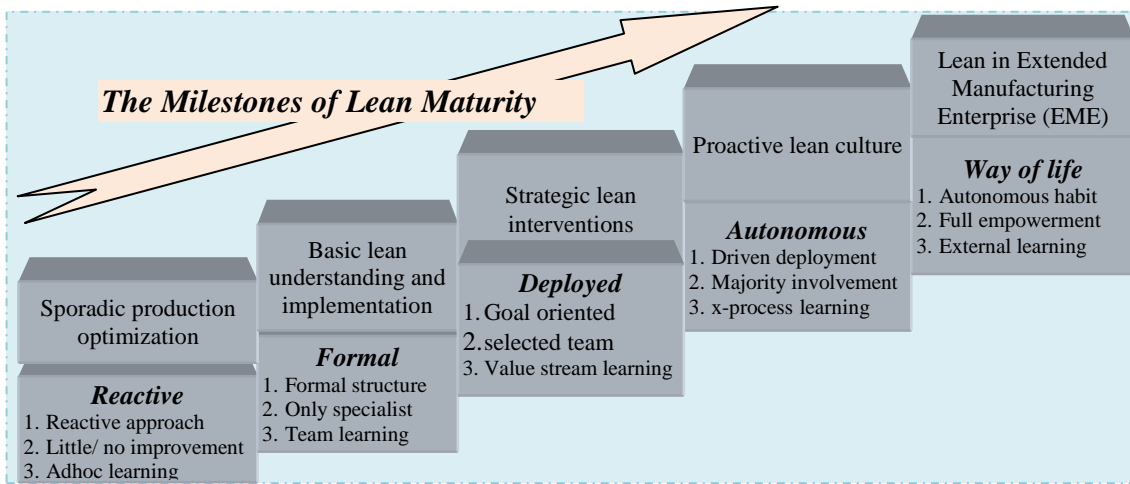


Fig.2. 7 Lean implementation maturity levels, [46], [56]

## 2.4. LPS Models and Adaptation Approaches

Many researchers suggested various types of Lean implementation frameworks and models. Some authors stress the preparation phase (initiatives), others concentrate on the usage of the tools and techniques and still others are concerned with sustainability of Lean. The main adaptation approaches can be grouped into step-by-step procedures, hierarchical models, change management approaches, building blocks/ Lean houses, transition roadmaps and extended Lean approaches.

### 2.4.1. Step-by-step Procedural Approaches

There are different sequential Lean implementation models to guide the intervention. The peculiar characteristics of these approaches are the Lean activities precedence relationships that guide implementers how to proceed from one step to another. In this regard, many authors cite sequential Lean application approaches, [6], [12], [26], [38], [39], [77], [78], [94], [123]. After reviewing literature, [6] concludes that most frequently mentioned steps include: pilot project, planning for changes, VSM, analyzing the system and training. These models have slight variation in their number of steps, tool prescription, training emphasis, implementation period and feedback mechanism. Regardless of details and emphasis, the summary of frequently recommended steps is depicted in Fig.2.8.

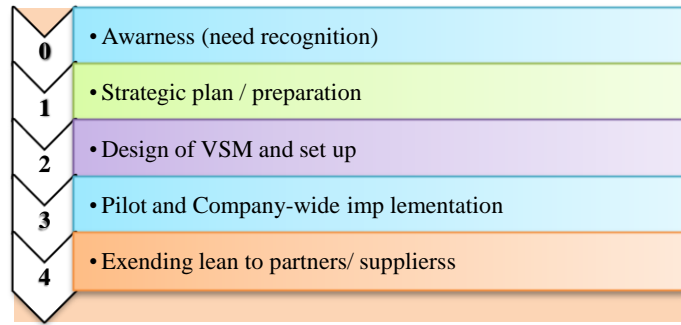


Fig.2. 8 Lean Step-by-step Sequential Approach for Implementation (based on [38], [78])

As per [78], the rough priority for a good start is often the deployment of 5s, followed by visual management in the pilot area, training, empowerment, rewards and standardization of processes. The progress of Lean in terms of its technique application and corresponding metrics is indicated in Fig.2.9. Apart from their simplicity, these steps do not consider many behavioural views that make the Lean adaptation beyond step-by-step procedure. The prevalent drawbacks of these models include: lack of focus on change approach in viewpoints of people and system behaviour as well as the appropriate organizational factors.

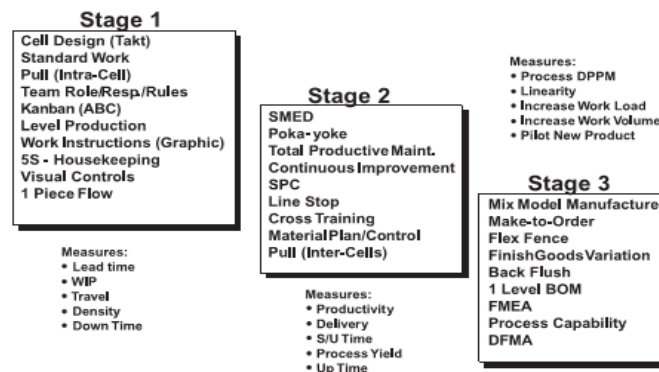


Fig.2. 9 Stages and Performance Measures of the Lean Application, [123]

### 2.4.2. Hierarchical Approach for Lean Implementation

Lean is also described as a systems' approach with a four-level hierarchical structure of objectives that addresses the customers' demands, sub-goals for operative measures, methods and tools to achieve the sub goals, [26]. In line with hierarchical constructs, [106] also developed a conceptual and empirical mapping with a main concept at the top of ladder followed by three underlying constructs of suppliers, customer and internal relations. A variety of tools and techniques with operational measures constitute the bottom of hierarchy, [19], [132]. The general illustration for these kinds of models is given in Fig.2.10.

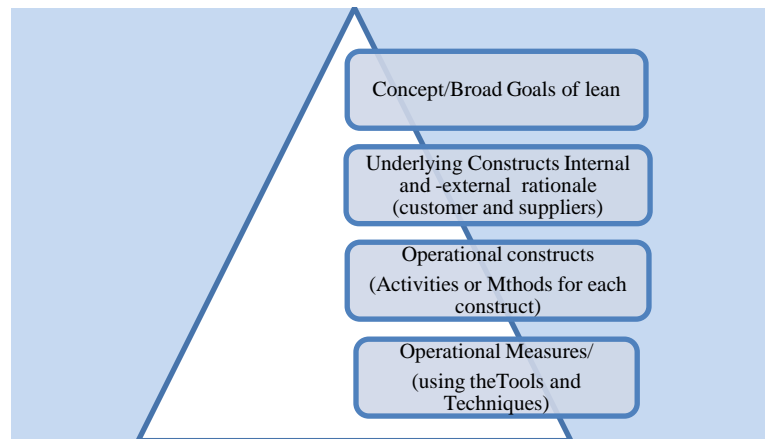


Fig.2. 10 Lean Hierarchical models - decomposition of Lean governing principles from the higher order concepts to the shop floor task elements, based on [106]

The 14 principles of Lean have been categorized into: philosophy, process, people/ partners and problem solving by [42], [75]. This Lean Business Model comprising five high-level blocks consisting of strategy deployment (shared vision), value stream management (not mapping), aligned tools and techniques to the needs, people enabled processes (shared goals) and extended enterprise (up- and downstream suppliers) is also recommended by [46]. In the implementation framework of [125], the techniques and infrastructures (structure, processes, suppliers, employees, customers, and others) support the three constructs, of ‘people’, ‘think Lean’ and ‘act Lean’.

All these models focus on the decomposition of Lean governing principles from the higher order concepts down to the shop floor task elements. These hierarchical models are essential in communicating the underlying principles so that employees understand the overall Lean thinking that will facilitate to establish a common platform for subsequent discussions. However, the context issue is not addressed.

### 2.4.3. Change Management Approach

This approach mainly concentrates on developing a change agenda in terms of vision, communication and modifying the people’s perception about upcoming organizational change and maintaining proper amount and scope within the change timeline. Even though these approaches do not deal with the common tools and techniques, they address cultural and contingency issues to some extent.

The Lite vs. full implementation refers to two pairs of organizational change, [94]. These are: (1) convergent (small changes) versus radical change (wide-scale transformation) and (2) evolutionary change (takes extended period) versus revolutionary change (quick and affecting the entire organization). According to [94], Lean must be conceived and managed as a radical change in thinking since it transforms structure, strategy and culture of an organization, whereas the improvements are continuous. The communication of new vision, changed culture and new practices and principles involves revolutionary view. Up on emphasis on enabling factors, [3] categorizes the implementation aspects into visible and none readily visible (underwater) issues. While technology, Lean techniques and processes represent the visible part, the invisible “enabling elements” are strategy, leadership and engagement of people, [79]. The vital issue to focus in this regard are appropriate change strategies on culture of Lean thinking, continuous improvement, company-wide communication and articulated incremental change over short time-scales and gradually extending the scope, [21]. The right strategy for Lean transition is to build experience through visible results, less risk and less resistance. The right quantity of change keeps the proportion of emotional impact on employees less, while still moving to improve competitiveness’. By considering Lean from the organizational change perspective, [3] used a transformational framework to shed light on factors of successful implementation. Highlighted stages are:

- Mobilizing for Lean change - a robust top-down change management strategy,
- Translating strategy to Lean initiatives -VSM, parameters, process,
- Integration of all functions - engineering, quality and others (HR, sales ...and so on),
- Building learning organization - use of advanced SPC, Six Sigma, TPM and others tools,
- Managing innovation -knowledge and training on direct application of learned tools.

To focus to a common direction across functional processes, Lean Policy Deployment matrix is used to set procedures, targets, metrics and implementation team structures, [46].

#### **2.4.4. Lean Building Blocks**

The Lean building block approach considers Lean as a bundle of tools and techniques, giving little attention to the implementation procedure. It essentiality emphasizes the understanding of the concepts and its principles as well as the synergetic effect and convergence validity of all Lean elements for success, [19], [53]. “The house of Lean” model proposed by [75] indicates the requirements of the principles to achieve perfection, Fig.2.11. It is divided into



foundation and basement representing Lean culture with pillars (JIT, People and Autonomation). The roof represents process and customer orientation. [46], [102] also propose similar TPS models with emphasis on quality, kaizen, production smoothing, standardization, JIT, Jidoka and stability. The essence is that the techniques compose the Lean model for success. If something is missing, the house is not complete and the effort will be difficult, failing or partially successful.

The particularity in the Lean House is the due emphasis on collective importance of different Lean elements from strategy deployment to shop floor operational tools. There is no procedural implication that can be used as a signboard in the way to Leanness. These models emphasize the criticality of culture, but neither reflects the conditions of recipient on Lean implementation nor gives hints how to acclimatize the methods.

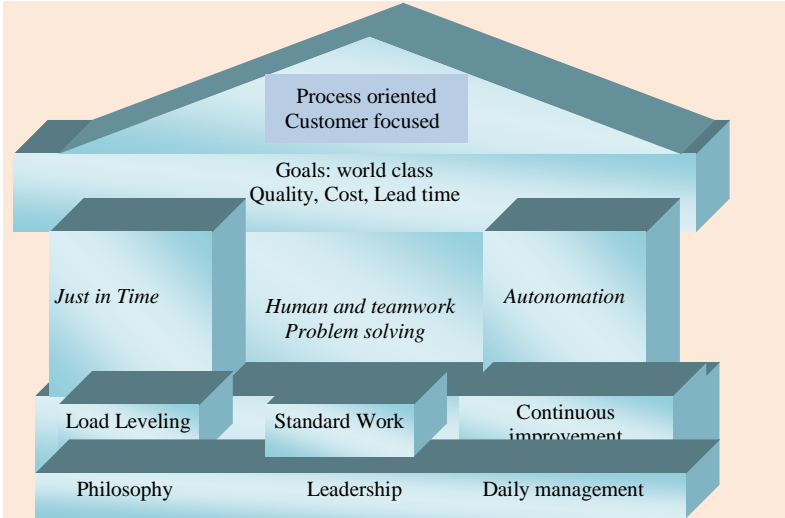


Fig.2. 11 Lean Building Blocks - essentiality of understanding of Lean concepts and convergence validity of all its elements for success, (based [19], [75])

**2.4.5. Transition Roadmap Approach**

One of the very important approaches with respect to Lean journey is the road map, which is a “pathway” that helps practitioners understand how and when to apply specific approaches, [6]. It displays specific actions in the order of precedence and incorporates checkpoints to ensure completion of previous phases before proceeding to the next. Enterprise level road maps which consist of three cycles: entry/re-entry cycle, long term cycle (decisions and paradigm shifts), and short-term cycle (details the implementation and monitoring plans) has been developed by [70]. In addition, [70] has a detailed framework for production operations

transition-to-Lean (TTL) with three layers of external environment (legal, business, suppliers), production system interface (organizational functions and major transition phases) and the interdependency of phases with a feedback loop. “Dynamic” roadmap to Leanness, which consider different templates at different implementation levels is also recommended by [6]. Fig.2.12 depicts representative a roadmap consisting of six phases.

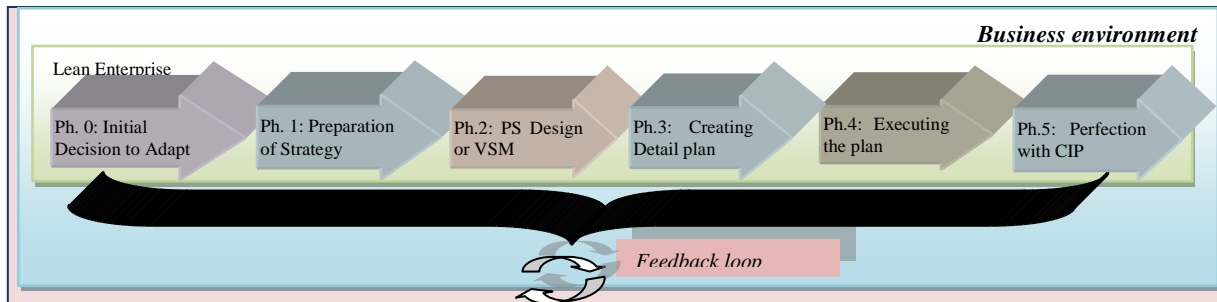


Fig.2. 12 Sample road map for Lean Adaptation and Implementation (based on [6], [70])

0. **Initial investigation and decision** - involve assessing the basic Lean requirements for such as crisis (sales, profit etc.), commitment level of management, change agent, resources, “Lean” knowledge and capability to apply the tools and techniques.
1. **Preparation** - involves developing of strategic plans, investigating available Lean knowledge and experts, identifying value and product family.
2. **Design** - involves developing of the production system and VSM by identifying value and the major kaizen initiatives with appropriate tools and techniques.
3. **Creating detail implementation plan** - is elaboration of the design phase and setting time frame and resources for every kaizen project identified in the design phase.
4. **Execution/ implementation** - implements the initiatives as the detail plan using respective cluster of tools first on pilot level and ultimately on the whole organizations.
5. **Perfection** – implies measurement, feedback, continuous improvement, learning and trial to achieve perfection. The performance metrics follows the ‘maturity matrix’ and the Lean enterprise self-assessment tools (LESAT), [70].

#### 2.4.6. Extended Lean Approach

The extended Lean approach emphasizes the implementation expansion of its techniques from a particular shop floor, perhaps a pilot area, to companywide level and then to suppliers and customers. Even though the same governing principles (waste elimination and customer values and continuous improvement) are followed, the approach emphasizes the internal and

external operations' interdependencies. Applying Lean thinking throughout the value chain brings opportunities for further improvements in the whole system, [121]. Accordingly, inter-firm integration create combinations of unique skills, knowledge and joint capabilities, [103].

The extended evolution consists of consecutive waves of Lean, Fig.2.13. The first wave is learning and applying the approaches on the shop floor such as 5S, SMED and JIT. The second wave consists of applying Lean tools and techniques to the entire company including service functional areas. In the third wave, network of partner companies in the value chain act Lean. The fourth wave includes the Lean extended supply chain and customers, covering end users and the interactions in the whole life cycle of the product, [83], [96].

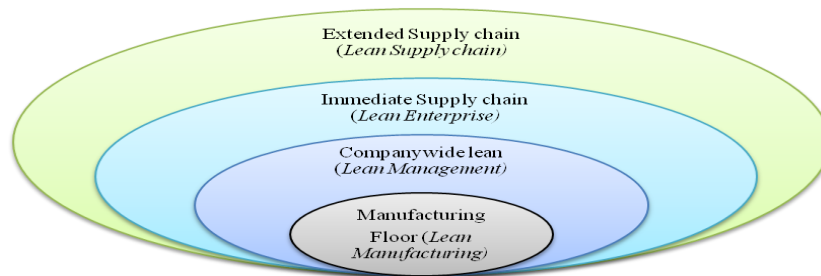


Fig.2. 13 The expansion of Lean from shop floor to the extended SN scope (Based on [96])

## 2.5. Emerging Production Systems

Lean thinking replaced the mass production system paradigm. Even at the matured products, commodity industries and other voluminous production, one of a kind production has set back, as customers demand more variety and markets become increasingly niche. The Lean customer philosophy of providing variety of high quality products at low cost and when demanded, replaced the lowest cost mass production.

Except for few prestigious items, high-class products and highly customized articles, craft production has also left the scene. Even on situations where craft production system are superior, the waste minimization and flexibility concept and timely delivery orientation have a potential to enhance job shop efficiency of crafts.

However, as a generic approach, Lean requires to stabilize the abrupt changes on the entire production system. It boils up to maintenance or standardizing processes and then improving to the next stage in the PDCA ladder, [51]. This continuous improvement and the steady approach for predictability have been challenged by market requirements of rapid

responsiveness, adaptability and agility, [29], [88]. Moreover, Lean focus on varieties within a product family hardly matches with the increasing demand of mass customization, [46]. The argument is that unstable, unpredictable and collaborative business environments do not coincide with proven and known patterns of approaches, [107]. Factors that lead to the importance of customized production models include: market saturation in the old economies, the globalization of production, the value chain in general, the concentration of production in the hands of global lead companies, radical reductions in cycle time, sourcing and ‘reflexive engineering’. As market conditions and customer preferences change more rapidly, there seemed to be a need to push on production principles and general ‘philosophies’ rather than on static PS models, [91]. Therefore, "a variety of production models will continue to coexist and flourish", while concrete and fixed production models will have little time to consolidate due to the speed of organizational learning and change, [90], [19].

Stability and predictability concerns and critics on LPS stimulate researchers and lead organizations to introduce the concept of adaptive and intelligent systems in the emerging production system spectrum. A list of production systems’ principles that have reconfigurable characteristics and their approaches focusing on particularity, partiality and generality through time are elaborated by [30], [66].

The most common newer manufacturing philosophies in this spectrum include: Fractal Company, Agile manufacturing, Holonic manufacturing and Bionic manufacturing. The systems may vary in underlying philosophy, structure, objective, change orientation, technology deployment, adaptability and so on, [101]. Different ‘cocktails of production principles’ are mixed, characterized mainly by change, adaptation and learning processes, not by fixed structures, [80], [91]. The post-mass production paradigm (PMPP) trajectories in the framework of intelligent manufacturing systems (IMS) and collaborative organization has been analyzed by [66], Fig.2.14.

1. **Agile manufacturing** represent the synthesis of successful companies’ experiences with diversified abilities, which come together in a joint venture. It uses the sum of abilities and resources of all the partners together. A peculiar characteristic of this concept is the rapid structure change of the networked organizations. The enablers of Agile System include latest ICT systems and organizational collaboration [36].

2. **Bionic Manufacturing system (BMS)** aims to master future demands of manufacturing systems through the application of technology that mimics the nature of living beings. The core idea is the *creative system*, in which the materials (embedding DNA-type information within it) provide the necessary information to the manufacturing equipment. Intelligent methods respond to this information using flexible and autonomous units, [65].

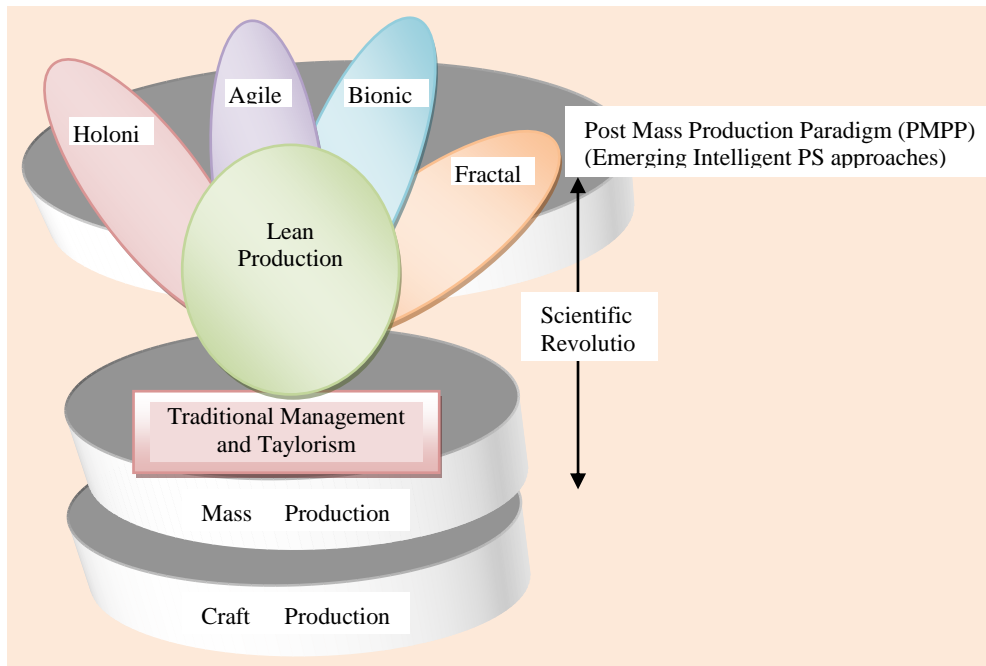


Fig.2. 14 PS spectrum and evolution – The contemporary trends (based on [66])

3. **Holonic Manufacturing Systems (HMS)** supports the setup of very complex systems that are highly resilient to disturbances and adaptable to changes. The idea is originated from behavioural properties of living organisms and social entities, which reveal that complex systems are adapted by evolution. Cooperating control units solve a common problem by exploiting self-reliance property of Holonic systems, leading to HMS, [101].
4. **The Fractal Company** envisions organizations as consisting of autonomous team units (fractals) that are attracted by market opportunities, which can be taken directly by the units. The units are goal-orientated and self-similar team units resulting properties of structural versatility, dynamics and vitality. As a consequence, detailed job descriptions and schedules have to be abandoned and replaced by self-organization, visualization of the objectives' updates and increased decision power of the employees, [35], [85], [107].

Although, these newer production philosophies (Agile, Bionic, Fractal and Holonic) bear potentials to evolve to paradigm level (a well universally accepted standardized production

norms) [71], their current conception remains short from paradigmatic status as standalone universal use. In fact, the systems do not violate the principles of Lean and they add emphasis for higher collaborative organizational operation borrowing adaptive natural phenomena to production system theory, [36]. Moreover, the Lean evolution embrace the perfection through continuous process improvement (CPI) accommodates the collaboration issues and for other emerging business confrontations.

## **2.6. Chapter Summary**

In this chapter, the basic theories behind PSs and the contemporary paradigm and its adaptation approaches are addressed. The evolution of the major contemporary paradigms and their current trajectories towards network oriented adaptable and collaborative operations are discussed. The popular Lean emphasizes a wide range of organizational issues both on the depth level (bundles of production floor tools) and on wider scope which pushes the application of tools to the supplier bases. For assessing performance, this PS has well articulated key performance indicators as well as elaborated maturity matrices. The adaptation of such broad methodology requires penetrating the underlying basic principles and tools. The main approaches vary in scope and perspective. In scope, they cover from shop floor to strategic supplier network level. In hierarchy, the approaches range from conceptual principles and visions to explicitly applicable tools and task level actions. The guiding procedures also range from simple procedural steps to comprehensive transition road maps. The transformation also ranges from incremental to large-scale change and from pilot to companywide and SN level. In summary, this chapter addresses the specific research concerns regarding to PS paradigms, major Lean constituent elements and adaptation approaches.

## **3. PS Transferability, Adaptation Contexts and Capabilities**

### **3.1. Chapter Introduction**

Organizations always seek to be better in performance and capability than their current position. Applied to PS, they attempt to enhance the business performance through different LPS related initiatives. Apart from the substantiated principles and the bundle of techniques of such approaches, there is still limited success in full implementation and sustaining the system, [6], [9], [44], [63], [79]. In this chapter, PS transferability perspectives, influences of contexts and organizational capabilities implication in PS adaptation are analyzed. In dealing with this discussion, commentaries are used based on related empirical works.

### **3.2. PS Transferability Perspectives and Diffusion**

#### **3.2.1. Transferability Perspectives**

Despite the Lean diffusion to different industries across the globe, the extent of transfer and sustainability in different organizational backgrounds remain debatable. Theoretically, the transferability views represent four perspectives: paradigmatic convergence, structuralism, contingency and process emergent perspectives, [71].

The convergence perspective recognizes LPS as the dominant production paradigm in the global competition and as a universal set of production norms that can be transferred to anywhere. According to this view, as nations develop, they embrace work-related behaviour common to industrial practices by adapting universal PS approaches, [91]. The globalization gives substantial effects to gradually merge advantageous features of the competitive methods such as IT-supported and networked operations and efficient Lean-based approaches, [58]. The structuralism perspective considers the transfer of Lean substances across national boundaries very difficult. This view contends that Lean systems are evolved in unique socio-economic context of Toyota, embedded in the Japanese culture, and are difficult to transfer abroad, [105]. The compromising contingency perspective relates successful PS implementation to organizational contingencies at recipient sites by long-term strategy, labour-management, market situation and social culture that condition the processes and outcomes of emulation. The ‘process emergent’ perspective views the diffusion of Lean as evolution of indeterminate processes. This perspective distinguishes between contingent

models ('optimal' techniques in a company context), and paradigms (a coherent body of 'general' principles that can be emulated). These general principles include: horizontal and vertical integration of functions, organizing based on teamwork, visual management, built-in quality processes, pull systems of procurement and continuous improvement. As these principles replace mass production paradigm since 1980s, many manufacturers develop their own unique production system models, constrained by contextual factors and contingencies, [71], [75]. While Japanese companies apply a 'Lean model' that has been successful worldwide, they adapted the model to a certain extent to local conditions. Manufacturers cannot make an exact replica of the idiosyncratic PS with inimitable socio-organizational origin, but develop its own production models emulating paradigmatic principles as world-class practice contextualized by external conditions and internal contingencies, [71]. German industries mixed or hybridized the PS with their product and production technologies and quality standards, the US with their pragmatic concrete problem solving approaches. Company-specific concepts range from the German emphasis on craftsmanship to the Japanese tendency to think in terms of life-long trajectories, [91]. According to [91], there is no superior PS, rather some advantageous practices and principles. These production principles – and not LPS as a coherent model - 'could be transplanted successfully to new environments'. Table 3 summarizes these perspectives, the possible influencing factors for emulation and the trajectories after implementation.

Table 3 Summary of Lean transferability perspectives (based on [71, 73])

<i>Perspectives</i>	<i>View of Lean</i>	<i>Transferability</i>	<i>Influencing factors</i>	<i>Resulting model</i>
Structuralism or divergence	Typically Japanese	Its substance is hardly transferable	Unique socio-economic context	
Paradigmatic convergence	Globally dominant paradigm	Transferable anywhere	Competition	Typical Lean
Contingence perspective	'Optimal' techniques in a company context	Conditionally transferable	Internal & external firm contingencies	LPS conditioned by external contexts of market and culture
Process emergence perspective	Evolving process (contextual technique) and paradigmatic principles	Transferable principle, but conditionally transferable technique	Context and process evolution path and changing business conditions	Transferred paradigmatic principles with unique and modified production model trajectory

Among the views, the contingency and system emergent perspectives emphasize the contextual factors. From the summary of perspectives, Table 3, it can be concluded that the LPS transferability is conditioned by context, or without the influence of other factors, except for divergence perspective, provided that the context and process emergence are manipulated. Supporting this view, [116] states that different constellations of production models indicate convergence towards LPS or into new hybrid production models.



### **3.2.2. Lean Diffusion**

Related studies in the countries outside Japan, such as US, China, Australia, Sweden, UK and others indicate that Lean concept, approaches and practices have become routinely accepted, [5]. The Japanese Kaizen technologies, which consist of substantial amounts of relevant methods that gravely contribute to performance of manufacturing operations, have been diffused to overseas sites, [58]. Major Japanese companies (Honda, Toyota, Nissan, NEC, Sony, etc.) have subsidiary operations (“transplants”) in the US, where job security and team work culture are not like that of Japan, [133]. The practices were transferred to non-Japanese cultural environments such as South Korea, Italy, United States, Austria, Germany, Finland, and Sweden in spite of their contextual dependencies, [5], [23], [39]. For developing countries, Lean approach is found attractive because it is not capital intensive, [23].

Companies are also able to adapt it to their specific company framework. For example, both Scania and General Motors (GM) have developed their own variants, coining their brand names, Scania Production System (SPS) (Scania 2004) and General Motor’s production system (GPS) (Ny Teknik, 2004), Mercedes-Benz Production System (MPS), with underlying principles similar to these of Lean production. Companies like Volkswagen, Porsche, Opel, Bosch and many others also developed their own PSs following the example of Toyota. Similarly, Hyundai emulated TPS in 1975 and adopted TPS principles, [71]. These evidences confirm the convergent, contingency and emerging process perspectives. Thus, elements of Lean are transferable, except that organizational culture conditions similar to that of Japanese increase the extent of a successful transfer, [71].

Since Lean can realize productivity improvement with little resources, a number of developed and developing countries with different cultures and business environments have adopted it. Besides its benefits on business and operation efficiency, it has brought positive impacts on work attitude, participation, work organization, simplification and standardization of processes, team work, and awareness of international competition, [22].

### **3.3. Cultural Contexts and Indigenous Methods in PS Adaptation**

Even though diffusion and popularity of Lean is rising, studies show transferability and sustainability problems associated with difficult aspects of Lean, implementation approaches and contextual conditions, [44], [93], [115], [127]. The identified difficult aspects of the

Japanese method include: work for common goals, consultative decision-making, two-way communication, long-term planning, sharing overall organization objectives at all levels, establishing harmony and loyalty, and a concern for people and their values [71], [102]. This analysis sees the transfer success from the cultural side confirming the divergence principle. They argue that Lean is too ‘Japanese’ to accomplish easily in other socio-cultural conditions.

There are several culture frameworks on various hierarchical levels such as national, regional and corporate culture, [1], [31], [47], [48]. The popular Hofstede’s culture theory views five dimensions of culture: Individualism, Masculinity, Uncertainty avoidance, Power Distance and Long-term Orientation. Dimensions of Humanistic, Performance and Future Orientation are added in [97]. The national culture has potential to influence the assumptions and actions of employee nature and behaviour. The influence of ‘collective programming’ of culture can make members of one group of people different from those of others, [47]. The members in a cultural group have shared orientation when they are choosing between values. For example, power distance at the national level tends to create low autonomy in the organizational level. Such shared system of meanings that shapes the way a group solves problems, [1].

Organizational culture clearly revolves around enterprise-wide shared values. It is defined as the basic tacit assumptions that determine people perceptions, thoughts, feelings, and their overt behaviours at all levels, [99]. This definition includes three levels of organizational culture: artefacts (organizational structures and practices), the espoused values (strategies, goals and philosophies that are “ought to be”) and the basic underlying assumptions. On operational level, it reflects its own attributes, concepts, observed and reported practices, [24].

On the organizational level, some studies assume malleability of individuals so that the management can create, maintain, and change the organization culture. In this case, people are independent and their choice of behaviour can influence the national culture and vice versa. As per [24] and [83] the influence of the societal culture typically accounts for little variance on organizational practices. Additionally, the same societal values may lead to different practices at the organizational level, for instance, high level of Uncertainty Avoidance in one society may lead to adopting many strict policies, while in another society it leads to developing few policies and discussing each situation for participative decision, [5], [15].

In theory, there is a negative correlation between power distance and the acceptance of kaizen, as kaizen requires delegation of responsibility where managers might resist, [110].

Despite this fact, kaizen has been successfully transferred to countries exposing high power distance level such as China, [7], Brazil, [50] and Singapore, [5], [15], [17]. Similarly, teamwork is difficult in individualistic society; nevertheless it is transferred to western countries, [5]. Hence, the effect of culture is not necessarily a determinant factor for successful transfer. The cultural influences on LPS adaptations rather reflect inconsistency between the implication of culture and the actual success of Lean techniques, [111], [127].

Looking critically into the culture of the successful adaptors, it is problematic to conclude that general cultural dimensions are in correlation with Lean practices. Probably, cumulated and complex indigenous knowledge systems determine the adaptation capability of an organization, [86]. The culture dimension can be manipulated if indigenous values support the transformation, [33], [43]. As indicated by [10], indigenous knowledge arises inside a social group within a cultural logic system of its own, combining locally developed experience with acquired knowledge from other sources. Therefore, a synthesis with the engaged scholarship thinking and obtaining the views of key stakeholders and community, [74] to codify informal cumulative knowledge systems for organizational implementation purposes. This indigenous investigation presently becomes a hot research theme in emerging economies like China, Brazil, African countries and others. The increasing evidence of success in non-western contexts has led to a growing interest in indigenous management practices. Indigenous methods in different intellectual and cultural traditions further could have immense potential to contribute to universal brand-new perspectives, [15], [74].

In response to this need, some associations have been established to promote indigenous management practices like Asian Academy of Management, Asia Pacific Journal of Management, the European Association of Work, Organizational Psychology, International Association for Chinese Management Research and Management and Organization Review. Reviews of some of these studies capture the characteristics of indigenous managerial practices and the hybridization of management processes, combining different approaches opposed to pure Western practices with paternalistic framework and role of indigenous methods. Further, “managing globally” goes further than simply adapting practices from one culture to another, rather what could be learned or contributed from the humanism of Asia, Africa and other areas in managing global enterprises, [55], [115], [117],.

Given the difficulty of transferring these important values, the mistakes in implementation further complicate the depth of buy-in among employees and management to genuinely adapt

Lean. The investigation of the features of Lean diffusion reveals the critical factors that influence the adaptation, including the methods [6]. By overlaying these partial efforts on the cultural setup and business environment, it is no wonder that fully embracing Lean thinking is so problematic. It can be concluded that all factors coexist and none of them should be ignored. Contingently, adapters need to exploit them without violating the modern PS postulates. Concerning the transferability perspectives, the adaptation methods are probably the most important issues as the methods can incorporate the factors in the adaptation.

### 3.4. Organizational Capabilities and PS Adaptation

#### 3.4.1. Organizational Capability Concepts

Organizational capability is defined as a “know how to act”, a potential of action, resulting from the combination and the coordination of “action levers” (resources, knowledge and competencies) of the organization. This potential can be mobilized through the value flow of the company to perform a specific objective, [92]. From this definition, the characteristics of capabilities include: systemic nature, inseparability from the “action process”, “path dependency” and “active learning”, Fig.3.1. Different perspectives of capability share that firms vary in their ability to control, to access and to organize productive resources, [72].

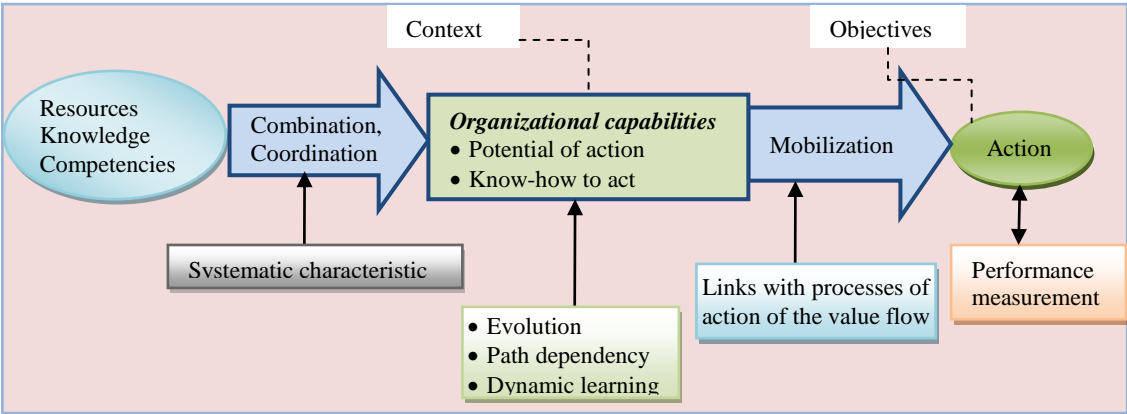


Fig.3. 1 Organizational capability concepts - potential and know-how to modify routines, [92]

The two broad perspectives of capability are the static and the dynamic capability. Static capability is based on the resource based view (RBV) that links competitiveness to bundles of available resources and the capacity to deploy it. Dynamic capabilities (DC), on the other hand, focus on organizational processes that enable to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments’ [4], [72]. Hence, the organizations ‘know-how to do things’ constitutes the firm’s systematic methods

for modifying operating routines by organizational learning. Such capabilities are dynamic in nature, since it stresses coordination, learning, and reconfiguration (sensing and transformation) routines, [103].

Generally capabilities are provided by a set of resources, combined together into a process (routine) or the total process of value chain for competitive advantage, [35]. The concept of routines refers to simple decision rules (rules of thumb) and also to complex and automatic behaviours that involve high levels of repetitive information processing, [27]. The three themes of organizational routines are: behaviour patterns, rules (procedures, heuristics, codified 'best practices' and handbooks etc.) and dispositions- potentials to engage in previously adopted or acquired behaviour.

There are different types and attributes of capabilities related with these perspectives:

- **Process capabilities:** include use of complex processes such as Six-Sigma, TPM, continuous improvement, Kanban systems...etc, [114],
- **Learning capabilities:** represent both patterns of repetitive problem solving cycles and evolution of capabilities (handling system emergence), [25],
- **Technology capability:** is the ability or skill of the firm at coordinating its resources and putting them to productive use. It includes: operative, acquisitive, innovative and supportive or managerial capabilities, [25]
- **Position capability:** is the strategic posture of a firm by its specific assets such as specialized plant and equipment, difficult-to-trade knowledge and complementary assets and reputation, [114], [130],
- **Copycat capabilities:** refer to competencies of combining technologies, hardship-surviving, absorptive, intelligence and information and networking use. These capabilities allowed enterprises in emerging economy to possess competitive advantages, [76].
- **Network strategic capabilities:** extend the internal capabilities to the supply networks by pushing it to strategic level, [128], which is a necessary antecedent for successful inter-organizational collaboration [14], [36].

### 3.4.2. Capability Development

Capability development ways generally focus on repeated practices (patterns of actions) combined with learning. The trajectories between routines and capabilities evolve from

simple imitation routines to the game of developing new routines. Routines evolve by developing and executing plans, extending existing routines to new purposes, improvising and sometimes flailing around almost randomly. Stable routines help to improve efficiency and effectiveness while it can resist accepting new information, which decreases innovation, [136]. As routines gradually accumulate, they create the ‘absorptive capacity’ and then evolve to ‘absorptive inertia’, which is self-limiting dynamics that may reduce the *desire* and *willingness* to learn or combine external routines, [40]. As the firms act as an open-system, the knowledge, experience and information of the firm become stable over time, which brings about habitual behaviors (potential and actual) in the process of operating a firm, [136]. Dealing with unexpected events when solving some problem or exploiting some opportunity, occasionally leads to development of routines but improvisation may stop when the challenge is resolved. On the other hand, capabilities and “best practices” are not static. As competitors improve time after time, static positions will not help over time.

The attempt to develop organizational capabilities uses whatever behaviours appeared appropriate and solve a problem through improvisation often and repeatedly. When the trial did not work, learning takes place from the failure that often provides a clearer and more useful information than success does, [40]. To avoid position erosion, continual revision of competitive advantages by extending existing capabilities to encompass complementary competences and managing them to evolve into new levels of capability is essential, [64]. The capability evolution of enterprises in emerging economy such as Hitachi, Sharp, Toshiba, Samsung and LG indicate three distinct phases: duplicative (or pure) imitation, innovative (or creative) imitation and novel innovation, [76].

### **3.4.3. Relation between Capability development and Lean Execution**

LPS programs are a form of organizational capability development that intends to internalize the process routines in an organization. Lean principles of pursuing perfection and continuous improvement routines keep the capability development process active by continually maintaining the absorptive capacity as a culture, [64].

The effect of Lean execution and capability evolution on building compositeness can be plotted using two-dimensional axes, Fig. 3.2. On the vertical axis, the LPS execution starts with pilot level practices and evolves to the extended supply network. In the process, the utilization of the tools and techniques require matching organizational capability

development. At the start, the applications call for the use of simple and common operational routines of exploitation and deployment and then gradually evolve to dynamic complex practices, exploration to improve and device new better routines. The repeated practice of imported routines and organizational learning at every execution stage, make the company flexible to adapt easily to business changes and retain competitiveness. It will be able to combine resources in new ways via network-based capability and continuous improvement. The systematic execution of Lean routines addresses with all aspects of the organization from shop floor through enterprise network.

On the horizontal axis, organizational capability development starts with simple routinized practices and evolves to Meta capabilities, [37]:

- 1) Routinized capability is static routines that have influence on level of competitive performance in stable environments. They involve optimizing internal organizational structure (team) and repeated implementation of simple routines such as 5s, poka-yoke, Jidoka, andon and so on.
- 2) The primary capabilities comprise development across functional boundaries and further emphasizes on routinized dynamic routines. The routinized learning capability can impact changes such as handling of repetitive problem solving cycles or a routinized pattern of system changes and solution retention. In Lean environment, this includes implementing TQC, TPM programs, six-sigma and others.
- 3) The highest dynamic capabilities are the Meta-capabilities in which capability is developed and managed across the supply network. This is evolutionary learning capability influences changing patterns of routine. It implies ability to acquire effective routines through any path, handling of the system emergence by exploration learning and use of optimum business model, [37] ,[64].

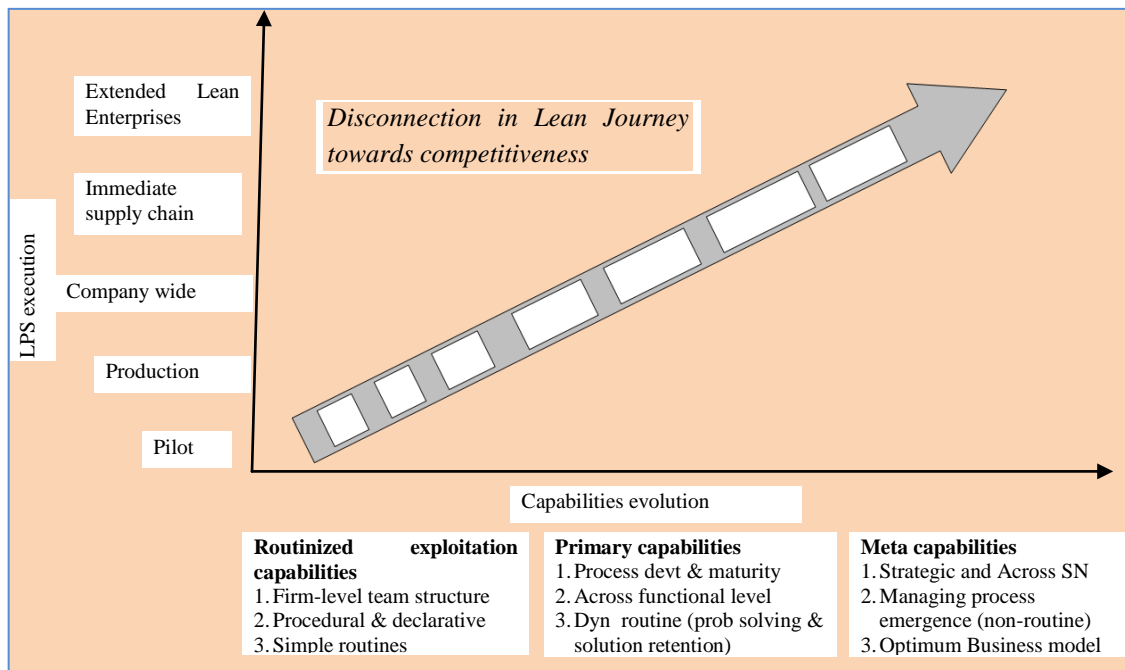


Fig.3. 2 The integrated effect of capability development and Lean Execution to facilitate the Journey to Competitiveness, based on [6], [37], [56]

The simultaneous development of both capability and Lean execution mutually supports each other facilitating the paces of the journey to the dynamic organizational capability for competitiveness. In such a way, the rate of progress from reactive improvement programs using simple routines to the use of Meta-capability across the supply network. The basic argument here is that the robustness in network operations depends on the extent of best practice adaptation such that the most matured Lean enterprises can play the higher role in the network and enjoys more dynamic capability. As these companies mature, the integration of their established capabilities with partners will be essential to benefit from comparative competitive advantages in the supply network. By establishing a dependable domestic capability and expanding the capability to operate in the network, companies can explore new opportunities from the collaborative business environment, [67].

### 3.5. Chapter Summary

In this chapter, PS transferability, role of cultural context, indigenous methods and organizational capabilities issues are addressed. The transferability mainly rests on organizational contexts based on the views of constructionist, contingency and convergence while structuralism emphasizes the difficulty of transferability. While confirming the wide diffusion of Lean, related empirical work on the influence of culture shows inconsistency.



Besides, extending the PS implementation from the manufacturing floor to the other enterprises within the value chain, complicate the effort.

Lean follows the organizational capability development paths, since the transfer of new method depends on competences of learning and exercising best practices. Hence, the simultaneous development of both capability and Lean execution mutually supports each other accelerating the journey to competitiveness. By establishing internal and external capabilities, companies can exploit opportunities from the collaborative business. In summary, this chapter tackles the research concerns of Lean transferability, impact of organizational contexts and work culture on Lean success and capability relation with Lean adaptation.

In order to reinforce the results obtained from the literature, companies' survey in Lean implementation is crucial. The experiences verify the argumentative research lines addressed in the related works, and enables also to identify problems and to derive lessons from the opinions of implementers. Chapter 4 deals with the survey of two different Lean implementation situations (Germany and Ethiopia).

## **4. Lean Implementation Surveys in Companies**

### **4.1. Chapter Introduction**

To build competitiveness, many companies around the world are attempting to renovate their business operation through adapting continuous improvement oriented production methods. The implementation efforts become a common task both in developed and in less developed countries. Thoughtful investigation of companies' experience with Lean implementation efforts is crucial for identifying problems and deriving lessons from the opinions of implementers. Such experiences answer and verify the argumentative research lines posed in the related works.

This chapter deals with presentation and analysis of the survey results of two contextually different Lean implementation contexts, one is from industries in developed country (Germany) and the other from developing country (Ethiopia). The survey results are presented and discussed using statistical analysis and comparison. Important theses relevant to the research topic are derived from statistically significant results and their implications.

### **4.2. Survey Approach**

The research design in this thesis included investigation of multiple cases, Fig 1.1. The literature review and the multiple cases in this study represent the triangulation of three backgrounds: Japan (the originator), German (adapting Lean to its own socio-technical environment) and Ethiopia (embracing Lean with the ambition to enhance competitiveness). The empirical results from these countries provide evidences for the transferability of Lean. The implementation experiences from developed countries on one hand, emerging and developing countries on the other give insights about scenarios of transferability. Further, the two survey cases reaffirm the industries experiences, expert opinions and differential approaches followed in the respective circumstances. This lesson deriving appropriate mechanisms for better exploitations of Lean practices and enriches the backgrounds for a more contextualized adaptation method. Even though the industries in focus vary in status, there is high similarity in adapting elsewhere developed techniques that follow the same guiding principles, techniques and performance parameters.

### ***Targeted Groups and Data collection instrument***

The targeted industries cover small, medium and large German and Ethiopian companies mainly in the manufacturing sector and few from logistics and agro-processing companies that are practicing Lean. The respondents consist of managers, engineers, consultants and team leaders who have profound experiences in Lean applications.

Production system assessments help driving information about the current performance status and identifying opportunities for improvement and learning. To fulfil these functions, the assessment tools need to reflect accurately the nature of variables, which could be more than one perspective in LPS case. According to [20], the assessment tool must include: (1) technical perspective (performance, methods and tools); and (2) organizational perspective (management, organizational and human issues, culture and learning). In addition, the tool should be able to measure the relative balance between these elements. Consequently, the survey instrument uses validated common tools, notably from [34], [53], [56], [57], [87], [106], [120], [123] and others. The German work culture set-up is based on [133-135].

After considering these sources with the research objectives and the congruence of the variables in the survey, the factors are categorized into: Lean notions and adaptation methods, utilization of tools and techniques, Lean supply chain practices, performance improvements, implementation challenges, cultural influences. Table 4 summaries the survey questionnaire essence and intended derivation.

Table 4 Questionnaire focus area and its implication for the study

<b><i>Questionnaire focus</i></b>	<b><i>Implication for the study</i></b>
General information	For validity analysis and stratification of the industries and respondents,
Perception about Lean and adaptation methodologies	Lean associated understandings, figuring out patterns of transformation and missing steps, relationship between improvement and approaches.
Lean tools implementation extent	Extent and frequently used tools, comparison of implementation across contexts, cross referencing with other variables, missing tools
Supply network practice	Level of supply network performance, internal vs. external orientation Extent of integration among supply chain member industries
Performance improvement	General levels of success and its relation with other factors Comparison of improvements across contexts
Lean Challenges	Common implementation challenges to verify its effect
Levels of cultural supports and/or barriers	Evidence on cultural impact in adapting new methods, identifying difficult issues in applying Lean, device appropriate adaptation mechanism,
Hindering factors and betterment idea	Identifying difficult factors for Lean implementation Generating improvement ideas and recommendation from practitioners

Consistent with these themes, the survey gathered relevant information on Lean transformation and rollout incidents through proper questionnaires, interviews and, in some

cases, industry visits. The developed questionnaire included closed and open questions translated into the participants' native languages (Amharic and German) and enhanced by comments from experts, academicians, psychologists and language experts.

For the German industries case, the online questionnaire structure followed the EFS 8.0 Survey software. Being online, the process was more user friendly for respondents than traditional paper-and-pen sheets. The sole difference in the survey procedure between the two contexts is: the survey languages, online vs. paper based questionnaires and addition of two open-ended questions about hindering and possible improvement ideas in the Ethiopian case.

In the German companies' survey, the online questionnaire was distributed with an attached cooperation letter from the host institute (Institute of Ergonomics, Manufacturing Systems and Automation, IAF) of Magdeburg University to the respondents, requesting to take part in the survey from 08.06.2011 to 15.09. 2011. The plan was to invite roughly 50 relevant employees to fill in the questionnaires, assuming a return rate of 20%. However, the online questionnaire link was distributed to 107 contacts by e-mail. From 107 (100%) participants in about 80 industries, 29 respondents, (36.25%), filled the questionnaire.

In the Ethiopian sector case, the study took two stages: first, factory visits and interviews with Kaizen/Lean personnel was conducted in 34 companies. Second, looking at the limited number of implementing organization and their interest to participate in the assessment, the entire 34 industries participated in the preliminary survey were taken for the questionnaire survey. The plan was to take roughly 250 respondents expecting a response rate of 20%. Practically, 238 questionnaires were distributed to 21 companies during the period of 15.01.2011 to 27.04.2011. The return rate was 78.15 % (186 filled).

### **4.3. Survey Results and Discussion**

#### **4.3.1. Profile of Industries and Respondents**

The questionnaire inquiring basic information about the respondents' position and profile of the industries was targeted to the participants. The result indicates the proportion of the respondents involved in the survey showed differences between the Ethiopian participants (186 respondents) and German participants (29 respondents). In German survey, 72.41% from 21 respondents were general managers, while for Ethiopia the managers only account 9.66% of the 178 respondents. The production manager/ engineer involvement was 13.79% for

Germany and 18.75% for Ethiopia. The consultant and transformation team leader is 0% for German respondents while Ethiopian case showed 10.80% and 50.57% respectively.

As far as the profile of the respondents is concerned, it can be concluded that the majority of participants in the German survey were general managers (72.41%), since the participants invited are business leader who communicate with the institute consultancy services. In the Ethiopian case, the questionnaires were distributed directly to relevant participants at site. Given the quantity of middle and lower level management bodies in the industries, more team leaders are included. Thus, the outlets and distribution mechanisms of the questionnaires in respective cases resulted in some profile variation.

Another reason for the profile variation was the effect of employee population in the sample industries. The majority of the companies in the German survey (61.54%) have been with less than 50 employees (implying in the range of medium size categories) followed by 26.92% large industries with employees greater than 501 workers. In the case of Ethiopia, the majority of industries (66.31%) have greater than 500 employees, while medium and small industries only account for 14.44% and 1.60% respectively.

Regardless of the slight difference in respondents' profile, the information gathered remains comparable. All respondents are actively participating in the implementation. It can be concluded that the survey participant variation will not have significant impact on the consistency of the data for the subsequent analysis.

The implementation duration also reflects differences among the cases. The majority of German industries, 65.52%, indicate less than one year and 31.03% more than two year duration periods. Most of Ethiopian industries have already gone two years, 66.67% including the preparation period including the pilot level. The company-wide implementation experience does not exceed one year for many of them. The expectation is that variation in implementation duration has significant influence on the actual performance and sustainability pattern of the practice. Experienced achievements or failures give foundations for learning and improvement or fine-tune the adaptation strategy from the feedback.

Further, the efforts required in managing the challenges of human behaviour such as resistance, attitudinal change vary with complexity and size of the industry, [121]. The overall visible performances for large industries may require longer time compared to small industries. Therefore, performance achievements in this survey may not be directly compared.

### 4.3.2. Lean Notions in the Industries

In an inquiry to assess the meaning of Lean/ kaizen for the companies, the respondents were asked to choose best fitting interpretation(s) from a list of known Lean notions. Accordingly, participants interpreted Lean as ‘Waste Minimization/ Elimination’ by 38.10% of the German respondents and 88.76% of Ethiopians. In the second place, the philosophy is associated with Teamwork & continuous improvements, 33.33%, for German respondents, with corresponding proportion of 53.48% for Ethiopian participants. However, the third Lean principle, ‘Company-wide improvement system’, 28.57%, for Germans, matched second for Ethiopian (76.97%). Lean philosophy as a toolbox of techniques is rated fourth by both groups of participants (23.81% German and 71.35% Ethiopian). The other notions rated differently in level are defect free product for German (28.57%) and Workplace organization for Ethiopian industries (89.84%), see Fig 4.1.

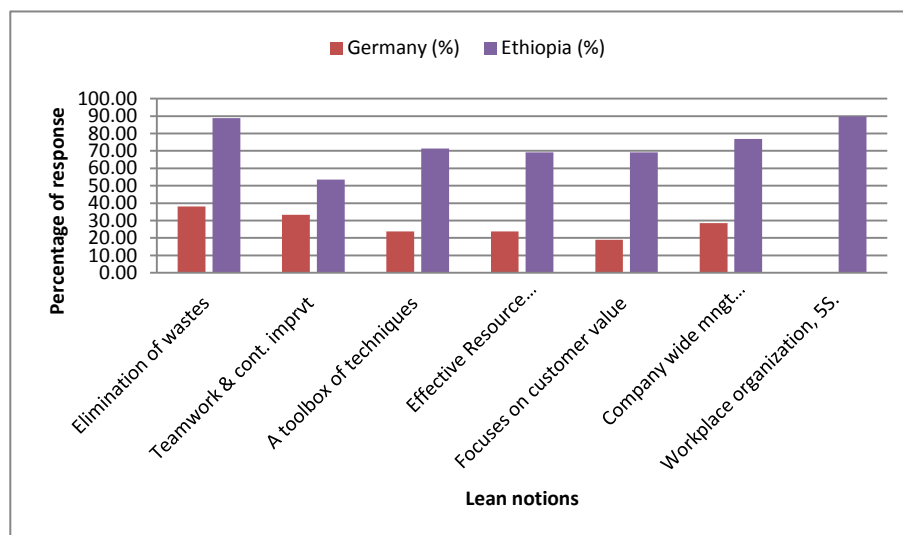


Fig 4. 1 Lean notions and their interpretation in the surveyed industries

Based on this result, it can be inferred that Lean notions among industries emphasize waste elimination while the relative emphasis among the notions reflects contextual issues. Although the proportion of respondents varies, the given precedence and result in most of the cases showed significant similarity with the exception of some statements. Accordingly, the first four interpretation of Lean by the majority of participants include: ‘waste minimization/ elimination’, teamwork, company-wide improvement system and tool box of techniques.

Regardless of relative emphasis on the waste minimization, which tend more towards technical aspects more than half of the participants share a common understanding on the basic principles, which can be taken as a presumption for success and sustainability. The result relating Lean to ‘Waste Elimination’ and to the toolbox of techniques by industries is also indicated by other studies [79], [87]. In [3], participants indicated the ‘tool box’ notion in the first place. Despite this commonality, this conceptual construct may not hold appropriately appealing for the generic Lean orientation. The views associated with customer focus compared to the tools and techniques, which have been put as first and second, still reinforce the participants’ tendencies on the tools’ aspects of Lean. On the higher conceptual level, the principles are better associated with customer value and continuous improvement to reflect a highest predisposition and attitude at the first instance with the customer value. Value creation and waste elimination can be synonymous only, if the customer explicitly defines the value and the production is according to the value definition. In that case, many tools and techniques help in eliminating the waste and maximizing the value. Keeping in mind the customer interest, believing in continuous improvement, delivering value to customer and attaining this with the basic techniques could make sense more than considering the system as a manufacturing waste reduction management.

The second view of ‘continuous improvement’ and defect free process capability perspective by German industries is in line with the main principle of pursuing perfection. Although these two principles stand at the top, one after another, only about one-third of the participants agree on these principles. This view, however, depends on how well the participants put the continuous improvement into practical behaviour. It is also notable that considerable number of the participants are hesitant in thinking that Lean as a company-wide improvement system. This attitude, especially by top-level managements, indicates the acceptance level of Lean as dominant management style in the respective industries.

Surprisingly, the Ethiopian industries considered 5s work place organization as the most appropriate implication of Lean/kaizen. Although 5s is one of the most important pillars of kaizen that keep work area fit and as a starting point to discover hidden problems, [51], it is not the core or the long-lasting principle governing notion. The kaizen implementation manual, [52], clearly states that the program is a system of continual undertaking to improve business processes with the goal to improve quality and customer satisfaction. Therefore, at

this particular stage and implementation experience, this interpretation for the industries is not appealing and therefore requires careful awareness creation and training.

The focus on process capability/ defect free product vs. the workplace organization surveys clearly indicates contextual influences. The shop-floor organization of German industries is already at advanced levels due to long-year self-learning, experience sharing, introduction of automation and new technologies, safety rules and regulation. Hence, many of the 5s principles are embedded capabilities for German industries. On the contrary, such issues are a big concern for Ethiopian industries, since production technology, workshop layout, material and tool management and shop practices are still very vital for industries.

### **4.3.3. Lean Adaptation Approaches**

The survey includes a question assessing the measures taken during Lean adaptation. Respondents choose the steps addressed in their organization in a number of possible phases in the transformation. Regardless of the sequences, the transformation phases considered are adopting Lean vision, setting Lean culture and infrastructure, defining value and value stream, creating implementation plan and implementing the initiatives. Fig 4.2 illustrates the factors and results of the survey.

Except for vision adaptation, both cases indicate that setting Lean culture and infrastructure (42.86 % of Germany and 76.19% of Ethiopia) was done. However, as a second measure, the majority of the Ethiopian respondents (71.43 %) put vision adaptation second, while German respondents indicate value stream mapping and vision only by small portion of respondents (14.29%).

The adaptation routes influence the subsequent implementation achievements. Setting Lean culture, defining value and value stream maps, and creating implementation plans are emphasized in both arenas. However, many companies do not pay attention to some of the essential steps. The unbalanced concerns are observed in strategy formulation, implementation plan, value definition, training and others. For example, VSM, one of the vital instruments is not among the lists in the top. Such problems of lesser attention by industries are also indicated by [38]. Deficiencies or flaws in the future VSM imply unclear visions about customer value and limited views to major points of waste on the stream that affect the subsequent kaizen initiatives, [41]. As a result, the channel to establish a common path and



mutual understanding of employees as well as the direct suppliers and customers would not be properly institutionalized. When the VSM is not clear, planning JIT delivery is not at the outset, which affects performance levels of supply chain integration.

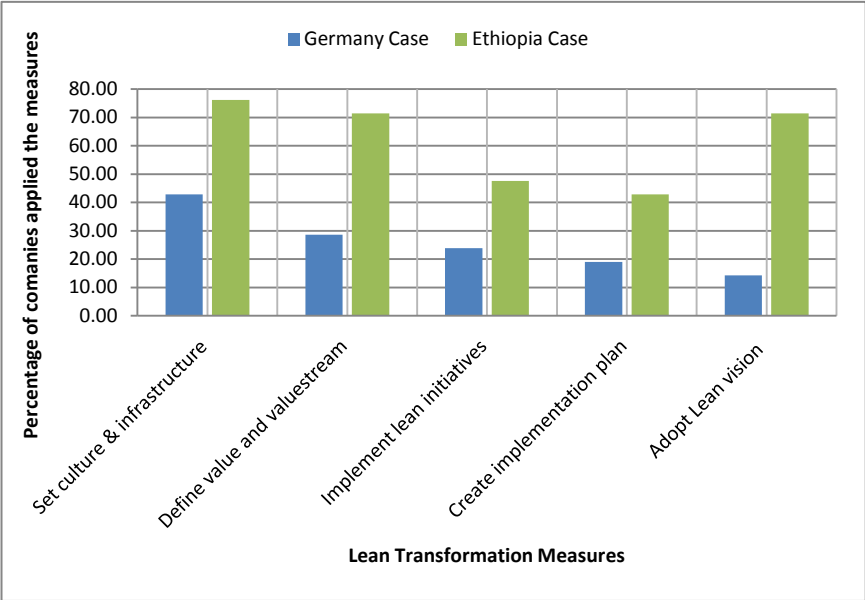


Fig 4. 2 Lean transformation approaches followed by the industries

The transformation steps also showed variations in emphasis among industries. For example, the German industries did not affirm strong Lean visions. Perhaps, the industries are adapting Lean as a tool to exploit the potential of the technique in quality, teamwork, and waste avoidance, as associated in the notions, and consequently, a vision shift may contradict with the built-in binding organizational routines and positions. The Ethiopian industries attempt to focus on adapting visions as the initiative is from a government transformation program, which usually succeeds in setting visions and strategies for communicating and cascading the subsequent execution phases. The importance of implementation steps arises due to its notion on the overall approaches. On the other hand, the industries do not indicate any other appropriate steps that may substitute known Lean steps.

**4.3.4. Application of Common Lean Tools and Techniques**

On the operational level, the respondents were requested to rate, using the 1-5 Likert scale, the extent of applying the common Lean tools and techniques in their day-to-day operations. Regardless of the extent of use, the illustrative radar curve reflects the results for the tools’ application, Fig. 4.3. Among commonly used techniques in the German industries; Waste Elimination, job stability and 5s- House keeping are rated with a relatively high

implementation level, 4.33, 4.20 and 4.00 respectively. The other tools in the high utilization level, (above 3.00) are: teams and teamwork and employee commitment and motivation (3.9 each); SPC, Job standardization, 3.8 each and TPM, 3.78. Hence, there is a general utilization extent ranging from 2.89 for ‘suppliers and customers involvement to 4.33 for wastes.

On the Ethiopian side, the majority of the tools used are above 3.00 Likert scale. In general, the indicator range between 3.36 for 5s, and 1.89 for customer and supplier involvement. The extent of utilization include: 5s, 3.36, Job stability, 3.32, teams and teamwork, 3.30, TPM, 3.28 and job standardization, 3.27.

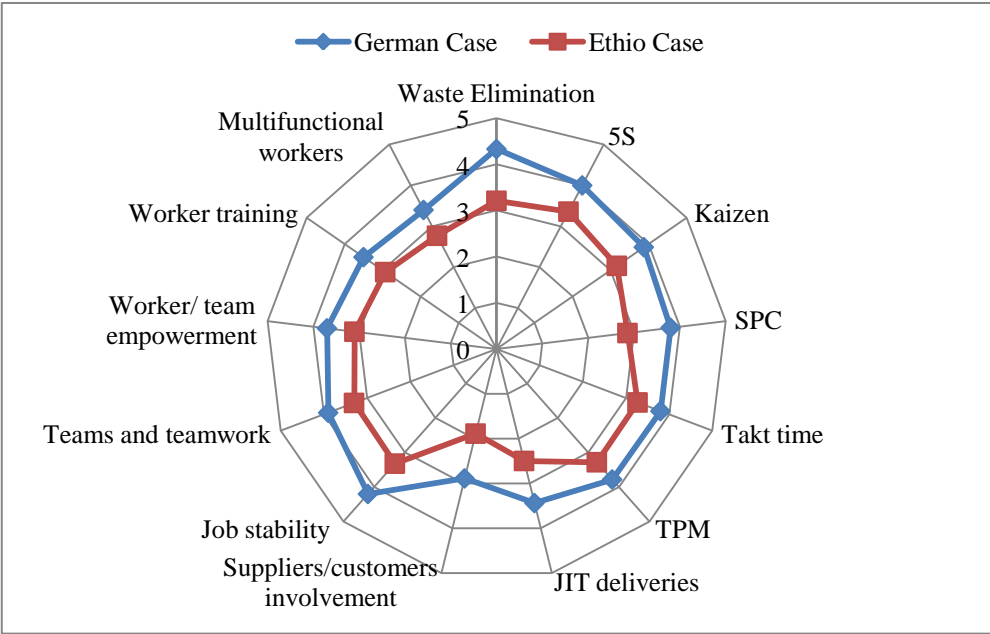


Fig 4. 3 Extent of utilization for Lean techniques in the industries

The result shows that the industries attempt to use a majority of Lean tools with varying intensity. The top three tools used are: 7 Waste (Muda) in production (overproduction, inventory, waiting, transporting, defect/scrap/ reject, excess motion and improper process), 5S– House keeping (Sorting, Set-in-order, Shine, Standardize, and Sustain) and 7 Quality Control (SPC) tools. In addition, other important tools such as teams and teamwork, TPM, job standardization (Takt time) have been also utilized to a high extent. Given the duration of implementation, this may reflect a positive remark. The majority of the tools are used between high and extensive ranges (3.00-4.33) while some tools are only used to ‘some’ extent (2.00-3.00). This is in line with [78].The least used techniques (2.89 and 1.89 for Germany and Ethiopia respectively) are tools that are related to external relations such as suppliers and

customers participation in business activities. The second least used techniques, JIT delivery is associated to streamlined logistics.

Generally, there is a high level of utilization for the German case, ranging from 2.89 for ‘suppliers and customers involvement to 4.33 for waste elimination. None of respondents reflected that they use additional tools other than listed in the questionnaire. The least used tools, ‘Suppliers and customers’ involvement’, indicate that the implementation is less mature especially in external organizational relation aspects.

The experience of the industries leads to the thesis that can be stated as application of the essential Lean tools and techniques by industries indicate imbalance. Strikingly, one of the most important pillars that is related directly to suppliers and customer, JIT deliveries are not among the top four tools. The same is true for the least implemented tool of ‘suppliers and customers involvement to improvement’. This reinforces the assessment result with the notion of companywide approaches. The least applied technique coincides with previous research work of [87], [98], where it is shown that firms have difficulties in applying tools related with external relations.

The other interesting finding is that experiences of the industries on tools application indicate similar pattern and commonality. Regardless of the extent, the radar chart reflects a similar trend line patterns in the utilization of the techniques for the two contexts. Relatively top rated tools for Ethiopian cases are similar to that of German cases. This pattern leads to the conclusion that the application of the techniques is not highly influenced by work culture, which supports the convergence perspective of industrial culture. In contrast to [5] conclusion of significant cultural influence, the major factor here is related to industries the capability. It may reflect also either the concentration of either groups of industries on similar tools or the easiness of these techniques for users. The relative emphasis to wastes, 5s reflects that the industries selected tools for early implementation followed by the utilization of other tools with higher intensity.

#### **4.3.5. Aspects of Lean Supply Network Practices**

The survey about the Lean supply network practices intends to assess supply chain integration mechanism. Approximately, equal percentages of respondents, 40% for Germany and 33.33% for Ethiopia, reported that their industries are on the ‘Adopter’ level in which there are limited

links of supplier strategies to corporate visions, goals and objectives. The levels in integration with supply chains are found along all ranges from internal focus to mutually beneficial arrangements of supply chain. The integration enables the value creation across the value chain to operate as a seamless network along which information, knowledge, equipment and physical assets flow smoothly, [59], [68].

On the mechanisms followed for integrating with the supply network, 46.79% of the respondents from the Ethiopian side indicate the focus on internal capabilities with little cognizance of tacit or explicit knowledge sharing across suppliers. 44.44% of German industries have already set the technology roadmaps that facilitate the pursuance of common strategic visions and usage of shared metrics and 33.33% of them established internal organizational structures and processes that leverage supplier-based knowledge and innovation. The structural integration for the Ethiopian side is only 2.44%. Surprisingly, mutually-beneficial arrangements across the supply network is not indicated by any respondents of German industries, see Fig 4.4. The result further reflects that technology roadmaps that support suppliers in the pursuance of common strategic metrics are in place. For the Ethiopian industries, even though making effort to adapt the Lean supply practices, their industrial background and little experience limits the practice to the traditional supply chain. With a similar logic, logistical infrastructure and other local constraints restricted Lean-oriented SN practices. The effect of IT connectivity on supply chain performance was also clear, which is hardly used among industries in Ethiopia. As the integrating mechanisms within the supply network, the majority of Ethiopian companies focus on internal capabilities.

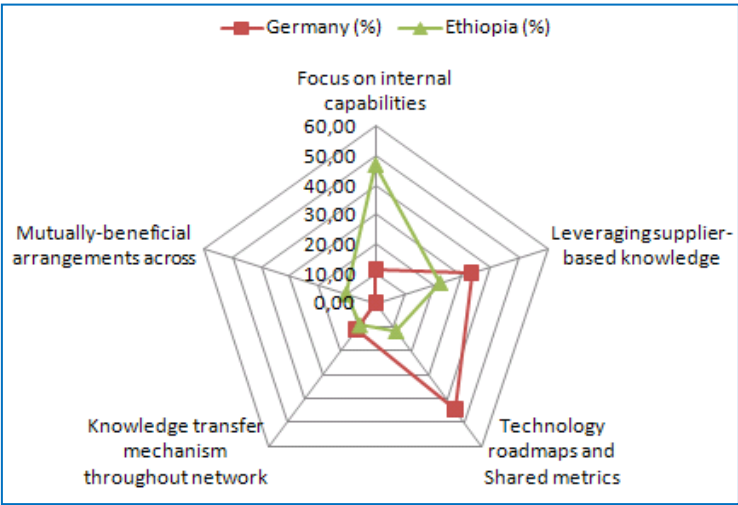


Fig 4. 4 Lean supply network practices and integration mechanism in the surveyed industries

Hence, besides the implementation of the tools and techniques in internal operations, the external relation or interaction within the supply network environment could be more challenging for less capable industries. Despite external constraints, the industries could have developed JIT delivery mentality and establish the necessary arrangements to practice within the constraints. In other words, the Lean supply chain success is highly linked to organizational capabilities, so organizations with less capability face difficulty to pursue external relation on extended levels. For example, for supply networks, whether Lean is thought or not, the European industrial experiences and infrastructure (transport and communication) is well established, compromising the difficulties and perhaps hiding the wastes through technological efficiency, which may not be necessarily as high as that of aspired by Lean. In terms of integration among parties, (producer, supplier and customer), the operation is perfectly synchronized due to these capabilities.

Therefore, the supply chains' performance in Ethiopia is striving to form the baseline (traditional), while the business situation requires internal and external integration. Nevertheless, the pace of progress to integrate the supply network function is crumpled by internal capabilities. Reinforcing the results of tools application, the supply chain optimization and the transformation along the value chain constellation become difficult to attain. In order to benefit from the suppliers' JIT delivery, a company must first establish the best possible efficiencies in its own internal processes, [12].

The thesis to be inferred is that excelling in an extended Lean supply network is only possible when there is industry dependence on each other, the infrastructure and other regulatory issues have facilitated the practice. The implication is beyond mere supply integration and maturity. The performances set at different levels of Lean maturity indicate how the company is able to balance between internal and external orientation, operational and strategic capability. Even if the internal operational performance is attractive, the impact on the cumulative competitive factors (cost, speed, quality and variability) may not be dependable until supply chain integration is high and the organization is able to play a significant role in eliminating non-value-added activities in value chains.

#### **4.3.6. Performance Improvements**

The focus in assessing the rate of Lean implementation performance is the level of improvements on Likert scale, Fig.4.5. Achievements signify that the industries have

considerably enhanced their performance. For German industries, the top benefit gained with estimation of very high improvement levels (4.11) was on product quality followed by delivery time and overall productivity (3.90 each). Performances on customer/ stakeholder satisfaction and flow/ cycle time rated with 3.80 score each; quality yield and change over time was improved with 3.70 and 3.33 points respectively.

The participants from Ethiopian industries also indicated considerable performance enhancements. More specifically, work place use, 3.78, followed by overall productivity, 3.34, cycle time reduction 3.30. Similarly, product quality and defect/ rework rate are enhanced by 3.11 and 3.19 points.

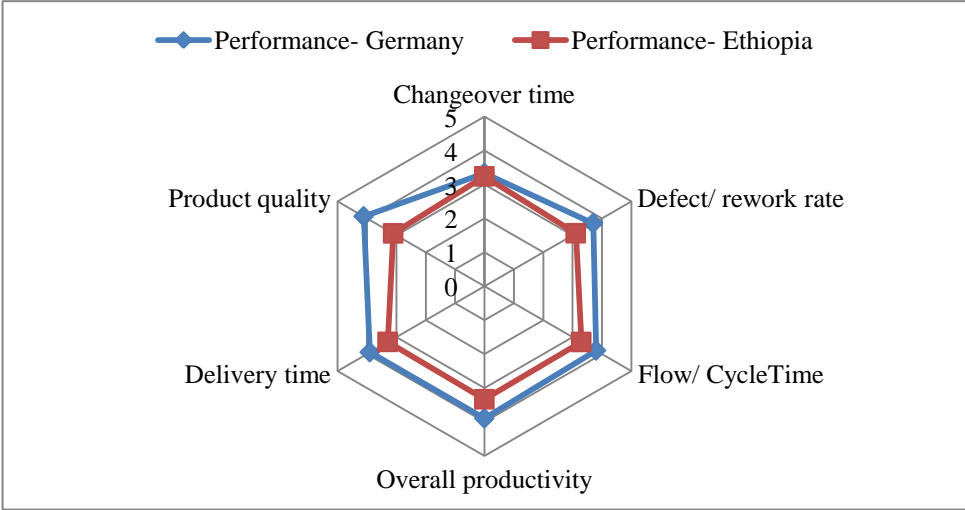


Fig 4. 5 Gained performance improvements by the surveyed industries from Lean implementation

Majority of the surveyed companies in Germany and Ethiopia estimated 50-75% enhancements in quality improvement, delivery time, overall productivity, cycle time reduction and workplace utilization. Performances on customer satisfaction, cycle time, quality yield and change over time have been significant.

Though the reliability of the quantities need further verification, the estimated results signify remarkable benefits. This implies that regardless of limitation in balanced tool utilization, the industries are benefited from the implementation. As finding, it can be remarked that companies implemented Lean for reasonable period always report improvement achievements, regardless of flaws in adaptation steps. Similar benefit reports are given by [78], [124]. However, a significant improvement in the early phases of implementation may not reflect true incremental performance over long period. At the early stage, when the Lean

expedition is a fashion, the result may show significant value [46]. The sustainability of these achievements and the right attitudinal thinking needs to be internalized. While the early results motivates for further achievements, the failure to sustain or ‘backslide’ to old ways may have adverse effect on making the effort as failure.

For the tool applications, regardless of contextual differences, the experiences of the two groups of industries indicate similar trends in performance improvement results. The gap in the implementation emanates from comparative capabilities of these industries. The higher value of German cases in some measures confirms the effects of supportive operational skills, technological infrastructure and experiences. This result could also reinforce the interpretations of Lean as 5s by Ethiopian respondents and further can be attributed to the industries background capabilities. The application of 5s has resulted in considerable improvements in work place utilization and continuous improvement. Reorganization of the shop floor has improved material management and space use. During the preliminary survey, visible signs of kaizen workshops were also observed such as co-operative effort in handling day-to-day operations, kaizen board, slogans on manufacturing wastes, visual control systems, suggestion system and performance reports.

#### **4.3.7. Lean Implementation Challenges**

The difficulty level of common Lean challenges is rated by respondents on the Likert scale ranging from easy (1) to very difficult (5). Fig. 4.6 illustrates the variables with the corresponding responses. The challenging factors considered were: management support, shared vision among employees, understanding on Lean concept, implementation time, implementation know-how, employee resistance, backsliding to the old ways and effect of past project failure. Accordingly, the results mentioned by Ethiopian vs. German respondents respectively are lack of understanding on the concept 4.63 vs. 4.0, lack of management support 4.30 vs. 4.9, ‘backsliding to the old ways of doing things, employee resistance 3.98 vs. 4.2, lack of know-how to implement, 3.86 vs. 3.90, and so on.

The difficulties of these challenges show high similarity. Unlike the extent of tools utilization and performance improvements, the score lines reflect staggering points and concurrencies. The most difficult factors are: lack of understanding on Lean concept, lack of management support, ‘backsliding to the old ways of doing things and lack of shared vision among all employees, employee resistance know-how to implement and participative leadership style.

The least difficult factors are: Lack of time to implement and past failures. The findings coincide with change management efforts, [3], [91]. From the result, the guiding thesis implies that Lean challenges are universal regardless of the contexts

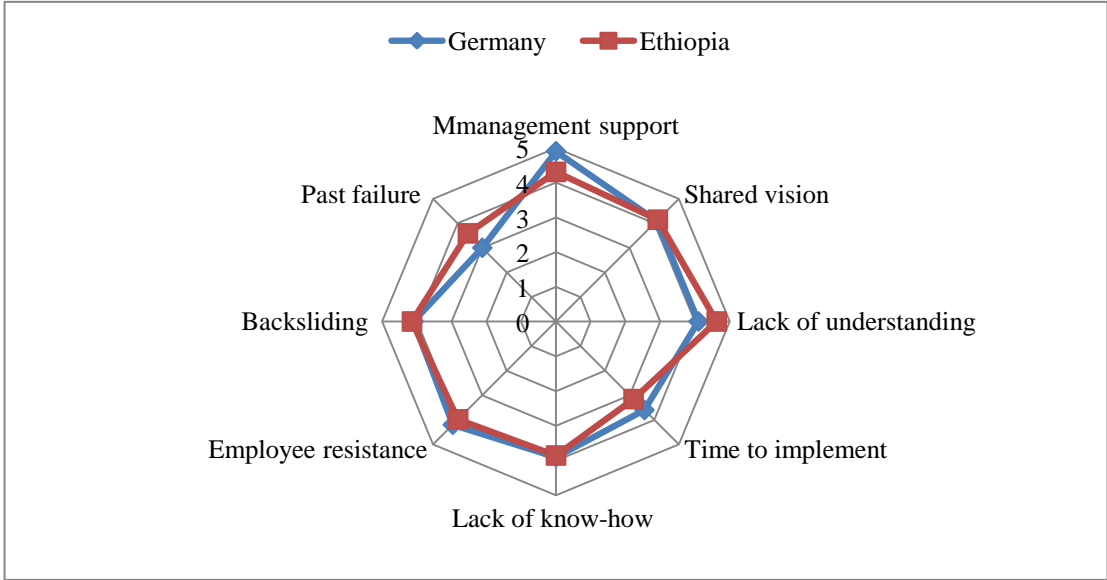


Fig 4. 6 Challenging factors in Lean implementation and their difficulty level

#### 4.4. Specific Contextual Factors of the Surveyed Industries

Regardless of organizational culture or/and other factors, the key performance variables in Lean assessment emanate from the same principles. As a result, assessments based on Lean indicators may not fully measure the idiosyncrasy of the industries’ contextual dimensions. Therefore, the harmony of the Lean requirements with deep-rooted work culture and indigenous factors and their influence society remain understand. To investigate the factors more reliably, context-specific questions are posed.

##### 4.4.1. Differences in Cultural Contexts

The basis in this investigation takes two contextually different cases. In Germany, many industries are practicing Lean or its elements, hybridized with their own PS to improve quality, waste elimination, pull systems, continuous improvement and standardizing the processes, [91]. The globally known firms like GM, Mercedes-Benz, Volkswagen and others accepted the governing principles and applying the tools either partially or holistically, [6]. The German indigenous PS approach is known for their long history of experience usually attributed for product quality and reliability based on some governing work norms. The PS



can be categorized as a standalone model, based on a qualified workforce, social consensus and a rational system, which may vary from Lean approach in terms of job design, team structure and autonomy, [31]. These position capabilities with all embedded routines is expected to influence the adaptation effort in either way.

Ethiopian industries are also introducing modern operational methodologies such as Lean/Kaizen with the aim of ‘internalizing and scaling up of skills, technologies and other organizational capabilities that support competitiveness, [9], [52], [109]. The existing capability status is attributed with poor competition, less modern production technologies and traditional production routines. Most of the industries operate in a local market and are found themselves in direct competition with the global companies reaching their limited market with better product quality and cost. The Kaizen initiative by the Ethiopian government and Japanese International Cooperation Agency (JAICA) recognized inefficiencies in the operations of manufacturing industries in quality and productivity as well as the need for change on the patterns of mind-settings of workers and managers, [52]. These positions obviously influence the Lean adaptation in different ways. This stagnant industrial setup could be less supporting for dynamic capabilities, but may not be fixed and binding. Accordingly, Lean/Kaizen is selected for its well-known focus on efficient utilization of resources and promoting participation and problem solving work culture. Hence, the statuses of the two groups of surveyed industries have significant differences.

With regard to Hofstede’s culture model, there are differences among the Japan (Lean originator) and Ethiopian as well as German (Lean adapting countries), Fig 4.7. The significant difference between German and Ethiopian cultural dimensions lies in power distance and individualism. The Ethiopian high power distance (less favourable to Lean empowerment principle) matches with German high individualism (less favourable for teamwork principle). On the other hand, the power distance value make Ethiopia closer to Japanese culture (the ideal Lean context) where as the collectivism value of Japan is about mid-way between the two countries. The long-term orientation, uncertainty avoidance and masculinity reflect slight variation. Based on these evidences, it is difficult to conclude that cultural dimension of the two cases is either favourable or fully fitting for Lean efforts. Empirically, investigations on culture influence of the adaptors (section 3.3) does not enable to conclude that even a single cultural dimension is fully fitting for Lean demands such as disciplined people and hungry mentality to work, [126].

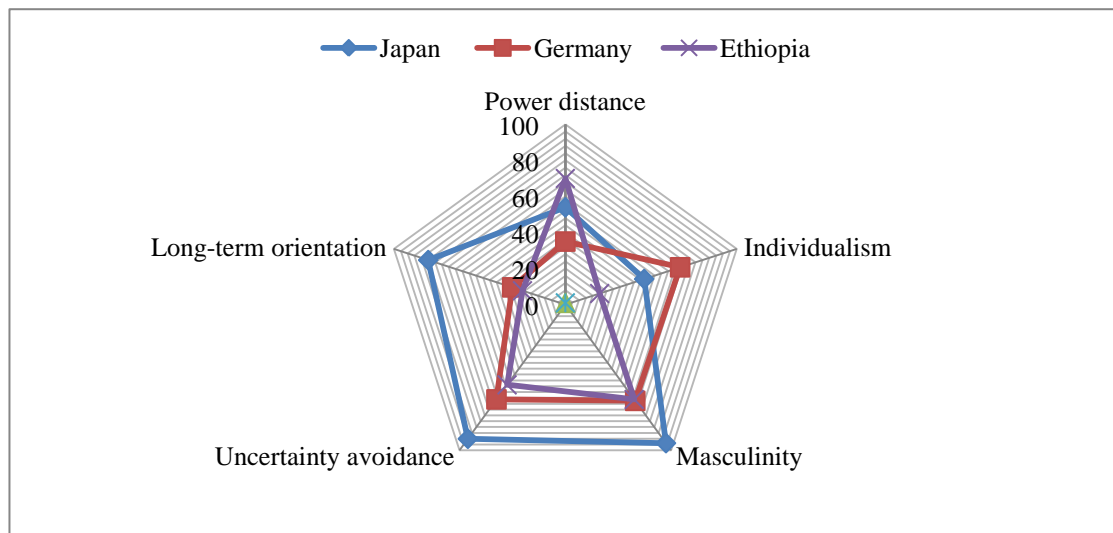


Fig 4. 7 Hofstede's cultural dimension differences among Germany, Ethiopia and Japan, based on [48]

#### 4.4.2. Specific Work Culture and Capabilities

To investigate the context-specific influencing work culture on Lean method in the industries more reliably, some questions are posed to rate the influences and gather opinions.

##### 4.4.2.1. German Work Culture Influences

With respect to the influence of common German work culture related factors, respondents were asked to rate the effects on the Likert scale as (1) strong negative effect; (2) some negative effect; (3) has no effect; (4) some positive effect; (5) very strong positive effect.

The survey results and its implication of these culture values to common Lean notions are presented in Table 5. Respondents rate the effects of German work culture factors, 'Individualist, yet consensus-seeking approach', (4.3) 'Uncertainty avoidance and assertiveness' and 'standard orientation', (4.2 each); 'Focus on Facts', 4.1; defined system structures (4.00). These values imply strong positive effects on Lean implementations. The other culture manifestations of seemingly confrontational communication, focus on tasks, time management, functional orientation of managers and high degree of worker specialization are attributed as having some positive effect (3.0-3.9). The factors given lower value by respondents have been worker union (2.9) and less human orientation (2.2).

As per these responses most of the embedded work culture has either a strong positive influence or some positive effect on Lean implementation (3.00- 4.30) and seems to be in harmony with the principles.

Table 5 German work culture effect on Lean and its implication to Lean principles, [131], [133]

No.	Common German work culture Manifestation	Impact level	Implication to Lean principles
1	Individualist, yet consensus-seeking approach	4.3	Consensus-seeking supports Lean decision-making, team work and shared value among employees approach
2	Uncertainty avoidance and assertiveness,	4.2	Encourages information and data analysis for team decision
3	Standard orientation	4.2	Support process standardization, but may affect continuous improvement when permanently rigid
4	Focus on Facts,	4.1	Facilitates application of scientific tools to manage by facts
5	Defined system structures	4	Related with process standardization and predictability. However, rigid and hierarchy affects empowerment & autonomy of teams.
6	Seemingly confrontational Communication	3.9	Open two-way communication is essential in Lean; probably confrontation could affect team behaviour.
7	Focus on Tasks	3.8	Lean focuses on value adding tasks with flow and job enrichment strategy, if the tasks are without any muda
8	Time management	3.7	Time Management goes with JIT delivery and cycle time; if the cycle is based on Takt time and levelled production
9	Functional orientation of managers	3.2	Contradicts with Lean shared value, teamwork and value stream orientation
10	High degree of worker specialization	3.1	Contrasts with multi-skilled worker and teamwork approach in Quality circles, TPM and SMED
11	Worker union	2.9	Depends on union and management policy in dealing with change
12	Low levels of humane orientation	2.2	Lean is human-oriented approach, training, safety, job security, ergonomics all are humanly.

In the analysis, many of the top rated factors are found to match with the governing principles, provided that the factors are not highly rigid. Nevertheless, some results from the survey, such as defined system structure (4.00), high degree of worker specialization (3.1) and functional orientation of managers seem to contradict with the widespread Lean notions. The issues require further investigation whether there is a shift in these values as a result of culture dynamics or managers may have unique approaches.

#### 4.4.2.2. Ethiopian Specific Context Influences

To extract the specific issues in the Ethiopian industries, two open-ended questions were posed inquiring respondents to reflect their free opinion on the major hindering factors and improvement opinion for successful implementation. The question type is changed because there is no reliable articulated attribute reflecting the Ethiopian work culture, in one hand, and the national implementation team suggested improvement opinions for better adaptation.

##### *(1) Hindering Factors for Successful Lean Implementation*

For the question requesting to list possible hindering factors for Lean success in Ethiopia, the respondents cite a number of causes. After reorganizing and aligning frequently mentioned factors to some themes, the result is presented in Fig 4.8.

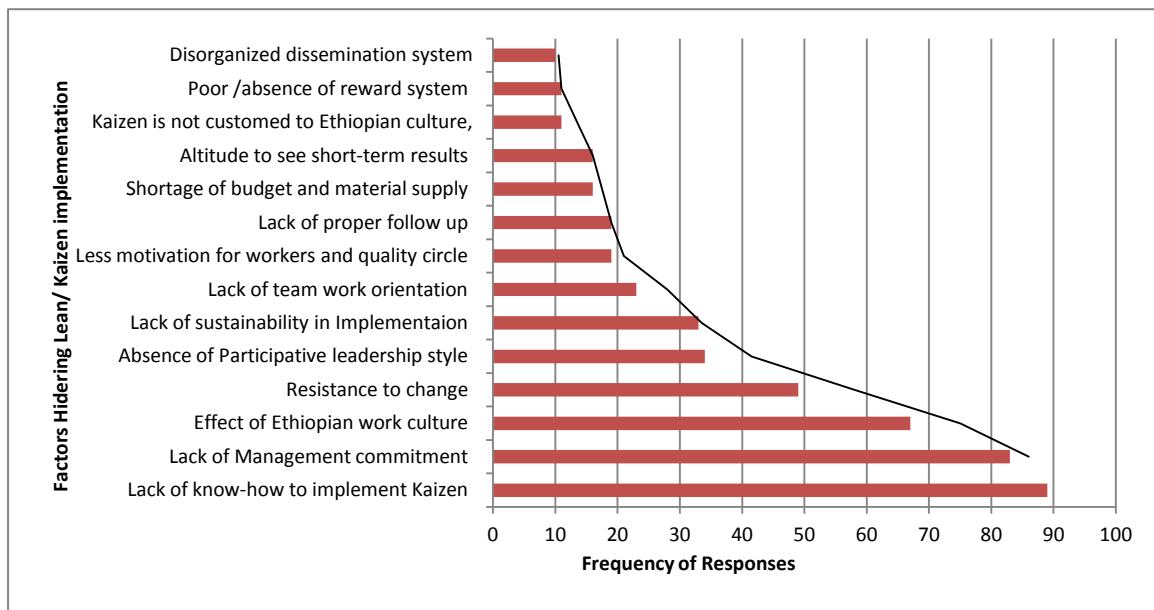


Fig 4. 8 Experts opinion on possible hindering factors in Kaizen implementation

The vital hindering factors mentioned are limited know-how to implement, lack of ‘management commitment and motivation’, change resistance, leadership style, sustaining the implementation and so on. These factors are all related to the universal Lean barriers, Fig. 4.7. Other most frequently mentioned hindering factor is the general term ‘work culture’ with hosts of attitudinal issues such as problems in convincing workers, developing and sustaining discipline, teamwork orientation, management and goal orientation, short-term orientation, disorganized system, considering Lean as extra job, worker commitment and so on. These difficulties are mainly related to the human side, [126].

Keeping the common challenges underlined by literature as universal, the specific contextual factors are local work culture and absence of customization to Ethiopian context. These concerns indicate that respondents are aware of their distinctiveness with respect to adaptation of foreign methods. In fact, there is no trial to contextualization, as indicated in the interview with transformation people, who relate the flaws in addressing the prevailing work culture. The work of [9] and [23] also confirms this matter. The methods followed by industries does not customize to the specific situation.

According to this argument, cultural backup and contextualization of methods are essential ingredients for the Lean adaptation methods. The deliberate acclimatization of the newly introduced system to the condition of adapting company is very important. Successful transfer seems to be highly dependent on the degree of fit within the culture context, method,

organizational transformations and management style. Adapting without considering contexts may result in under-achievements. The customization of Kaizen to local culture in order to have the highest probability of success is also recommended by [22].

Many local contexts contain their own competencies that incorporate indigenous knowledge and cultural values that combine locally developed experience with acquired knowledge from other sources, [10]. Maximizing these positive values facilitate the adaptation and build own particular approaches, which can be a source for inimitable competitiveness.

Moreover, better awareness and improving the know-how gap through Lean strategic deployment and learning from practice itself could considerably minimize the difficulties, as humans react and get committed depending on their acquaintance with the system. Along this line, the attitudes of employees towards Lean/Kaizen show two stages. Some people on top and middle management have considered kaizen as an extra burden, time-taking task and paper work, until they develop common understanding on meetings and practically observing the real benefits. The workers considered it first as a fashion and tend to stick to old ways. Gradually, the 5s practices on the shop floor and its visible benefits reduce the resistance across the organizational ladder. Except for the individual differences, the perception by all employees become constructive in most companies.

## ***(2) Opinions on better adaptation and implementation approaches***

As a rich source of expertise and owner of the challenge, the questionnaire further requested participants to reflect their idea on how to make the Lean implementation better. After grouping recurring themes, the opinion is presented in Fig 4.9.

The extracted opinions on how to improve the effectiveness of implementation programs, indicated the importance of: training and awareness creation, (with extraordinary frequency), detail implementation plan with employee participation, promotion of ownership attitude and gradual and steady progress/ sustainability with close follow-up and periodical evaluation, and various forms of incentives. Many of the respondents believe that a detailed implementation plan developed with participation of the employees is important to get them all on board and take shared responsibility. With regard to the adaptation strategy, respondents recommend customizing of imported methods to the context and institutionalizing the method on the national level, company-wide commitment and competent leadership. These findings are in line with the hindering factors and addresses the problems in

lack of know-how, commitment, disorganized system, unproductive attitudinal matters and so on, Fig 4.8. Many of the suggested opinions coincide with what [51] recommends.

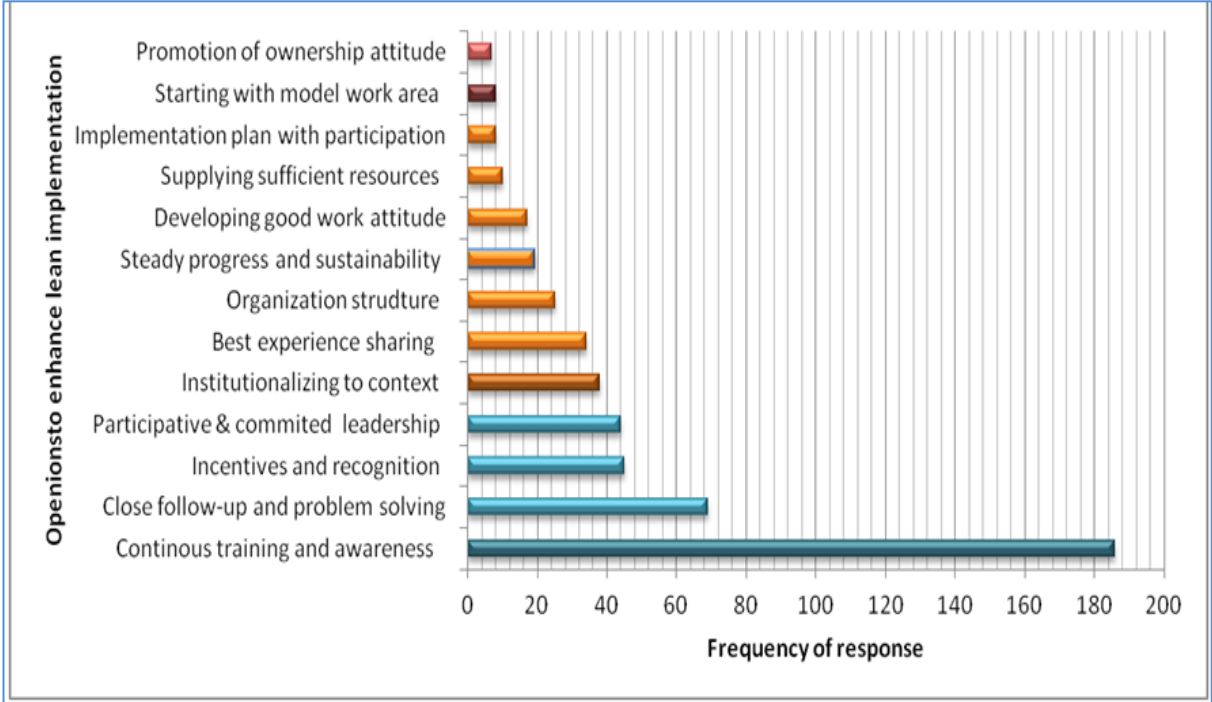


Fig 4. 9 Expert opinion on better Lean/ kaizen implementation approach

Additionally, contextualization and institutionalization of the method, competent and committed leadership, company-wide commitment and working on attitude change are specified as a way for successful implementation. The contextualization of the method implies a need for specific customized approach that calls to the contextual issues, managerial styles and the role of indigenous methods. Few respondents mention being supplied sufficient materials and pilot work area approach.

Further, the results confirm that there are many opportunities for excelling in Lean implementation by a contextualizing the adaptation approach and developing corresponding capabilities. Though this process capability concept extends to various patterns of behavioural routines, the exploitation and deployment of Lean initiatives are stressed by respondents. In principle, the practice leads to a higher level of dynamic capability.

**4.4.3. Implication of Capability Attributes in the Surveyed Industries**

The pattern similarities with differences in statistical values of the survey were highly attributed to routines residing in these industries, which play an important role in

organizational learning, Fig.4.3, 4.5, 4.6. One of the most important aspects of Lean journey is that it is a capability building process. Table 6 indicates the commonality of Lean and organizational capabilities, taking the dynamic capability attributes and their implication with Lean. In this analysis, the definitions of six Dynamic Capability (DC) attributes are matched with corresponding techniques and principles of Lean. The analysis indicates similarities among the DC attributes and Lean implications. The Lean impact on capability and on overall business performance is also analyzed by [64].

Table 6 Commonality of Lean and dynamic capability attributes; based on [6, 31, 49]

<b>DC Dimension</b>	<b>Definition</b>	<b>Lean implication</b>
<i>Nature</i>	<ul style="list-style-type: none"> <li>Abilities (or capacities) + processes or routines.</li> <li>Learned and stable patterns of collective activity, (“regular and predictable behavioural patterns”)</li> </ul>	<ul style="list-style-type: none"> <li>Process and Team-based continuous improvement</li> <li>Standardized job</li> <li>Continual incremental predictability</li> </ul>
<i>Specific Role</i>	<ul style="list-style-type: none"> <li>Integrates, build, and reconfigure competences, (routines, path dependencies, and learning). Change of key internal components or altering resource base,</li> </ul>	<ul style="list-style-type: none"> <li>Effective resource coordination for waste reduction</li> <li>Increasing process capability</li> <li>Change human attitude</li> <li>Multi-skill team</li> </ul>
<i>Relevant Context</i>	<ul style="list-style-type: none"> <li>Highly dynamic environments vs. different degrees of dynamism vs. both</li> <li>Open to systemic technical change, developed global markets or institutional shocks occur.</li> </ul>	<ul style="list-style-type: none"> <li>Robustness and dynamism</li> <li>Instable and dynamic markets</li> <li>Local process to international Supply chain</li> <li>Continuous improvement</li> </ul>
<i>Creation and Development (Learning) Mechanisms -</i>	genesis and evolution <ul style="list-style-type: none"> <li>Repeated practice (and consequent experience),</li> <li>knowledge articulation and codification,</li> <li>Past mistakes and improvisation and imitation</li> </ul>	<ul style="list-style-type: none"> <li>Learning by applying PDCA Continually</li> <li>scientific application of tools for management by fact (quantitatively)</li> <li>Process standardization or Predictability</li> <li>Learning through SN synchronization</li> </ul>
Heterogeneous -	paths, asset positions, and processes, <ul style="list-style-type: none"> <li>Firm-specific, path dependent, investment histories and commitments to the creation and development of DCs.</li> <li>Exhibit Portfolio of method elements</li> <li>Context-specific</li> </ul>	<ul style="list-style-type: none"> <li>Common resource with suppliers base</li> <li>Contextualized by strategic contingencies</li> <li>Flexibility and adaptability to respond for specific customer demand.</li> <li>evolutionary emerging system</li> <li>Learning enterprise</li> </ul>
<i>Purpose</i>	Sustained competitive advantage as outcome, <ul style="list-style-type: none"> <li>“To address changing environments</li> <li>Pursuing improved effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>Competitiveness</li> <li>Value maximization process</li> <li>Respond for market demand</li> <li>Pursue perfection</li> </ul>
<i>Outcomes</i>	<ul style="list-style-type: none"> <li>Firm success/ failure, competitiveness, wealth creation.</li> <li>Causal mechanism (prerequisite) to create rents/ profit,</li> <li>Damage in wrong cause–effect assumptions with long-term commitments of resources</li> </ul>	<ul style="list-style-type: none"> <li>Success in customer satisfaction</li> <li>Prerequisite to develop capability and effectiveness</li> <li>Marker/ customer defines value for ...</li> </ul>

## 4.5. Chapter Summary

This chapter presents practical LPS implementation surveys in Germany and Ethiopia that are adapting Lean to their specific socio-technical backgrounds, which provides evidences for the transferability of PS and gives improvement ideas for the adaptation approach. The research methodology follows survey questionnaire and interviews to collect information for study purposes from relevant target groups of sufficient sample sizes. Except for context specific issues, the analysis uses common PS variables.

The survey results are analyzed using statistical methods and comparison give insights on the possibilities of Lean transferability, implementation challenges and benefits. The results indicate that all industries are one way or the other dealing with the techniques with varying degrees enjoying benefits in performance improvements. Nevertheless, there are observable differences in performance between the two sectors with surprising similarity in trend line patterns of the practices and performances. The differences in results must be attributed to capability position, absence of customized method accompanied with less attention to tools with external relation. In addition, many of the influences of German work culture are found supporting Lean, while the Ethiopian companies recommended capability building and customizing the method to the context. Further, DC characteristics relation with Lean has reflected commonality.

Based on the research agenda, at this stage, the research addresses many of concerns raised in the research outset such as impact of context and work culture on Lean implementation, extent of transferability, industries experience, variation among industries approaches and organizational capabilities influence on PS adaptation.



## **5. Limitation in Existing Adaptation Methods and Practices**

### **5.1. Chapter Introduction**

The previous chapters have addressed the literature review of contemporary PS paradigm, empirical studies on transferability, context influence and industries' implementation experiences. The discussion iterates that, with its explicit value oriented philosophy and a bundle of practical tools, Lean is found a common PS approach. This chapter analyzes and articulates the research gaps, the missing elements in the adaptation approaches and practices, contextual issues and indigenous methods by cross-referencing to the results obtained.

### **5.2. Limitations in Adaptation Methods and Industries' Experiences**

#### **5.2.1. Transferability of PS and Adaptation Approaches**

The transferability of PS, at least influenced by contexts, is confirmed by convergence, contingency and process emergence perspectives. With respect to empirical investigation of Lean diffusion in other environments, the cultural influences reflect inconsistency. Hence, it is not possible to put pessimistic correlation between distinct cultures and modern PS adaptation. Rather, the given theoretical perspectives and the empirical evidences support the possibility of the transfer. The relation between capability evolution and Lean expansion shows the possibilities of accelerating the Lean journey by synchronizing the two dimensions.

Section 3.5 analyzed a number of implementation methods in literature (Section, 3.5). The models reviewed represent various characteristics of Lean adaptation. The most cited approaches vary in scope and focus. In scope, they cover shop floor to the strategic supplier network level applications. In hierarchy, Lean models range from conceptual principles to explicitly applicable task level tools. The guiding procedures also range from simple procedural steps to comprehensive transition road maps. The transformation also ranges from incremental to large-scale change and from pilot to companywide and SN levels. The other methods give directions on how to reduce waste in the whole value chain and bring collective capabilities of all supply chain partners to seize opportunities in the businesses. The tools are readily available principles and the guidelines are clear. In spite of all adaptation approaches and organizations' efforts, organizations face problems to put methodologies to the ground.

### 5.2.2. Implementation Experiences in the Surveyed Industries

The typical Lean implementation surveys in Germany and Ethiopia indicate that these industries are applying the tools and enjoy the benefits in performance improvements. The overall implementation schemes lead to the following interesting results. Regardless of adaptation methods and performance levels, companies practicing Lean affirm improvement achievements. Despite the contextual differences, the Lean challenges indicate universality. The assessment result shows observable differences in performance between the two cases with surprising similarity in trend line of tool application, achieved performances and majority of challenges, Fig 5.1.

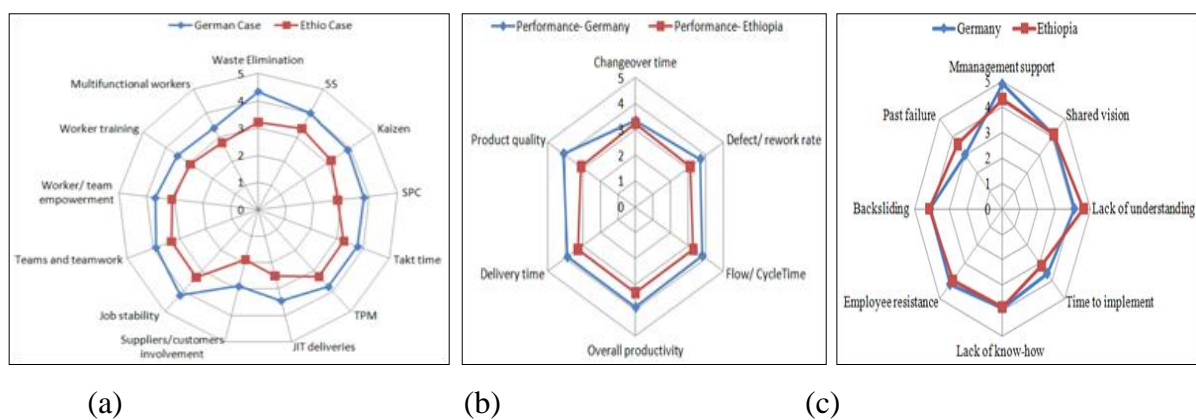


Fig. 5. 1 The differences and commonality of survey results between Ethiopian and German industries reflect organizational context influences: (a) Tools application, (b) performance improvement, and (c) Lean implementation challenges.

The gaps in score values between the two sectors emanate from comparative contextual capabilities of these companies. The higher values of the German cases confirm the obvious superiority in expertise, facilitated manufacturing and experience, which lead to efficient utilization of the competences in implementation. On the other hand, limited experience and little awareness for the Lean management aggravated by the absence of sufficient operational facilities make the application harder for Ethiopian Industries. This implies that the adaptation is highly dependent on the prevailing socio-technical condition and the capability. The opinions of the experts with regard to t implementation barriers and the recommendation for better adaptation approaches was also associated with lack of know-how and sustainability in implementation. These issues are capability matters that confirm the dependence of adaptation success on the capabilities of industries. Further, there is a disconnection between capability evolution and Lean execution.

### **5.2.3. Need for Appropriate Lean Adaptation Methods**

The main drives to adapt Lean are challenges of existing business factors. Companies in deep trouble, or threatened by upcoming fierce competition or those firms aiming at long-term lead in the overall business performance, all look for recipes of methods in contemporary production system databases. The value creation needs internally capable methods with increasingly complementary competence from partners due to the increased SN integration, [67]. Further, when a company operating globally or influenced by global operations, the adaptation of universal method becomes indispensable to keep the balance between internal process and external relation. In addition, being a Lean organization for increasing productivity and quality and /or quoting Lean management as business strategy becomes an image building mechanism, [3]. The principles and systematic applications of the techniques address these requirements more than any other approach. However, appropriate methods that take into account specific conditions of companies remain the concern of industries.

### **5.3. Research Gaps**

The summary of the research gap from literature, empirical works and the industry survey is outlined in Fig 5.2. The problem to adapt and to sustain Lean can be attributed to the gaps in implementation methods to consider contexts and adaptation competencies. The various implementation approaches in the existing literature do not show contextualized methodologies. None of the contemporary implementation approaches explicitly addresses the appropriate issues such as indigenous methods and capabilities required for adaptation. Literature emphasize stereo type Japanese Lean instead of the contextualizing it with contingencies and indigenous methods in the phases of the execution. Methods are just recommended to be taken as complete package without regard to work culture, capability and other matters. The adaptation of new PS is not easy as the organization practices and implementation requirements of new method for benign work culture and discipline may not align. The cultural readiness and influence, the capabilities required to exercise Lean, the role of indigenous routines in favour or against Lean are not considered. The organizational analysis before implementation focuses only on the performance gaps instead of or as-is capability. Adaptation approaches followed by industries in one hand is not customized and on the other hand do not give sufficient attention to some essential steps and techniques in the existing approaches. Further, the assessments reflect capability and context influences on

implementation. There are still methodical problems to implement world-class methods in various organizational situations.

According to [6], the Lean techniques and tools such as flow, 5S, pull, Kanban process control, usually shadows the methodical approaches. Thus, one of the reasons for not sustaining a system can be attributed to mistakes committed during either the adaptation or the implementation. In line with this methodical flaws, [19] argues that failures in Lean initiatives result from lack of identified needs and reasons for change, lack of a clear understanding and evaluation, lack of strategic perspectives within the whole context. Other reasons for limited success is the partiality of approach as some companies emphasize only some aspects of Lean (i.e. manufacturing), devoting less attention to other functions such as design and link to the SN of the value chain.

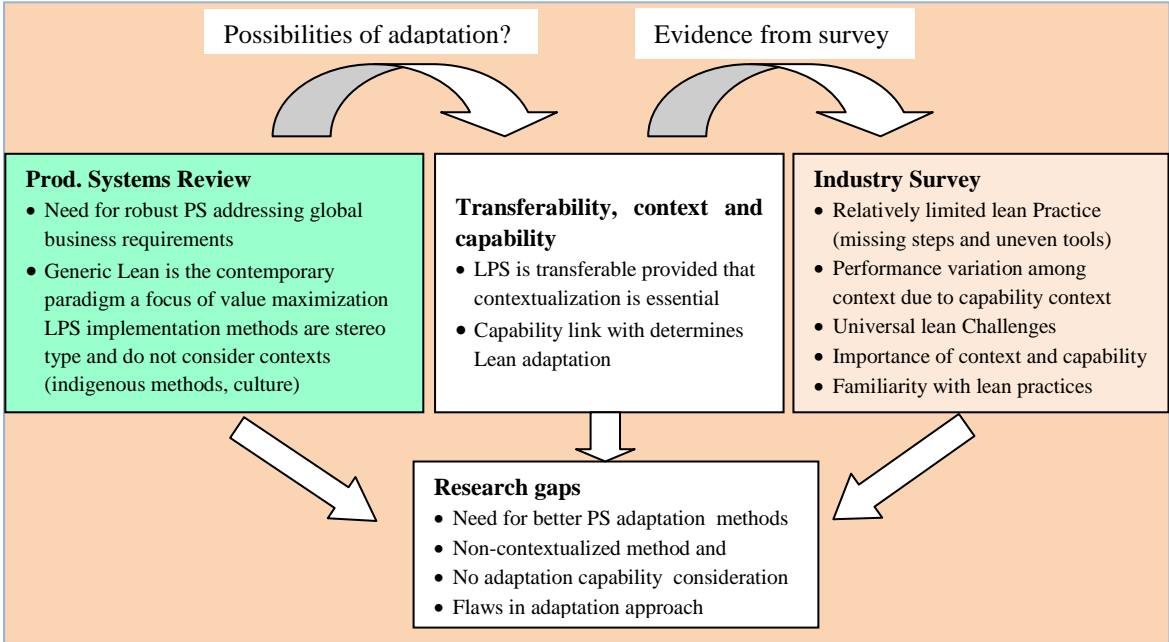


Fig. 5. 2 Schematic diagram how the research gaps are extracted from literature, empirical works and the industry survey

**5.4. Chapter Summary**

Chapter 4 focused on the extraction of the gaps from literature, available implementation approaches, empirical studies and practical surveys. These Lean methods review represents various organizational characteristic from operational, technical and some strategic perspectives. Regardless of abundantly available methods, organizations face problems to put these methodologies to the ground. The result shows that there are observable performance

variations among the cases with surprising similarity in pattern that can be attributed to capability position. In addition, industries give less attention to some essential phases and application of the essential tools and techniques

In general, this chapter articulates the research concerns raised into research gap by stating the impact of context on implementation, extent of transferability, industries' experience, performance variation among different industries approaches and organizational capabilities influences. Based on the research agenda, the research articulates the research gaps. The next step is to propose solution schemes.

## **6. Developing Context-Oriented PS Adaptation Approach**

### **6.1. Chapter Introduction**

Cross-referencing the research gaps identified from related literature and survey results, this chapter develops solution schemes. The gaps in the existing PS approaches include lack of explicit indication to deal with hosting contexts and its potentials and the need for adaptation capability. In a similar token, the approaches followed by the surveyed industries are neither customized nor given attention to some essential steps and techniques. Developing appropriate method with the required capability that takes into account contextual issues is therefore the major objectives for this study.

Consistent with these concerns three solution schemes are developed. Firstly, to address the PS contextualization, a general system adaptation framework is developed. Following the framework, the vital multi-faceted influential factors on the adaptation evolutionary lifecycle are analyzed. Secondly, a more elaborated context-oriented adaptation method is developed that includes exploitation of indigenous method and process emergence perspectives. Then, latent and adaptation capabilities that enables operate in the contemporary SN are pointed out. To exploit the potential solutions residing in the context, mechanisms of developing indigenous methods and managing culture dynamics are developed. The evolutionary trajectories of PS adaptation shows multiple scenarios resulting in context-specific methods for specific industry (context-dominated Lean), universally adaptable context-free methods (Lean dominated) and combination of portfolios.

Finally, the solution schemes and their major constituent elements are synthesized, to outline the complete picture of Lean Journey. The main recurring theme in this approach is that companies need to consider the appropriate organizational culture, adapt to the standard production system package (i.e. LPS), incubate indigenous methods and manage emerging systems while simultaneously developing and using the required adaptation capabilities. While the solution is inferred to the surveyed industries, other industries in similar tracks can get new insights for exploiting their potentials in developing appropriate customized PS.

### **6.2. Evolutionary Framework of PS Adaptation in Different Context**

The Lean adaptation process along the systematic melting of indigenous methods follows evolutionary phenomena. This concept is expressed by using adaptation frameworks, which

addresses the identified gaps in the existing methodologies. It took into account four major interdependent components: observing habitual domains, adaptation approaches, managing emerging process during implementations and redesigning customized PS portfolios, Fig 6.1. The influencing factors such as global business environment, various organizational contexts and Lean requisites will be an input to context-oriented adaptation approaches, which consists of adapting methods as advanced best practice, culture management, developing indigenous methods and building appropriate capability. The implementation of these approaches involves different interacting PS elements leading to seemingly incompatible situations in the form of resistance, conflict, setback, lack of motivation and the like. The condition requires consideration of context oriented approaches. The interplay of both intended and unintended actions as well as the learning involves highly irregular processes resulting in multi-path system emergence so the system trait may not be explained by the behaviour of initial planned actions alone. This leads to a scenario in which adapting modern PS and at the same time exploiting own indigenous method and contextual potentials evolve to a new context-specific or context-free portfolio. In the following sub section, the main components of the framework are discussed with their implication.

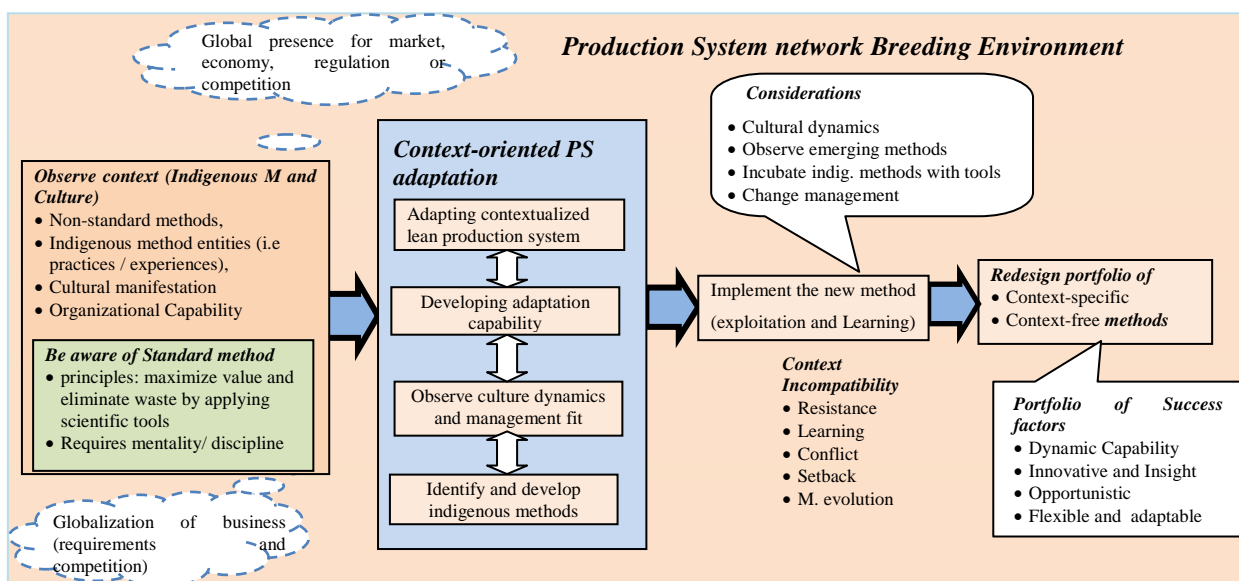


Fig. 6. 1 Production system adaptation Framework: adapting modern PS and exploiting contextual potentials evolve to context-specific and/or context-free PS portfolios, [81]

### 6.3. Influencing Contextual Factors in PS Adaptation

The complexity of all involved factors in the process and context incompatibility with newer PS requisites, the methods face challenges of effective means of transfer. From the review of related literature and the industry survey, it is derived that Lean adaptation is prone to contexts of organizational culture, organizational capability and transfer methodology. These factors coupled with the other Lean challenging factors such as shared vision, management support, lack of understanding, implementation know-how and employee resistance tend to maintain the status quo of the common practices, unless overriding urgency (problem, threat, opportunity dynamic strengths...etc) is apparent. Hence, the adaptation should consider a way to negotiate or penetrate this context shell and gradually replace the old system by the new one. Based on the experts' statements, the easiest way is to comprehend the new method and to customize it to the existing conditions.

Five major contextual factors are identified, which are highly influential and relevant for PS adaptations. These contexts are: contemporary global business, culture, indigenous routines, adaptation requisites and organizational capability, Fig 6.2.

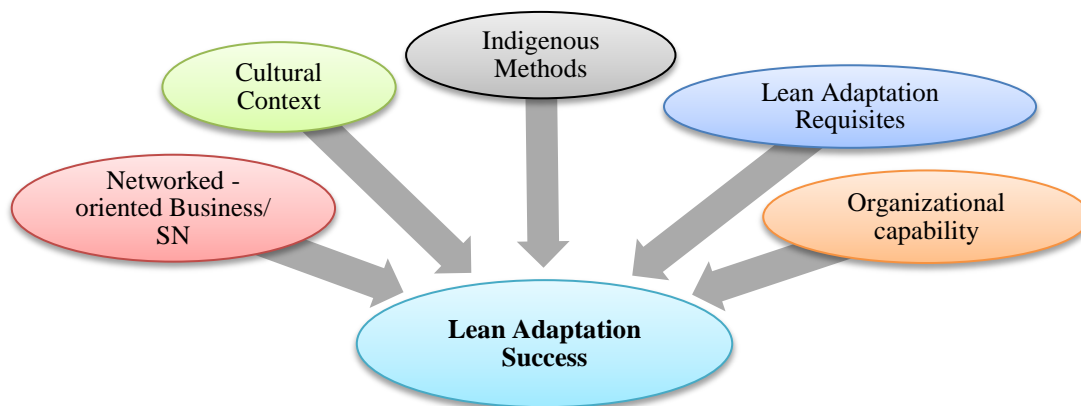


Fig. 6. 2 Contextual organizational factors that influence PS adaptation success

#### 6.3.1. Network-oriented Business

Production, as system phenomena, operates in an increasingly unpredictable environment. Contemporary businesses are operating in production network environment regarded as open systems due to the ever-distributed production trend. Recently, value creation has appeared as a result of networked operations that span across multiple companies and geographical areas



making networking to be a new type of manufacturing feature, [68]. As the business is getting more global, opportunities as well as challenges affect both industrialized and developing countries. The environment bears challenges of necessity for real or implied global presence while at the same time it provides opportunities for adapting readily available standard PSs and the use of network-based complementary capabilities, [45]. As a result, firms either aim at global footprint, outsourcing or operate by looking for more flexible and contextualized production approaches. Partner companies and other relevant stakeholders inquire firms to embrace universal best practice for the sake of establishing mutually beneficial cooperation.

Hence, embracing modern PS approaches and practices become one of the prerequisite for the successful participation in such networks. Leveraging appropriate competencies allows operating and participating meaningfully in the relevant PS network environment thereby contributing to better overarching network interoperability.

### **6.3.2. Cultural Contexts**

The importance of culture as influencing factor arises due to the influence of norms in individual and collective actions of employees. Regardless of generality, the survey responses indicate strong effects of cultural contexts on organizational practices. The studies also show that some culture variables such as lower power distance, high collectivism, and future orientation are positively linked with the overall manufacturing performance, since such attributes facilitate important requisites of modern PS such as open communication, employees' involvement, innovativeness, fact-based decision-making, and the like, [83].

Ironically, the assumption goes to the idea that cultural variables and organizational work norms have influence on adapting best practices leading to immediate reflection of many practitioners to the idea of less compatibility of foreign methods for their culture base, [15]. These assumptions coupled with Lean challenging factors coin a perception on the difficulty of embracing and sustaining foreign methods. The high concerns of respondents in Ethiopian industries reinforce this supposition. Accordingly, cultures that resembles norms of the origin of the method are expected to have higher potential for success than others.

Nevertheless, the adaptations of Japanese organizational practices became common since the 1980s and are accepted globally. The emulation of Japanese practices such as Lean, Just in Time (JIT) and TQM are successful in many countries. The survey in this study gives a vivid

evidence for the Lean familiarity, application of tools and reported benefits. Thus, the debate on cultural effort indicates the possibilities of simultaneous existence of divergence and convergence validity of Lean transferability perspectives, section 3.2.

### **6.3.3. Indigenous Methods**

The adaptors of Lean are culturally different. This makes the sole cultural influences on adaptation less responsible to accommodate the so-called Japanese approaches. The similarity of the performance trend in the surveyed industries, section 4.3, can also be a clear indication for less contribution of culture, at least in the tools' application. Rather, specific organizational routines and indigenous methods influence the success of the transferability. Apart from the modern industrial world, historical artefacts can witness vividly the success of many communities in various production phenomena. The Chinese, Indians, Greece, Romans, Ethiopians, Turkish, Egyptians ... etc, have reflections for such successful crafts from their old traditional knowledge and practices. Once upon a time, these people showed exemplary input-output transformation processes. This experienced and acquired knowledge was supposed to pass through generations. Even though these practices are not visible currently, the potentials to regain these capabilities are highly feasible. Some emerging countries have already determined to bring themselves to the front inculcating their value system in the industrialization process.

Incorporating indigenous approaches into adaptation programs encourage local participation for problem resolution, which can facilitate the implementation and in the long run leads to novel approaches. When identified and exploited, fertile indigenous capabilities not only simplify the transfer but also inspire new methods that can bring benefit to the world beyond the emulators. Though indigenous methods seem to be easy to inculcate or develop, they might be in contradiction or incompatible to governing competitive factors or hardly understandable for partners in the value chain. A thorough understanding is necessary on the general impact and harmony of the identified entity on strategy, overall contemporary business value and ethics. Particularly, during the initial and intermediate stages, awareness to the drawbacks of some non-productive routines is essential. The basis for the methods acceptance should be their explicit contribution to the success of universally accepted PS targets. When they appear contradicting, the priority always be given to the standard practice.

#### **6.3.4. Lean Methodologies Requisite**

Lean methodologies refer to different schemes of LPS transfer, Learning, implementation, customizing and sustaining, that referred here as ‘adaptation’. Generally, there are many types of Lean related methodologies depending on particular problem domains. Commonly known collective methodologies include: Kaizen, TQM, Six Sigma, TPM, JIT and BPR. All of these methods have positive contributions to the high-level Lean metrics of flow, stakeholder satisfaction, quality-yield and resource utilization, Table 1. Consultants and management decision usually influence the selection among these methodologies. For instance, the Ethiopian productivity and quality improvement intervention is typically Kaizen but the objectives and prescribed techniques aspire the features of Lean management, [52]. The same is true with the long journey of Porsche when Lean concepts met the German tradition, embodied in superior technology to form a hybrid system, [125].

The particular characteristics of these alternative methods are that they are typically new for other contexts challenging the commonly held methods. The adaptation of such broad method requires comprehending the underlying basic rationale and balanced application of the techniques. They require certain collective behavioural characteristics among employees such as participation, teamwork, leadership, innovativeness and loyalty, which are in many cases contextually difficult to implement and sustain it, [112]. Wide ranges of organizational issues are involved both on depth level (bundles of practical tools and aligned production resources) and on scope level involving supplier bases. Regardless of contexts, the implementation challenges that constrain the smooth transformations are already verified in the survey. Cultivating these requirements and routines in organizational setup where the work value drivers are different, makes the implementation difficult. Besides, managing transformation and natural change resistance factors trigger context incompatibility, capability requirements, commitment and so on. Extending the application from shop floor to value chain further complicates the processes.

#### **6.3.5. Organizational Capabilities**

Another demanding factor in new PS intervention programs are organizational capabilities, which comprises routines, deployment of new methods, resources, learning and innovation. As per the capability theory, transformation is constrained by the organizational history (hard to overcome grounded constraints), inherited routines and managers’ bounded rationality

(asset configuration, managerial influences), [113]. These routines, available resources and infrastructure constrain company's success in adapting new method and abandoning old methods. While assets could influence the initiatives, the essence of Lean adaptation's success is highly linked with the management of the process emergence or handling of dynamic and non-routinized practices. The adaptation depends on the ability to accept, to exploit, to explore and to develop continuous improvement culture.

With respect to Lean adaptation, the utilization of the techniques, the pace of progress to familiarize with the principles and the relations with stakeholders are influenced by internal capabilities. Moreover, the integration with the suppliers further requires infrastructural bases that can facilitate logistical processes, which is beyond single or networked companies. If many aspects of the organization change simultaneously, like in Lean intervention, organizational capability influences the way to cope with the requirements and to comprehend cause-effect relationships and to integrate multi-tier routines. The survey results clearly showed the influence of organizational capability, whereby German industries were superior in tools utilization and performance improvements than the Ethiopians. To meet the goal of Lean organization that fosters innovation across value chain, companies need to have balanced progressive dynamic capabilities at all levels and scopes.

#### **6.4. Context-Oriented PS Approaches and Adaptation Capabilities**

One of the issues emphasized in this study and incorporated in the general adaptation framework is appropriate adaptation method. Based on the influencing factors, this subsection develops a context-oriented PS method, appropriate adaptation capability, ways to exploit indigenous methods and the dynamics of culture.

##### **6.4.1. Context-Oriented PS Adaptation Method**

The general business situation and the interacting elements in the PS adaptation life cycle have been addressed in section 6.2. The Lean adaptation as a business process strategy should follow appropriate mechanism. The adaptation requires comprehending the underlying basic notions that envision value maximization for customers and the endless learning journey on continuous improvement ladder. The hierarchical constructs and perspectives need to be clear so that every party involved in the implementation, is aware of the conception. The effort is a continual improvement and learning experience that is taking place on actual process and

gradually progressing from reactive stage to innovative learning organization. The journey starts with an assessment of the organizational situation and boils-up to never-ending continuous improvements efforts. When Lean thinking and practice govern the organizational culture at all levels, the evolution brings dynamic capabilities and insights beyond Lean.

PS adaptation refers to the decision to adapt the generic philosophy of value maximizing and waste elimination through application of techniques exemplified in LPS. Awareness about best practices and its opportunity for overall performance leads to this decision. Awareness of management about Lean and its opportunity for firm's overall performance lead to the decision of adaptation. This temporary decision calls for a thorough analysis of the company situations, problems and gaps. Consequently, an effective Lean adaptation program will include deliberate strategic intent and specific design of implementation methods.

At this stage, elaborate and more detailed procedure recipes is proposed addressing the missing critical factors in existing approaches. It considers industries' experiences, contextual implications and potential merits of indigenous methods. The context-oriented PS adaptation approach for the developed Lean Journey refers to organizational intervention in the route that consists of many intermediate patterns and even randomly emerging processes from various interactions of internal contexts and external conditions. As the route is very dynamic involving multiple and seemingly contradicting factors simultaneously, the transformation requires managing emerging organizational processes. Further, as indicated in the survey and literature, (section 2.3.2, 3.5.3, 4.3.4, and 4.4.2), it requires full management and employee commitment and rational and balanced utilization of the tools. Even though system emergence can occur through random trials, deliberately chosen steps based on known Lean phases with in the imposed external or internal constraints are strongly recommended. The seven phases of Lean journey in the prospect of context oriented approach are illustrated in Fig. 6.3.

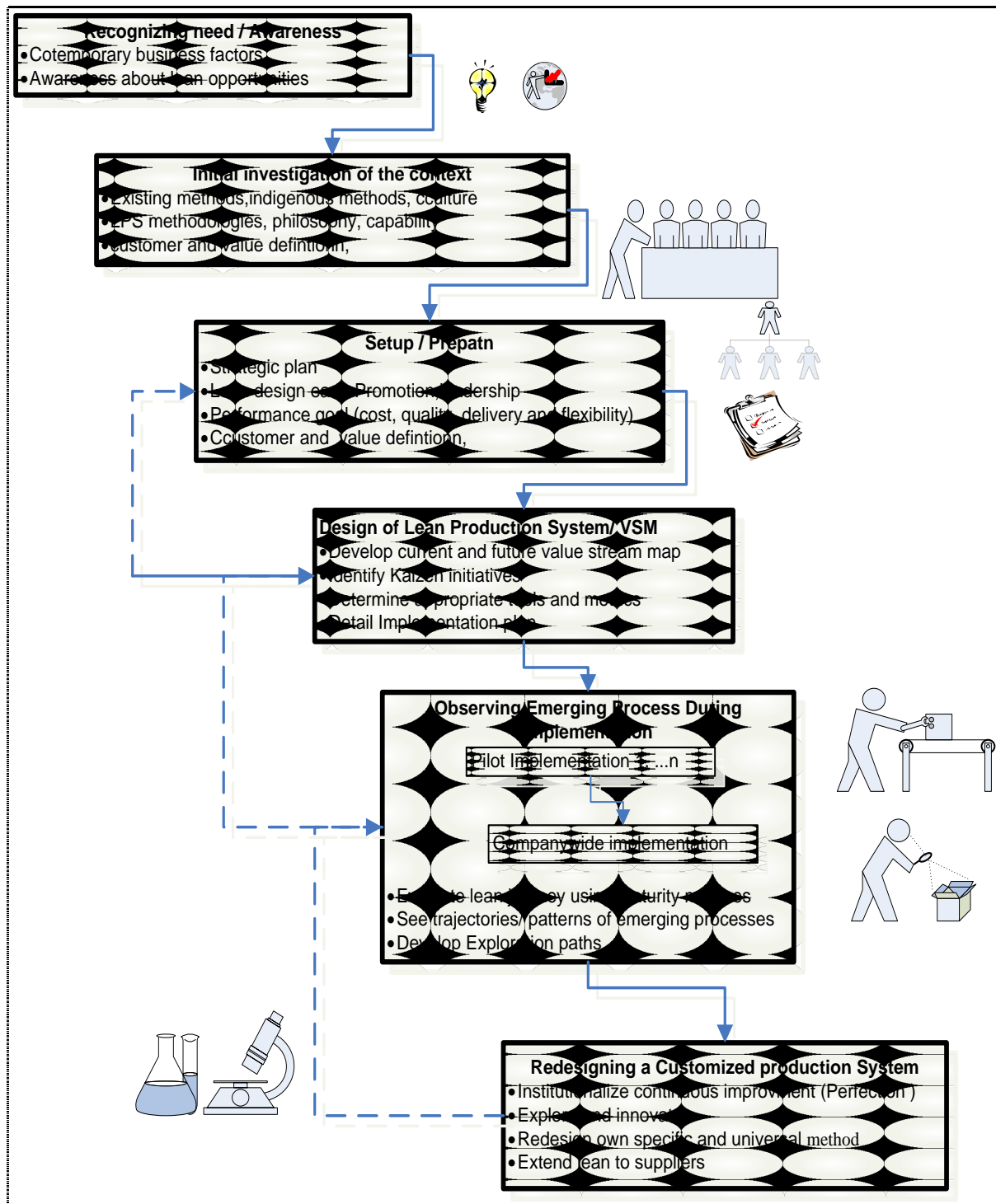


Fig.6. 3 Context-oriented PS adaptation procedure to guide the journey towards Leaning organization,

Phase 1- **Recognition of the need for adapting best practices:** Adapting best practices needs a deliberate and well-thought interventions as it involve tremendous organizational expertise, recourse, efforts and swinging the usual operational patterns. It is not a trial-and-error approach without conviction of decision-makers for its necessity. Rather, the program must get commitment and full recognition from all influential bodies as a best organizational

transformation approach. To begin with Lean route, first, awareness should arise in the management. The triggering factors for the adaptation arise from high level business needs or existing production situations. First, the focus of Lean on maximizing value for customers and maintaining efficiency through production waste elimination is in direct alignment with organizations determined to remain in business. Second, the contemporary business factors such as the need for real or implied global presence, respond to frequent changes in business, fierce competition, ever-pressing customer requirements in cost, quality, and delivery speed and shortcomings in the existing methods always call for better methods. The business environment exhibits pressing needs for adapting universal methods as acceptable operational criterion in the value chain. The recognition of the need for internal efficiency maximization, external opportunities seizing and threat alleviating situations triggers decision-making for LPS adaptation. Thus, adapting organizations must feel these factors and commit themselves to the realization of the program.

**Phase 2- *Initial investigation of the context.*** This is a detail assessment phase, which involves the investigation of the existing circumstances from different perspectives. The traditional PS conditions usually have non-Lean method, indigenous method entities (i.e. practices / experiences), commonly held work culture manifestations and other as-is potential capabilities. Often, these contexts may generally counteract to any newly introduced improvement initiatives, unless overriding urgency (inherited as-is strength, problem, threat, opportunity) is apparent. Given these conditions, Lean as standardized method package with its explicit philosophy of waste elimination and customer value, brings organizational practices, which require suitable work mentality and discipline. The identification of these factors and Lean success requirements helps companies in devising subsequent strategic operational mechanisms, section 6.3.

**Phase 3 - *Setup or Preparation:*** The preparation phase involves setting the necessary groundwork for adapting this paradigm as a guiding philosophy. The activities include: defining customer and customer value, developing implementation strategies, establishing implementation leaders and team(s) and determining key performance parameters and targets. The strategy should address contextual success factors such as available knowledge and experts, analyzing structural implications with respect to the companies' norms, roles of indigenous methods, capability development mechanisms and other relevant issues, section 6.3., 6.4.3 and 6.5.1.

Phase 4 - ***Design of the new method/ VSM***. The design of PS involves recording of current value stream, developing future VSM for key product family of the company, listing Kaizen initiatives based on the identified wastes in the VSM, determining appropriate tools and their rational application, establishing more detail success indicators with metrics, developing detail plan with time frame, determining the necessary supporting resources. This phase determines the path to be followed in the implementation and must be documented as a guiding book. The Lean policy deployment in [46] is an important tool to capture all vital factors in the design process. The indigenous method entities, culture moderation and other contextual implications need to be clear so that future VSM is contextually sound. Both current and future VSM and the overall aim of the program as well as its attitudinal and technical requisites need to be communicated to the employees and their awareness on the new route must be promoted.

Phase 5 ***Pilot and companywide implementation***: from the designed VSM, sample projects are implemented on specified pilot areas to get feedback for the designed VSM and detailed implementation plans. Accordingly, both design and plan are revised as per the experiences in pilot implementation, if deemed necessary. Then, the implementation extends to the companywide level whereby the future VSM (door-to-door) is implemented across the production areas and lastly entire company. Ultimately, the implementation is extended to suppliers and customers. For the success of the implementation, consideration of the match between the new method and contextual culture, identifying and incubating indigenous methods and observing emerging methods is essential, section 6.5 and 6.6.

Phase 6 ***Observing emerging processes during implementation*** - this phase is not necessarily successor of the previous phase. It happens in the entire intervention process. The pilot case is an example. It is a check and balance effort in order to see the actual implementation processes and their resulting emerged methods. The whole journey is evaluated using Lean maturity metrics and the trajectories of the transformation will be drawn. Especially, when culture is considered as moderator and indigenous methods are integrated, the emerging PS will take a new and probably unpredicted form, based on the contingencies and the impact of the context. The resulting amalgamation induces different forms of work culture schemes and action patterns. This evolutionary process requires observing cultural dynamics and incubating indigenous methods, organization learning from emerging incidents, transformation process and matching capability. Based on the evaluation result, promising



patterns of methods are explored further, which lead to the consolidation of own PS model. It is expected that the context interaction with newly adapted methods will provoke resistance, learning, conflict, setback, and other sorts of reaction and challenges. The transformation process requires alertness to core themes of change such as culture conditions, contingent leadership (top-down and bottom-up), management support, effective communication, rewards and close follow-up.

**Phase 7 *Redesigning a customized production system*.** Pursuing perfection in the Lean term implies measurement, feedback, continuous improvement learning and trial to achieve higher level of Leanness. After sufficient implementation experience on this line, a new production method hybridized with contexts and managerial transformation efforts, emerges. Accordingly, up on deliberate consideration of contexts, the new method will be enriched by either moderated organizational culture or indigenous methods or the combination of these factors depending on the degree of dominating contexts. Hence, the redesign of the own PS consolidated with indigenous gains becomes necessary. The resulting trajectories are context-specific methods for a specific industry or locality, adaptable context-free methods and the combination portfolio of these methods, section 6.8.

Lean as destination represents a highly capable organization, possessing a competence to operate dynamically in the value chain. This organization would have successfully implemented a future VSM initiative confirmed by the established metrics. The exploration and innovation process enables the company to generate dynamic capabilities that are important to acquire the strategic flexibility to adapt to changes and thus to secure sustained competitive advantage in unstable institutional situation. The learned capability enables the company to play an orchestrating role in the production network environment.

## **6.4.2. Context-oriented PS Adaptation Capabilities for Enhanced SN**

### **6.4.2.1. Link among PS adaptation, Capability and SN Practice**

The interrelation between PS adaptation and DC and their strong link with SN can be described using system perspective, Fig 6.4. The diagram conceptually illustrates that the need for change is triggered by influential global business environments (competition, SN requirements, change...) and internal method deficiencies. To respond to this need, organizations require appropriate PS. The PS, as an integration of resources and routines to effectuate input-output transformation process dynamically reacts with the business contexts,

requiring continuous revitalization of PS to meet the entire stakeholders' expectations. The adaptation requires DC to learn and improve these best practices.

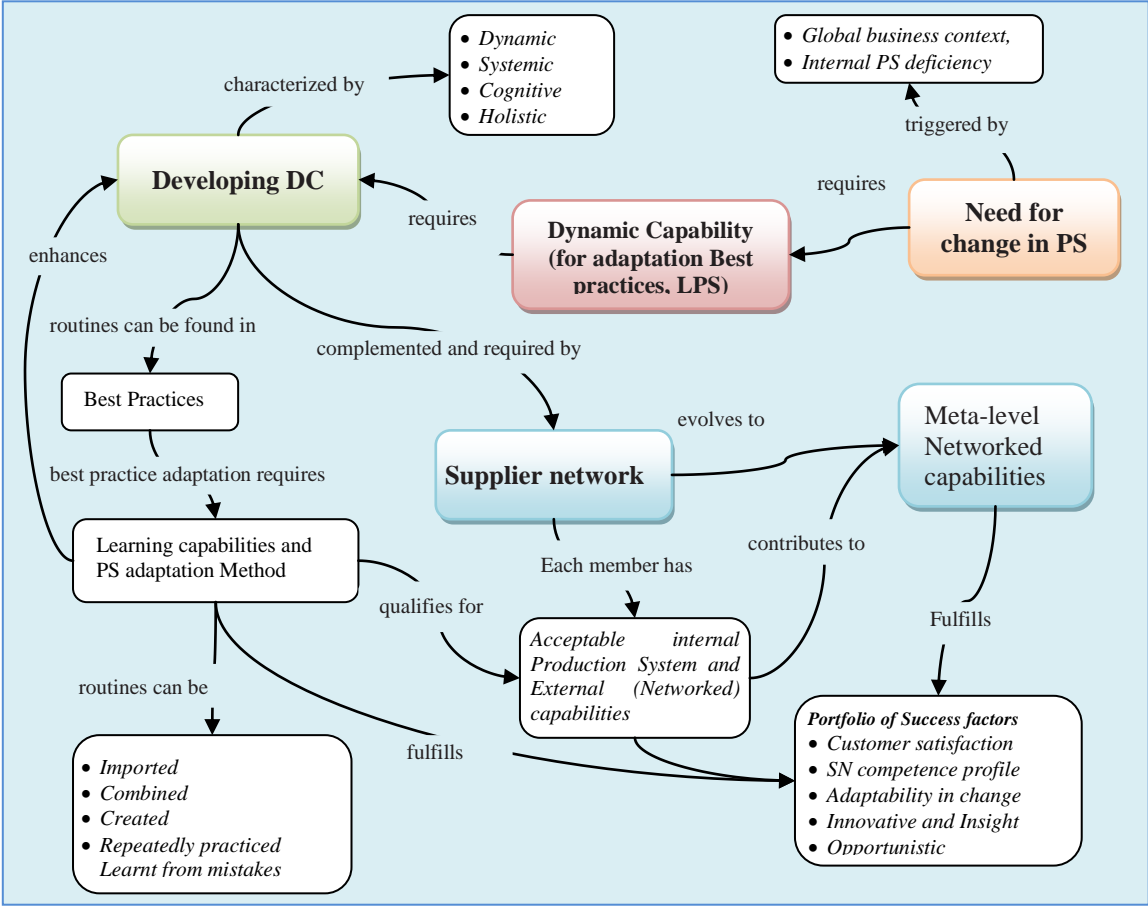


Fig. 6. 4 Conceptual relations among PS Adaptation and DC in enhancing SN operations

Developing such dynamic PS requires adapting best practice routines (identifying, selecting, imitating, modifying, improving and renovating) and generating own new ones. These routines can be imported from successful adapters through networking, following certain lines of action (contextualized adaptation methods, codified ‘best practices’) and repeatedly practicing them while learning from the mistakes and improvisation. Repeatedly practicing the best practice routines and developing behavioural patterns in implementing these techniques generate potential capabilities. By creating new routines exploration learning and handling non-routinized system emergence enhance the sustainability and dynamicity of the capability. A systematic progress in implementation of Lean methods gradually qualifies for acceptable internal operational routines (Production System) and external capabilities to join the supply network or operating in the value chain processes sequence of ‘make, source, deliver, plan and return’.

Thus, the supply network is formed by capable industries to jointly compete as per the global and local business requirements. The network embraces members that fulfil internally efficient PSs and externally good relations. Hence, to join the network, each network member must be qualified for acceptable DC. Each member of the supply network represents a unit with relevant competence and contributes to the high-level Meta capability. In return, the supply network provides complementary capabilities for scarce resources, technical and market knowledge which is also a source of routines for further DC development. This SN integration develops a high level Meta-capability, which secures different portfolios of success factors in the contemporary business environment. The combined effects of essential capabilities brings many competencies together as shared pieces of knowledge and routines that enable wider access to markets and generate sustained competitive advantage. The commonality of Lean and DC in terms of purpose and role is already shown in Table 6.

The systemic view of capabilities and PS adaptation along their link to supply networks assumes that organizations possess certain level of capabilities, which enable them to learn new methods. By definition, transformation is a function of current position (as-is capability) and the paths ahead (i.e. designed method). Hence, features of as-is or latent capabilities influence the inherent organizational dynamism for pursuing best practices' adaptation.

#### **6.4.2.2. As-is and PS Adaptation Capabilities**

One of the basic concerns in adapting best practices is the required adaptation capability. The surveyed industries both in Germany and in Ethiopia show implementation of Lean in various levels of intensity. Specifically, the external relation or supply network practices are less for the majority of industries, indicating gaps in close cooperation within the value chain. The extracted opinions from the experts such as lack of know-how to implement and sustaining the success are associated with capability factors. The operational and strategic dependability of organizations is based on establishing sound internal and external capabilities. For building competitiveness, the adaptation processes need to be matched with required capabilities. This subsection identifies possible features of as-is capabilities and required capabilities that match to the context-oriented PS adaptation method.

##### ***Features of as- is capability***

The as-is capabilities are closely related to potentials residing in organizations, learned and adapted experiences, indigenous method entities available in the society. Every firm has its own habitual domain (HD), which will lead to diversified behaviors and potentials according to the environmental changes. In the positive-effect, it increases responsiveness and in the negative-effect, it may become rigid, which hinders the response capacity in a turbulent environment [136]. As the intervention is typically a new way of doing things comprising broad and complex socio-technical organizational and operation experience, its absorption demands benign situation. As per HD theory, people have habitual ways of thinking, judging, dealing with problems, acting, and responding to changes affecting the adaptation process, [136]. In this study, seven latent capabilities are identified, Fig 6.6, which can influence the adaptation processes and their readily availability prior to Lean commencement, determines the relative success of the intervention.

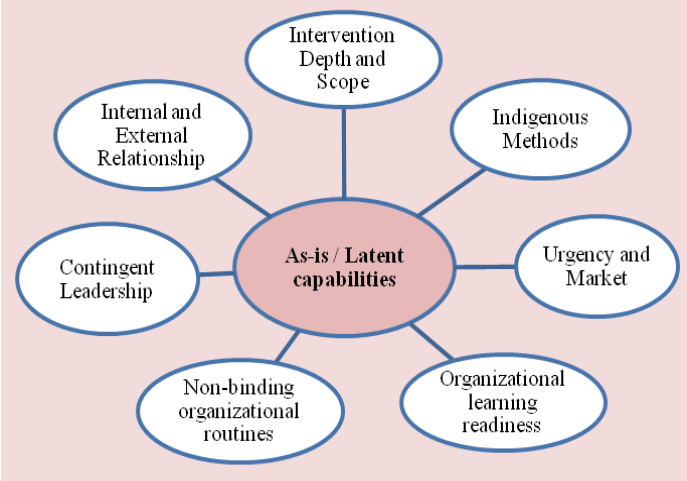


Fig. 6. 5 Factors for as-as context (latent capabilities) that determine the organizational readiness for PS adaptation

The factors that positively influence readiness for Lean adaptation include:

- 1) **Non-binding organizational routines**: organizational routines as a pattern of doing things can facilitate or inhibit learning from newly introduced method. In Lean journey, new pattern of processes and practices are combined in new organizational setup. New methods from outside contexts are internalized and the existing indigenous and learned routines compromise, enrich, or readily accept the imported practices and approaches. Many deeply rooted factors in the routines often colour the change initiative with unique

capabilities. Flexible and non binding routines facilitate Lean success. Hence, the change can be constrained by history and inherited routines.

- 2) ***Contingent leadership***: both transformational (enforcing to-down style) and transitional (democratic participative style) leaders play a great role in facilitating the organizational transformation. As a change agent, those who guide the intervention with a combination of both characters can shake the stagnant and defensive routines, facilitate exploitation and exploration learning. The presence of such personnel asserts the organizational readiness to Lean adaptation.
- 3) ***Indigenous methods that can facilitate systematic adaptation***: some traditional values and practices can be used systematically to promote attitudinal and action changes such as loyalty, patriotism and other elemental practical methods. The methodical entities include traditionally developed routines that are deeply engrained in the value but may not be formally incorporated in production approaches. Indigenous entities in favour of Lean requirements facilitate the adaptation success.
- 4) ***Organizational learning***: Learning capabilities represent patterns of firm-specific ability of handling repetitive (routinized) problem solving cycles, handling of non-routine system emergence to acquire effective routines. Absorptive and imitation capabilities for newer practices determine flexibility, adaptability and agility to enrich and explore new methods.
- 5) ***Urgency or market***: sever threats from competitors or attractive opportunities always stimulate changes. If such triggers are prevalent in the business environment, there is a high possibility to readily accept and sustain new methods. Urgency conditions are not necessarily a lasting motivation as organizations may slide back to old ways if the threat is relieved or the opportunity is secured.
- 6) ***Internal and external relationship orientation***: In the contemporary business, companies operate in collaboration. To fit in such collaboration network, internal operational capabilities need to be maintained and balanced by external relations. Appropriate external relation with partners and customers is a source of knowledge and technical expertise. A balanced approach to internal operational efficiency and good business relation with customers keeps the organization alert and fit for anticipated changes in business as well for extended Lean enterprises.

7) ***Intervention depth and scope***: this refers to the size of an organizational unit, subject to change. Obviously, dimensions such as pilot versus companywide or small versus large and complex organizations are not equally benevolent for transformation. Hence, overall easiness depends on the size of the company, the peoples' profile involved and the special characteristics of business and industry. Piloting and planned approaches as well as rational applications of imported methods may facilitate approaches.

These as-is factors must be given attention, in the surveyed industries in order to enhance the chances of success and develop corresponding capabilities in the implementation process. In the surveyed industries, these issues are not addressed in adequate way. For instance, many of large Ethiopian industries impose the adaptation on company-wide level without the consideration of piloting. Leadership, learning and balanced relation concerns were also under-managed. The significance of these factors is that companies can self-analyze whether they can readily pursue the transformation or can take affirmative reform actions before commencing or give emphasis on as-is factors during the preparation and the implementation stages. These capabilities can be developed systematically using continuous training, organizational learning, open and frequent communication, incremental change, exploiting indigenous methods and managing of emergent processes.

#### **6.4.3. Profiles of PS Adaptation Capabilities**

Capability development generally focuses on repeated practices and purposeful learning with actions. The routines could be sourced from procedures of prior organization, combination of accessible routines, real-time experiences and indigenous methods. At the core of capability development is the exploitation and the deployment of new methods and gradual creation of new routines. DCs enable to sense and shape opportunities and threats, to seize opportunities and to maintain competitiveness through enhancing, combining, protecting, and if necessary, reconfiguring the business enterprise's (intangible and tangible) assets', [114].

LPS adaptation is a form of organizational capability development program that intends to internalize best practices for competitive advantages, [68]. The hierarchical integration of routines from core operational routines into integrated SN routines challenges PS any adaptation endeavour. From capability development perspective, best practices cannot be imitated easily because these routines represents integrated knowledge of specific tasks, aggregated to high-level organizational or supply network operations, which leads to poor

imitations of the practices, [13]. Lean represents distinct task level best practices as well as higher-order managerial processes. Accordingly, the inter-functional and inter-organizational integration of routines that form core competencies become unique and hard to replicate.

Regardless of the difficulties to imitate, any context-oriented adaptation is found to be feasible, provided that learning is the core ingredient for success, section 3.2. Only, the use of best practices, which combines a wide variety of “bundled” management (best) practices in an integrated system, eventually lead to superior performance, [4]. In world-class manufacturing superior results are achieved by certain lines of action, [13], [70].

Hence, the strategic value of adaptation is justified if the capabilities to be developed are relevant to customers’ needs and learning, improvement and codification remain possible. Developing and changing organizational capabilities base upon repeated use of appropriate behaviour, solution of problems and learning from failures, [40]. To pursue Lean program, the organization should have these minimum capabilities. Firms with little inherited routines can respond to change by adapting, combining and repeatedly executing these routines. They enable to build higher capability as long as *desire* and the *willingness* to learn are apparent.

The extent of success is highly linked with adaptation capabilities. If there is no proportionate dynamic capability along the progressive phases, the implementation is deemed to fail. In fact, it is the learning capability that realizes the new methods. The PS adaptation capability has to be defined as the basic organizational capability including imitating, assimilating, modifying and renovating a contemporary PS by sensing opportunities and threats of influential factors. It involves learning new methods, repeated practices, systematically modifying and improving them in some ways that enhance competitiveness.

The Lean organizational learning process for the adaptation is usually done by Plan-Do-Check-Act (PCDA) cycle and stresses integration of cognition, action, theory and behaviour, [49]. When improvement becomes a new standard, the next cycle is setup for further improvement-Kaizen self-practicing. Accordingly, it includes the knowledge part (know-what) and the skill development (know-how), which will induce changes in attitudes. The principles of pursuing perfection through continuous improvement routines keep the capability development process active by continually energizing absorptive capacities, so that solving problems or exploiting opportunities will not stop because of temporary success. This

repeated practice at every stage of improvement builds confidence and stabilizes the process and lastly, dynamic routines make the company flexible to take any path.

The adaptation processes is commenced with the recognition of changes, designing the transformation roadmap for change, managing emerging processes during implementation (exploitation and deployment, consolidating the design for the context and finally becoming learning organization, Fig 6.6. The techniques lead to the development of routinized dynamic capabilities, which eventually ends with exploration and innovation of new methods that enable to acquire strategic flexibility for changes and secure sustained competitiveness.

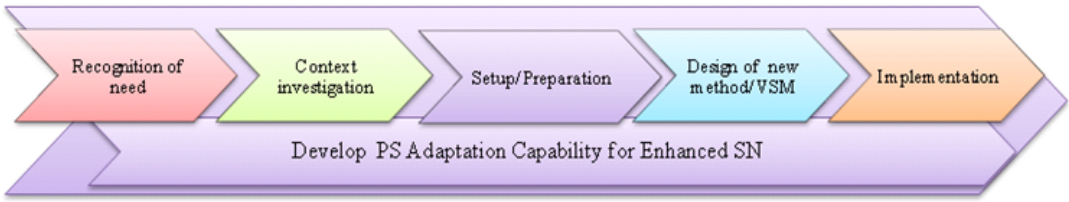


Fig. 6. 6 Simultaneous progress of Lean with PS adaptation capabilities developments

Taking into account all proposed phases to Leanness, the required capability issue corresponding to PS adaptation is developed, Fig 6.7. Even though the focus and scope of implementers may vary from industry to industry, these steps will hold true to many industries. However, the capabilities required in each step, need to be supported. The PS adaptation is linked with the organizational ability of exploitation learning and improvement.

To match the capability profiles with the lean adaptation phases, the required competence inventories identified and developed into adaptation capability profiles. Fig.6.7 depicts the Lean phases, activities and profiles of the required adaptation capabilities. The Lean adaptation phases are: context investigation, preparation, design of the new method (VSM), pilot and companywide implementation with many intermediate patterned and randomly emerging processes. After observing the emerging processes and consolidating the results with the specific organizational context customized PS is redesigned. The phases are connected with feedback loops to monitor the progress.

During execution, each phase requires various activities, which are listed next to respective phases (second column), and corresponding Lean adaptation capabilities (third column) to execute each Lean adaptation activity. For instance, ‘need recognition’ requires activities that promote the awareness for PS change and the identification of potentials and opportunities



available in the best practice adaptation. This entails decisions for adapting new method to alleviate existing PS inefficiency and aspiring efficient operation in the SN environment. Sensing and business environment scan help to capture the internal and external contextual factors and to screen out a prioritized articulated strategic and operational needs. These appraisal activities, however, need appropriate organizational capabilities such as the □ability to sense the need and adapt best practices as well as inherent organizational capabilities that enable to accept, apply, improve new methods. The availability of supportive capabilities gives a momentum for development of further DC through repeated practice and purposeful learning. Similarly, the Lean implementation phase needs a list of activities including provision of resources, training, applying basic tools, etc. These activities need capabilities to handle system emergence to generate dynamic capabilities through combining routines in new ways, to adapt to changes and to support sustainability (knowledge sharing, career growth, culture). The dynamic routines create behaviour patterns of actions codified operating procedures, heuristics, etc. and ability to engage in previous capabilities. Other phases have also comparable profiles of activities and capabilities. These PS adaptation capability profiles enable companies in robustly adapting, improving and redesigning a customized PS. Further, the recommended capabilities in lean journey give a new perspective on developing appropriate competences along the lean adaptation.

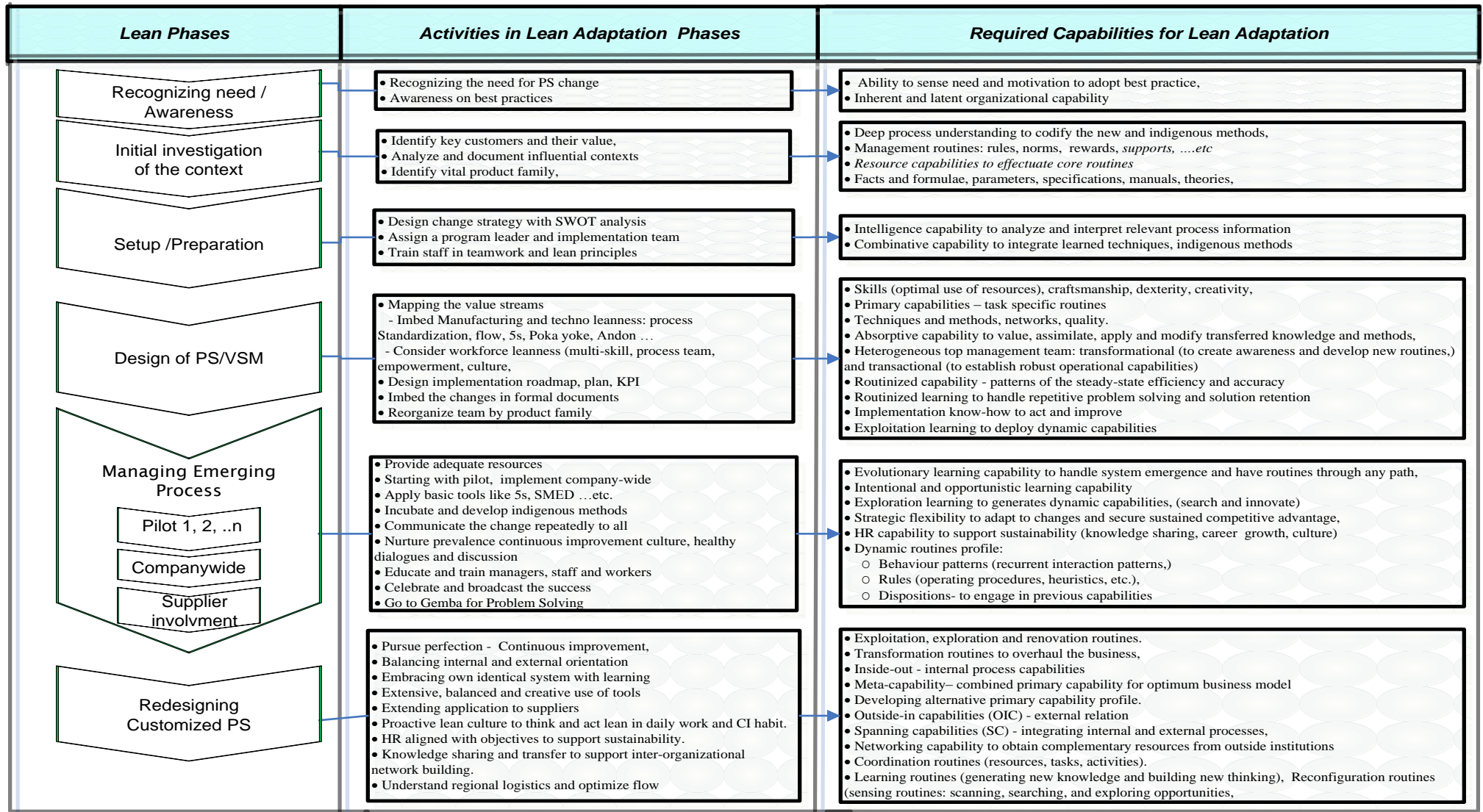


Fig. 6. 7 Context-oriented PS Adaptation: Lean phases, activities and profiles of the required adaptation capabilities

## 6.5. Observing Culture Dynamics and Fitting Management Techniques

One of the context-oriented approaches is using appropriate management techniques that can reduce the level of context incompatibility and facilitate better adaptation scenarios. This implies, in one hand, observing culture and fitting management techniques and on the other manipulating the culture dynamics for developing the desired work culture.

### 6.5.1. Observing Culture Moderated Management

For better adaptation scenarios of Lean programs, harmonizing the Lean requirements and the influential factors may reduce incompatibility problems. This means moderating between cultural characteristics and appropriate management techniques to ease the implementation process by admitting the concept of management technique particularity for every culture. In this view, a company in a high power distance country may apply certain hierarchical and rule based methods. Accordingly, organizations that relate their national culture with certain appropriate manufacturing practices have better chances of manoeuvring the adaptation endeavour with less tension and cultural conflict. Even though, the work culture influence on the success of Lean is not conclusive, section 3.4, there are certain managerial recommendations on how to fit cultural dimensions with apparently fitting management practices. This approach could be an alternative technique for those who have difficulty to break the culture barrier. Taking the surveyed context, sample managerial hints with corresponding Hofstede's cultural dimensions are indicated in Table 7.

Table 7 Managerial implications of Hofstede's cultural dimensions for Ethiopia and Germany, based on [48]

<i>Culture Dimension</i>	<i>Ethio Score</i>	<i>Managerial tips (Ethio)</i>	<i>Managerial tips (German)</i>	<i>German Score</i>
Power distance (PD)	High (70)	<ul style="list-style-type: none"> <li>• Acknowledge a leader's power.</li> <li>• One need to go to the top for answers</li> </ul>	<ul style="list-style-type: none"> <li>• Use teamwork.</li> <li>• Involve people in decision making.</li> </ul>	Low (35)
Individualism (IDV)	Low (20)	<ul style="list-style-type: none"> <li>• Show respect for age and wisdom.</li> <li>• Suppress feelings and emotions.</li> <li>• Respect traditions and commence change slowly.</li> </ul>	<ul style="list-style-type: none"> <li>• Acknowledge accomplishments.</li> <li>• Don't ask for too much personal information.</li> <li>• Encourage debate and expression of ideas.</li> </ul>	High (67)
Masculinity (MAS)	High (65)		<ul style="list-style-type: none"> <li>• People expect male and female distinct roles.</li> <li>• Advice men to avoid emotionally based decisions.</li> </ul>	High (66)
Uncertainty avoidance, (UAI)	High (55)		<ul style="list-style-type: none"> <li>• Be clear and concise of expectations and parameters.</li> <li>• Plan and communicate often and early, provide detailed plans, focus on tactical job aspects</li> <li>• Express emotions through hand gestures and voices.</li> </ul>	High (65)
Long-term orientation (LTO)	Low (35)		<ul style="list-style-type: none"> <li>• Expect to live by same standards and rules you create.</li> <li>• Be respectful of others.</li> <li>• Do not hesitate to introduce necessary changes.</li> </ul>	Low (35)

### 6.5.2. Manipulating Culture Dynamics

Rapid change in business due to global influences, cultural learning, imported new organizational practices and business standards cause the emergence of different ‘negotiated culture’. Exposure to international media, cross-border commerce, international political and economic competition facilitated cross-cultural exchange experiences, [33]. The global culture influence is common in everyday life of people in home, life styles, language and so on due to the effect of multi-media channels and mass communication. PS approaches and work cultures can also be learnt from such sources by bringing them systemically to the stage of organizational learning. Moreover, the organizational setup constrains people’s behaviour in certain ways by virtue of employment such that management can create, maintain and change the employee work culture. The business dynamics, organizational contingencies, global influencing factors and individual malleability reshapes a culture through learning, repeated practices and cultural friction. Organizational culture frameworks affirm also different value orientations such as hierarchical, rational, group, and developmental, [104]. Hence, culture reform can play an important role in aligning the interplay between particular culture and Lean execution. As a result, changes in psychological commonalties will experience new value.

The amalgamation among the new methods, indigenous methods entities, existing and modified organizational culture will result in different interaction schemes. Hence, on the implementation process, not only the static culture but also the dynamic universal culture should be aimed at. The possible influencing factors to cultural change are strategic orientation, contingencies, globalization, effect of management actions, business challenges, individual learning behaviour, learned experience from new method and societal culture, Fig 6.8. Unlike culture-moderated adaptation, the dynamic culture perspective stresses the manipulation of culture to fit desired state by influencing the context if deemed appropriate.

Accordingly, the organization task is to manipulate the dimensions to develop suitable organizational culture, such as participation, teamwork, leadership, innovativeness, loyalty and the like. Hence, in adapting new PS, the effort is to establish ‘ought to be’ issues in the continuum from as-is culture (existing manifestation) to the ideal desirable cultural value so that destroying unproductive work cultures become possible.

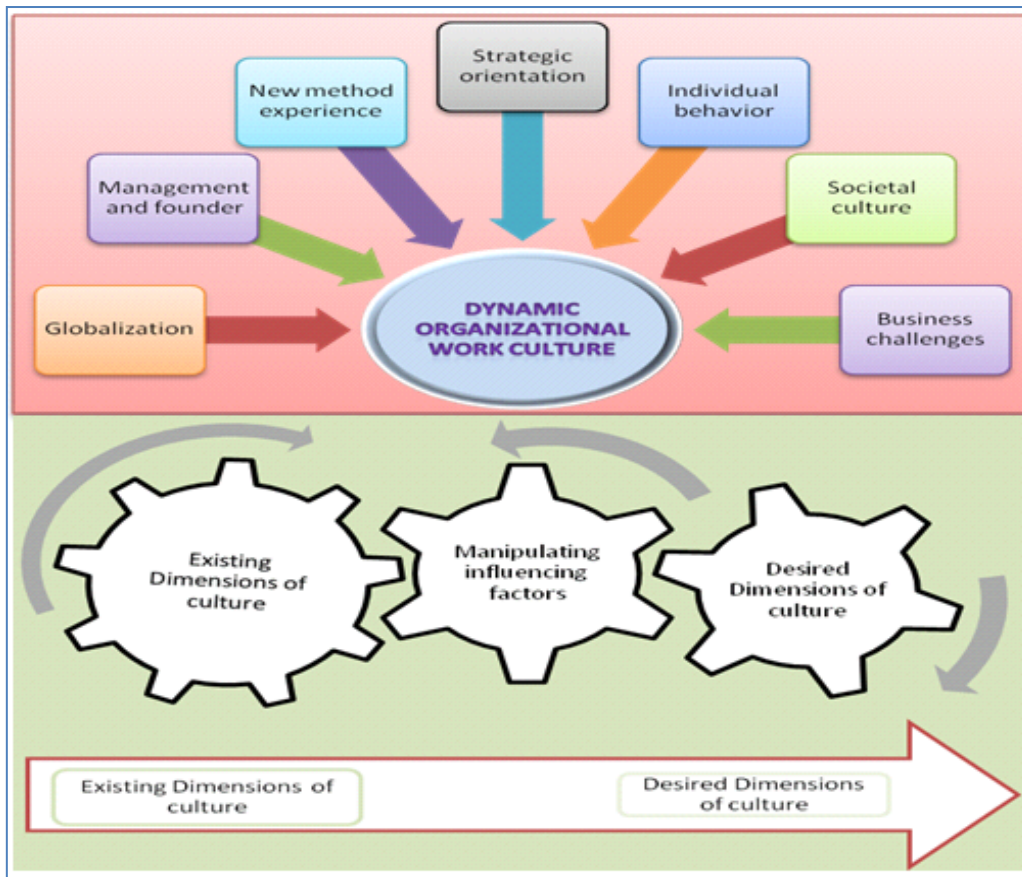


Fig. 6. 8 Organizational culture and factors influencing culture dynamics: Manipulating existing condition to have desired state

### 6.6. Developing Indigenous Methods

The essence of developing indigenous methods' as part of context-oriented method is to observe the local practices and values with the intention of simplifying, verifying, modifying and developing these practices along the new methodologies. Every community maintains its own indigenous knowledge systems and practices that can be articulated properly and incorporated into organizational operations. They can provide a firm base for increasing productivity and building a more sustainable development strategy. Identifying and incubating imperative traditional practices and learned experiences by exploiting different viewpoints from history, culture, values and practices of certain socio-technical background on thematic problem, more penetrating and insightful ideas can emerge. The collective behaviour, patriotism, war practices, group works in social events, selective practices of many nations and nationalities can be taken as initiation for indigenous methods. As an example, in the some Ethiopian industries, a long-year war practice has been evolved into a good team

orientation, fostering dialogue and discussion in manufacturing industry setting. When identified, these fertile capabilities not only simplify the transfer but also inspire new approaches, [84]. There is high prospect to support adapted PS with indigenous methods not only to generate effective local solutions but also contributing to universal methods.

Besides, companies are not supposed to imitate all foreign methods disregarding their rational creative capability to contextualize or develop their own system. Practically, many of the dominant existing management and production techniques are typically taken from western approaches and others. Applied cross-nationally, many of these approaches are biased and their features may not be replicated in other nations' condition. Even though Lean is Japanese for non-western and for non-Japanese affiliated contexts, all approaches have difficulties in adaptation. However, much scholarly work are concerned more on westernization of Lean, which can be another bias. Therefore, it is important to identify a particular deep-rooted cultural capability to benefit from its volunteer potential. There is an immense opportunity and possibility to revitalize this capability to maximize learning, and creativity of respective contexts. In essence, what are useful and valuable are retained and integrated to generate a synergistic work culture with socio-cultural realities and functionally, [117].

The procedures to identify, to incubate, to develop and integrate indigenous methods with Lean consists of assessing and identifying the entities, merging and splitting identified indigenous entities that support Lean, observing possible integration and evolution scenarios with Lean method and differentiating between specific and universal trends, Fig. 6.9.

In order to carry out the incubation and development steps, a separate team is formed from the Lean adaptation committee that can assess and identify possible indigenous method entities. The team should have a thorough understanding of the Lean principles and techniques so that they do not violate the governing business values. Using discussion and interview techniques with the employees and the society as well as classic and new local literatures, they identify lists of indigenous method entities for further consideration. The entities include traditionally developed potential routines that are not formally incorporated in production approach. They can be also observed artefacts, patriotism, traditional practices and other values that promote changes for better. The incubation of these indigenous methods advances from simple application of existing methods at some locality to the progress of exposition of the indigenous method to the world.

1. Adopt/ exploit the lean method and verify compatibility to the context.
2. Assess and identify indigenous method entity, find/ discover unique indigenous method that can be modified/ revised with the adapted methods,
3. Identify indigenous methods that support lean principles, build new conceptual method to complement the adapted method principles using inspirations from classical thoughts and values of the community and organization founder.
4. Integrate and synthesis adapted and indigenous method by employing controversial debates, like flexibility-stability; internal efficiency vs. external market; and so on,
5. Observe evolution of indigenous methods and lean method, develop portfolio of methods.
  - Context-specific method – difficult to imitate
  - Culture-free – generalizable, extendable to the world and replicable

Fig. 6. 9 Procedures to develop and integration indigenous methods

Although a thorough investigation is necessary on the common Ethiopian Indigenous systems, there are some known potential sources of indigenous constructs and practices. Some of the basic sources are the philosophically of diverse ‘school of thought’, including Ethiopian traditional wisdom, religious courtesy, social negotiations and others. The well established practices of Debo (team work), Edir (social cooperation and network), Equb (financial system), Geda (Oromo administration system), traditional religious schools, war approaches and other tribal wisdoms can be rich sources for many constructs. Attention must be given also to traditional practices like in Awramba people practices and other unexplored tribal systems. These concepts and theories are not exploited yet and wide open for both theoretical and empirical enquiry. In this sense, there is a need for renaissance and enlightenment to modernize PS approaches in respective contexts. Important Ethiopian practices need scholarly attention to bring practical insights for addressing pressing problems in the context. The Ethiopian Kaizen institute may lead and support this initiative to maximize the efforts in the exploitation of such indigenous methods.

### **6.7. Synthesis of the Solution Schemes- Putting it altogether**

Section 6.2 through section 6.7 of this chapter puts the solution schemes of the research. In this subsection, the developed methods are synthesized to illustrate the complete methodical procedure, Fig 6.11. It is organized in three main stages: as-is and PS context (pre-Lean entry contextual situation), managing emerging process (during Lean journey) ranging from entry to the level of full implementation followed by consolidated and customized PS and lastly becoming learning organization. In this expedition, companies need to consider the contexts by observing cultural dynamics, developing indigenous methods and adaptation capabilities.

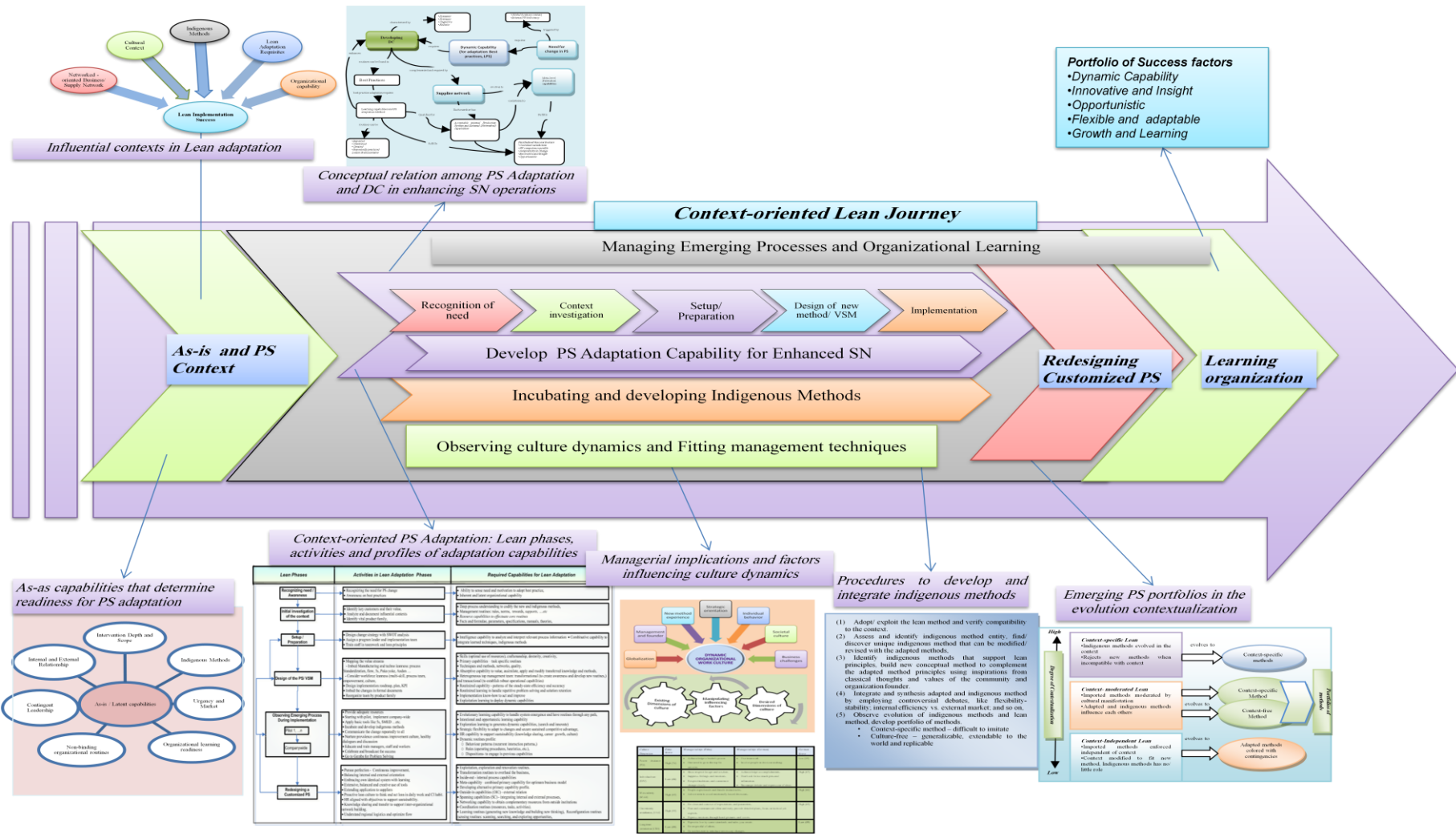


Fig. 6. 10 Context-oriented Lean journey - Synthesis: The journey starts from as-is PS context. Context-oriented Lean phases with required adaptation capabilities and simultaneous exploitation of cultural dynamics and indigenous methods lead to the redesign of customized PS that enables to become learning organization.



At the pre-entry level, influencing factors for PS adaptation and the as-is potential determines the readiness to adapt and pursue Lean journey. The highly influential and relevant contextual factors are: contemporary global business, culture, indigenous routines, adaptation requisites and organizational capability, section 6.3. The as-is factors are: non-binding organizational routines, contingent leadership, indigenous methods that can facilitate systematic adaptation, organizational learning readiness, urgency or market, internal and external relationship orientation, intervention depth and scope, section 6.4.2.2. The awareness to the contexts and the availability of basic capabilities to learn and improve prior to the Lean commencement will facilitate the adaptation journey.

In the second stage the firm deals with the routes from the entry (recognition of need) to the full embracing of the continuous improvement principle as a way of life (Learning organization). This process proposed context-oriented approach in the route to Leanness consists of seven steps, section 6.4.1, starting with awareness and advancing to the redesign of a customized PS. This stage is very dynamic and involves multiple and seemingly contradicting factors that interact concurrently, necessitating managing emerging processes. Hence, the journey should be simultaneously leveraged with the development of required capabilities, Fig. 6.7. At the core of this route are managing system emergence, organizational learning and systematic routine integration. Parallel, the simultaneous context-oriented approaches are developing PS adaptation capability for enhanced SN, observing culture dynamics and fitting management techniques and exploiting and developing imperative indigenous methods, 6.4.3. These approaches harmonize the Lean requirements with influential factors. The evolutionary trajectories of this contextualization evolve to multiple scenarios resulting in context-specific, context-free methods and combination there of.

The outcome of this journey is a capable organization that can play an active role in the supply network. The DCs developed through full implementation of Lean phases with the integration of indigenous methods and other contextual exploitations enable the Learning organization to exercise exploration to take dynamically any path and seize opportunities in the business environment with portfolios of contemporary business success factors. In summary, companies need to consider the contextual organizational culture, adapt the PS package (i.e. LPS), incubate indigenous methods and manage emerging systems while simultaneously developing all required adaptation capabilities. As the solutions are tuned for the surveyed industries, they are applicable for others in similar track as well.

## 6.8. Evolutionary PS Adaptation Scenarios

Continuous exploitation of these methods with Lean, leads to new features of production system depending on the starting conditions and the specific implementation path followed. Accordingly, up on deliberate consideration of these contexts, the production system will be enriched by either moderated organizational culture, by the indigenous methods or by the combination of these factors. Consequently, the evolution process of the Lean package over time offers practical insights to the scenario of developing context-specific methods for specific industry or locality, adaptable context-free methods for universal use and the combination of these portfolios (hybrid production systems), Fig 6.10. If these new hybrid configurations gain a certain degree of stability, maturity and efficiency, they could form an innovative production models with new principles. A convergence towards specific models may not necessarily take place. Following are the discussion for three scenarios.

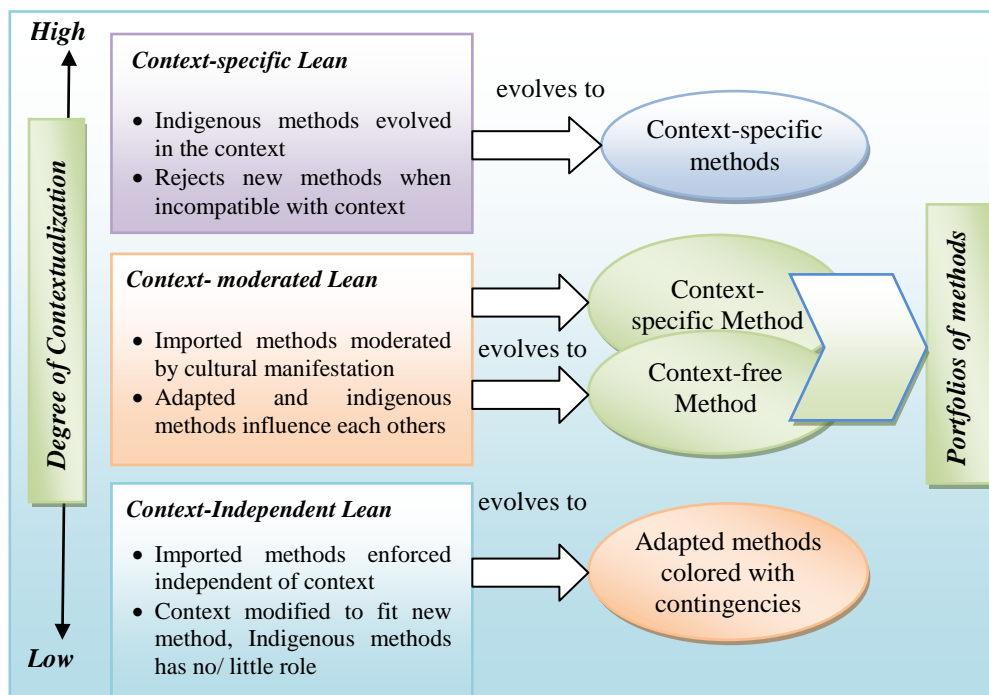


Fig. 6. 11 Possible PS portfolios emerging in the evolution of context-based method depending on the degree of contextualization that enriches the new PS

1. **Indigenous methods evolve in the context.** The company in this scenario does not look for best practices in a sense of adaptation. By its self-contained nature, such scenario is hesitant to introduce new methods that challenge the established context. New methods can be seen as secondary matters. Because of priority to its own practice, new methods

took long time to be introduced depending on company strategy, management insights towards market and internal efficiency. The resulting evolutionary trajectory is highly customized t so that replication in the value chain, like that of Lean approaches or to others even in similar sector is hardly possible. Such method may have difficulty in integrating with the supply network. However, it may enjoy brand names to serve very specific niche customers.

2. ***Imported PS moderated with indigenous method and work culture.*** The essence of indigenous methods is to observe the content of the existing context with the intention of simplifying, verifying, modifying the new method or developing new one. Unlike forcing the new method to the prevailing situation, selective productive indigenous methods are made to support PS adaptation. This method allows context specific methodical entities to evolve not only for the company but also for the discovery of universally applicable methods.

While the specific methods form a source of inimitable competitive capability, the free methods contribute to the development of universal PS techniques and build reputation. This exploitation and exploration experience of Lean adaptation with indigenous method will develop a high level of organizational learning capability and flexibility to take any path. Even if the indigenous methods tend to be learned by similar organizations with higher learning capability, the already acquired dynamic competence enables the company to exploit specific methods internally and within the value steam globally in a faster way.

The culture-moderated adaptation seeks to adapt best practices, but without directly confronting the organization work norms. Hence, the cultural manifestation moderates the adaptation of the new methods, Table 7. This transformation approach enjoys the easiness of change, but slowly, as the approach respects and maintains the uniqueness of organization. However, the integration of the new method with the existing cultural manifestation is neither simple nor guarantees success. The Lean method requires certain values that can be difficult to fit easily with many contexts, whereas cultural dimensions are in a continuous change and culture influence is inconsistent. Further, maintaining a particular culture may prohibit flexibility.

3. ***Adopted methods independent of context*** – the priority of the company in this adaptation scheme is to implement the typical Lean, as stated in literature, using appropriate

roadmaps. The firm enforces the imported methods independent of culture. The core idea is to achieve organizational change by modifying the existing context to fit the new method requirements. In this approach, indigenous methods or organizational culture have little roles. Even though this approach is interesting for firms that have no confidence on their habitual domain and having little binding routines, it is highly challenging as the adaptation practices would not be frictionless across cultures. This adoption method depresses the organizational and cultural identity leading to conflicts between Lean values and hosting norms. The transformation effort is much more challenging especially when the company has long history of routines. Even if the context is benign, it is difficult to completely avoid strategic contingency and other constraints. On one hand, the approach is probably the only one to establish a truly Lean organization. On the other hand, the resulting method after complete implementation is not free from certain level of contextualization.

### ***Implications for Surveyed industries***

The combination of these three portfolio paths may affect organizational routines across firms and regions. In general, universally prevalent patterns emerge when decision makers share identical objectives and constraints worldwide, when best practice is transferred to everyone, and when the context allows only a particular pattern to survive. Region- and firm-specific patterns may emerge when each company takes a random walk, face unique constraints, is led by different visions, shares regional environmental constraints, knowledge transfers are restricted within each region or has varying levels of evolutionary learning capabilities. All patterns can coexist for a single international industry, [37].

From these scenarios, the context-moderated method performs best for the case industries. Especially, in the Germany context, the deep-rooted practices bear paramount concern. On one hand, they have embedded practically proven and reputed quality oriented PS. As indicated in the survey result, Table 7, the majority of work cultures are also in a harmony with Lean requirements. On the other hand, it may be difficult to abandon such deeply rooted production and managerial routines in favour of imported approaches. The worker unions and lack of management support, which is indicated as less favourable for Lean, could also resist to replicate foreign methods. After all, the strong competitive and steady position of German industries bears very costly innovation and resilience capabilities orchestrated with technology and employee expertise. Thus, it may not be rational to abandon the original approach.

For the Ethiopian context, Lean dominated approaches with moderate contextualization may perform well. This is because the context has no deeply rooted production and managerial routines. If equipped with the learning capability, participate in the competition of domestic and global market, possess fewer deeply embedded routines, they face fewer constraints (absorptive inertia) and resistance. Hence, it may be easy to inculcate imported methods provided that the challenging factors such as commitment and shared vision are overcome. The social culture is also collective making a malleable context to develop teamwork habits. The interview in the Ethiopian industries show that the resistance level of employees is minimal if the management effort is optimal. This could be attributed to hierarchical culture orientation, which tend to expect a certain level of command and control or it could be due to the limited job security and opportunities. To alleviate the problems from the cultural context, influencing the culture dynamics could be necessary.

Although not comprehensive and not involving all the ethnic groups, often mentioned dominant Ethiopians values consist of: helping each other (cooperation), education and wisdom, patriotism (nationalism), bravery (heroism), politeness (courtesy), hospitality, power and domination, obedience, low tolerance for differences of opinion, family orientation and the like. Most of these values and religious tendencies can support change. Moderate customization to contextual values may be considered to enhance methods. Experiences from other countries show that people with deeply rooted spiritual tendencies make considerable economic progress through adaptation and contextualization of progressive production methods. China, India, Turkey, Iran and others are countries with similar values. Their traditional values are positively used for development efforts.

## **6.9. Chapter Summary**

By relating the results obtained from survey and identified gaps to the existing PS approaches, this chapter has developed three solution schemes.

First, to address the PS contextualization, a PS adaptation framework is developed that captures vital influencing factors. Second, a more elaborated context-oriented approach is developed for the journey, which has taken into consideration contextual factors to Lean approaches, especially exploitation of indigenous method. The focus of indigenous methods and their exploitation gives important orientation how to support adaptation method by local domain. Third, appropriate capabilities that enable successful transfer are identified. Besides,

organizational capabilities and its relation to best practice adaptation are analysed in systems' perspective. Based on the analysis of possible as-is capabilities and systemic relations of DC with best practice and SN operations, the required capabilities are developed that enable effective transfer. The contextualized approach and capabilities indicate how industries could adapt best PS in order to successfully enter in global SN.

The trajectories of this contextualization and the evolutionary nature of PS adaptation shows multiple scenarios. Finally, the three solution schemes and their major constituent elements are synthesized to a comprehensive model that displays the complete picture of the solution package. This complete solution package as developed in this paper applies procedural recipes for adaptation of PS along with their contextual methodical entities. It explicitly addresses the concern of appropriate methods for successful Lean adaptation. It proposes a solution mechanism to close the research gaps on the methodologies and analyzes how the organizational contexts influence Lean adaptation, section 6.2 and 6.3.

## **7. Verification of the Proposed Method Using Virtual Industry**

The solution schemes are in line with the problem investigation, section 5, which is validated with relevant literature, section 2, 3 and 4. Accordingly, the proposed method put a one-to-one correspondence to the stated research objectives with the solution designed. From engineering design perspective, the method directly tackles the problem in concern. Hence, companies adapting modern PS find practical guidelines from this method. In this chapter, the designed method is verified in a virtual industry.

### **7.1. Verification Using Virtual Industry Case**

To verify the replication of the proposed method, virtual medium-sized firm is taken. The primary business of the is manufacturing medium volume subassemblies that will be an input for machine building. Half of the components for the subassembly are produced within the firm whereas component producers supply some items and other standard parts are bought from market. Additionally, the company produces customized spare parts for different manufacturing plants on orderly basis. Hence, this company is part of a SN in the values chain of machine production.

As is the case for any contemporary companies anywhere in the globe, the industry is are subject to the influence of local and global environment. It is an actual or implied global company operating in the contemporary business environment, which is characterized by fierce competition and SN collaboration. As a global firm, the machine builder sees suppliers based on performance criteria of cost, delivery time, quality and flexibility so that the machine building extended value stream meets customer requirements. Hence, the case company is supposed to follow appropriate modern production method to satisfy its stakeholder needs. The main customer, machine builder, advised all immediate suppliers to improve their respective PS by adapting the popular Lean PS for interoperability of the entire value stream.

The existing observable context of this industry assumed to be characterized by non-standard methods, informal indigenous method entities, national and corporate culture manifestation, as-is capabilities, access to universally known production methods, and fierce competition from rivals. Hence, it requires systematic approaches in contextualizing the method to be imported and building absorption capacity for new routines.

The case company realizes the availability of worth adapting method for better competitiveness and customer satisfaction. From this awareness and recognition of the need, the firm decided to embrace the new method. However, the firm is in dilemma on the transferability and subsequent incompatibility of the new method with its peculiar organizational context as well as on the required capabilities. Given this situation, the solution scheme in this paper argues that the proposed context-oriented method can address the concerns of the company. Hence, the steps as per the designed solution become as follows:

At the pre-Lean entry level, influencing factors for PS adaptation and the potential capabilities are assessed to determine the subsequent challenges and extent of readiness to adapt and pursue the Lean journey. The features of highly influential factors, section 6.3., and the as-is latent capabilities, section 6.4.2.2., must be assessed and affirmative action must be devised for any dysfunctions. The awareness to the contexts and the availability of basic capabilities to learn and to improve prior to the commencement will pave the way and shade light on the adaptation journey.

Next, the firm deals with the routes from the entry (full recognition of need and committed decision) to the full embracing of the continuous improvement culture that will end-up with learning organization. The proposed route to Leanness as per context-oriented approach consists of six steps, outlined in section 6.4.1. The adaptation must be backed-up with observing culture dynamics, culture-fit management techniques and integrating positive indigenous methods, 6.4.1, so as to harmonize the new requirements with influential factors. The journey involves multiple and seemingly contradicting factors that interact concurrently, and hence, at the core of this expedition are managing process emergence, organizational learning and systematic routine integration, section 6.7. Simultaneously, the journey should be leveraged with the development of required PS adaptation capabilities, section 6.4.3. The process is outlined in a gaunt chart, Fig 7.1.

Executing and mastering this Lean program builds dynamic capabilities of the organization. The practical experience with this Lean journey along with developing indigenous methods and other contextual exploitations enable industry to exercise exploration learning and to play an active role in the supply network with portfolios of contemporary business success factors. In such a way, the case industry can internally maximize the efficiency of its process and operational capability and externally able to fit to the machine building SN environment with DC. From the above case, it is possible to conclude that applicability of this method is valid.



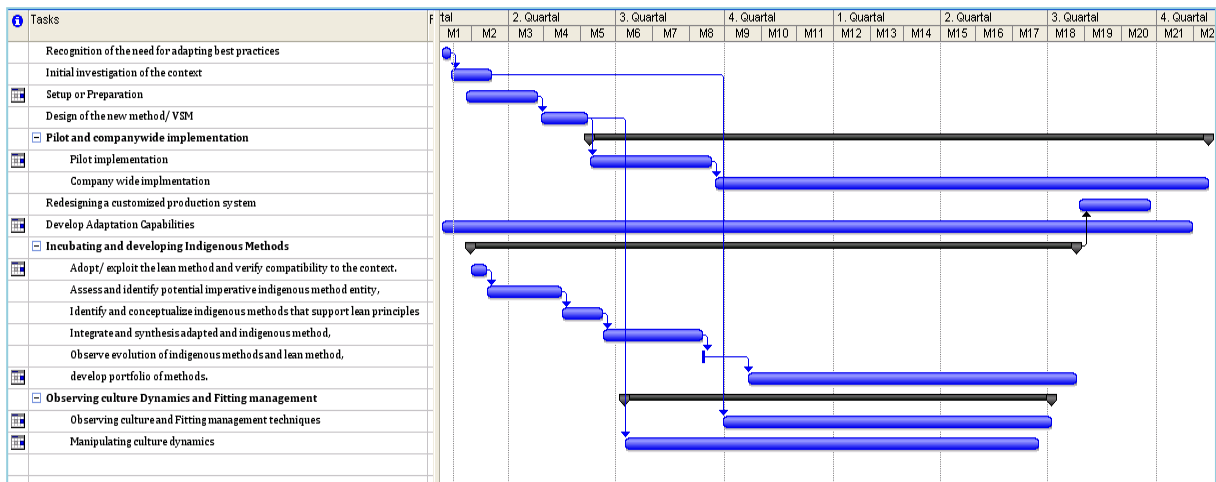


Fig. 7. 1 Context-oriented PS Implementation scheme- sample schedule

## 7.2. Comparison with Other Methods

Compared to other available approaches in literature and consultant cookbooks, the designed method has greater role in many respects. As the existing method do not show contextualized methodologies, section 5.3, these approaches face problems of incompatibilities with the involved complex contextual factors. The developed model and the findings benefit companies and researchers in many ways. Firstly, companies can critically assess the influential contexts and as-is capabilities prior to Lean entry for determining organizational readiness to commence Lean journey. Secondly, the verified interrelation among PS adaptation, organizational dynamic capability development and their combined role for enhanced SN operational performance reinforce the simultaneous importance of capability development for modern PS adaptation. Hence, the Leanness phases and activities matched with the required capability accelerate the pace of Lean journey to the learning organization. The approach gives a new perspective on exploiting of own indigenous methods and observing culture moderated intervention along standard Lean packages, which reduces the incompatibility of foreign method within a new organizational context. Besides, exploitation of contextual potentials can contribute into the PS body of knowledge through incubating and verifying PS insights from the unexplored industrial environments. This approach, apart from motivating innovation, the implementing industries enjoy developing context-specific methods that is inimitable by competitors. Such contextualized methods both (context-specific and context-free PS scenarios) developed through organizational learning and the interaction of context with PS enable to develop a dynamic and sustainable primary and Meta-capability.

## **Usability Contexts and Generalization**

The usability context of the solution scheme is virtually broad. The organizational contexts put the platform for analysing the existing multi-faceted contexts of industries and exploiting of the potential for enriching PS adaptation endeavour. Given the critical investigation and awareness of respective conditions in terms of business situation, culture, capability, indigenous method and modern PS requisites reveal the potential threats and opportunities in the environment. Based on these conditions, the industries attempt to design the appropriate contextualized method, which eventually evolve to a consolidated and customized PS enriched with the positives of the respective situation. The methods facilitate for a full exploitation of local techniques and bringing effective solutions to local problems. The solution schemes can be generalized dynamically for any context.

The generalization of the proposed method to other industries lies in its comprehensive approach that deducts from a general PS adaptation framework, which is equivalently valid for other industries in the same track. Companies benefit from embracing LPS as a business process strategy to optimize competitive factors of cost, quality, delivery and flexibility. This also is confirmed in the survey of the industries, section 4.4. In contextualizing the PS, a firm needs to identify and develop imperative indigenous methods by exploiting local practices and values with the intention of simplifying, verifying, modifying developing these practices along the new methodologies.

Probably, the sensitive issue is the trade-offs among the new method, indigenous method, and cultural management. As the existing context usually tends to maintain the status quo, precaution and thorough understanding of the general impact of the identified indigenous entity on Lean strategy and overall business performance is necessary. The inculcated indigenous methods might be in contradiction or incompatible or hardly understandable for partners or ethical business values. When they appear contradicting with some business values of productivity, the priority should always be given to the standard Lean package.

## **8. Conclusion and Outlook**

This dissertation set out to develop the context-oriented PS approach and the capabilities required for adaptation in various socio-technical backgrounds. This final chapter correlates the dissertation results with the research objective as conclusion, articulates the contributions to different groups of research beneficiaries and points out future research directions.

### **8.1. Concluding remarks**

The dissertation assessed the modern PS in terms of its principles, contents, transfer approaches and the various sorts of internal and external influences; i.e. culture and capability and global business. Every argumentative point is in line with the primary theme of context-oriented PS method and adaptation capability that is backed by the literature, industry survey, research gap analysis and technical design of the method. The approaches enable to comprehend the overall PS trend in general and advanced PS components in particular scrutinize the limitations of the approaches and influencing factors. To support the empirical works, industries' experience and expert opinions are investigated. As a result, the literature and survey reinforce each other to give a concrete research gap formulation, which become a springboard from which context-oriented PS method and adaptation capabilities are designed.

The problem analyzed and formulated at the outset, states that while the global business requires best practices for operating in the ever-changing and network-oriented business, the PS adaptation approaches' success and transferability are prone to influential factors. Additionally, work on adaptation and implementation approaches for the Known LPS do not deal with methods in different socio-technical contexts. Hence, enforcing these methods in an organization disregard the innovative potentials, indigenous methods in unexplored industries' context. Adaptation approaches followed by the surveyed industries also neither customized nor follow the common essential steps in a balanced way.

Based on these backgrounds, the proposed method insists to consider the contextual organizational culture, adapt the standard PS package (i.e. LPS), incubate indigenous methods and manage emerging systems while simultaneously developing all required adaptation capabilities. The solution schemes are in line with the problem investigation, section 5, which is validated with relevant literature, chapter 2, chapter 3 and survey results, chapter 4. Accordingly, the proposed method addresses stated objectives. From the engineering design

perspective, the method directly tackles the problem in concern and its argumentative conjecture sufficiently verifies the approach.

## 8.2. Assessment of Work against Research Objectives

In line with the problems, the study articulates the following research objectives: shedding on spectra of contemporary PS and their constituent elements, context influence on PS transferability, analyzing existing approaches and their limitation, developing PS adaptation capabilities, surveying LPS implementation experiences, developing context-based methods. In this subsection, the solution schemes are assessed against the respective objectives in order to verify the research result.

- ❖ ***Shedding on spectra of contemporary PS and their constituent elements.*** The basic production system model as well as the advanced PS paradigms exemplified in LPS and emerging PS approaches are reviewed in terms of principles, basic tools, metrics, transferability, implementation approaches, supplier networks and adaptation capabilities. The emerging PS trends indicate increasing shift to networked and intelligent system. LPS address contemporary business challenges by balancing internal process capabilities and external relations with synchronized application of the techniques and maximize competitive measures of cost, quality and delivery.
- ❖ ***Context influence on PS transferability and adaptation.*** Many of the PS transferability perspectives and its influential factors examined show that Lean transfer success mainly rests on organizational contexts and contingencies. Related empirical work confirms wide diffusion of Lean whereas the culture influences show inconsistency. Moreover, the experiences of surveyed industries and the experts' opinion verify the importance of contexts. The factors are further captured in PS adaptation framework and their influences and contextualization trajectories are explained.
- ❖ ***Developing PS adaptation capabilities.*** Relation between dynamic capabilities and best practice adaptation as well as their role in the SN environment are analysed and the as-is capabilities are identified. The capability profiles with respective Lean adaptation phases are outlined. It is found that that establishing a dependable internal and interoperable external dynamic capabilities enable to explore opportunities from the collaborative business environment.

- ❖ ***Existing Lean adaptation approaches and their limitation.*** The PS adaptation approaches are analyzed and their limitation is extracted. The approaches range from shop floor to strategic supplier network, from conceptual principles to explicitly applicable tools, from simple procedural steps to comprehensive transition road maps. The analysis of the approaches reveals gaps in considering influences of contexts and competencies. The reviewed approaches do not explicitly address the issues such as culture dynamics, indigenous methods and adaptation capabilities.
- ❖ ***Surveying industries' experiences with LPS implementation.*** To support the empirical works, the experiences of industries and expert opinions are investigated on sufficient samples of industries that represent different contexts. The survey result indicates that the industries are familiar with Lean principles and benefited from the exercises. The approaches followed by the industries show flaws in procedure and balanced use of the techniques. The statistical analysis show similar trend line patterns among contexts, reinforcing the influences of contexts and capability. The opinions also stress contextualization of methods and PS adaptation capabilities.
- ❖ ***Developing context-oriented method.*** Consistent with the primary objective of the study, a context-oriented PS approach with adaptation capabilities is developed. The method take into account the PS adaptation framework that captures influencing factors, the inferences of survey results as well as the potentials supporting PS solutions residing in the contexts. The solution schemes are synthesized into an integrated context-oriented Lean journey (PS adaptation approach with the required adaptation capabilities and supporting method of indigenous method and culture dynamics management. The method addresses the pre-Lean entry contextual situation, managing process emergence throughout the Lean journey and designing own customized PS.

### **8.3. Contribution to Beneficiaries**

Compared to other available adaptation approaches in literature and consultant cookbooks, the contribution of the research for policy makers, academics and industries are as follows.

#### ***Contributions of the research in policy development***

The dissertation contributes in enriching industrial policy, revitalizing indigenous methods and increased awareness on the potentials of contexts in PS adaptation. The study is partly

supported by the Ethiopian government, which is determined to import best practices and maximizes industrial productivity. This paper affirms that proper Lean adaptation can address contemporary business challenges balancing the requirement of internal process capabilities and external relations, which has implications on external trade policy and logistical infrastructure. The analyses of contexts show the vulnerability of adaptation for multiple contextual factors that make the Lean adaptation prone for failure. It is shown that, while culture may influence PS adaptation, manipulating culture and using fitting management potentially lessen the adverse effect of incompatibility. To capture business opportunities from the global business, the paper advises adaptation of best practices that leverage active participation of industries in the actual and implied global SN operations.

The framework captures the interacting multiple factors (organizational culture, indigenous methods, capability, global business environment, adaptation programs) and their evolutions. It bears paramount importance in formulating a better industrial productivity improvement policy that can assist in importing methods, exploiting contexts and exploring the dynamics of culture and global business. Government strategies may incorporate mechanisms for revitalizing the potentials of indigenous issues in national and organizational potential to exploit innovative potentials for local problems and enrich new PS's adaptation. Prior to and during the intervention, concerned bodies can assess influential contexts and as-is capabilities.

### ***Contributions to the academic sector***

The contributions to the academics and the PS body of knowledge consist of new perspectives on role of indigenous methods in PS design and improvement, evolutionary adaptation framework and verifying the inherent link between PS improvement initiatives and capabilities. The developed context-oriented methods give a new perspective on the vital role of exploiting indigenous methods to facilitate and enrich universal PSs. This perspective bears immense potential to contribute for the PS body of knowledge through incubating and verifying new PS insights from the unexplored industrial contexts. The developed framework captures the nature of PS adaptation evolution along the interaction of contexts and their aggregated trajectories to different portfolios of methods. The domains of the framework breed many interesting research themes on the influential contexts in the adaptation process, which require deeper investigation.

Affirming the gaps in the current adaptation techniques to explicitly consider contextual factors, the future PS model need to consider organizational contexts (culture, adaptation capabilities, and available best PS packages), indigenous methods and managing emerging process. Further, the analysis of the interrelationship among adaptation, capability and their link with SN operations verifies the simultaneous importance of capability and adaptation.

### ***Practical implications for industries***

The benefits of the dissertation also cover the surveyed industries and others in similar track. The comprehensive context-based PS approaches bear paramount importance for industries in comprehending the involved essential factors in the Lean journey and supporting ingredients in specific and global position. The dissertation gives features of as-is capabilities to determine readiness and profiles of capabilities to be developed during adaptation that can accelerate the journey towards becoming a learning organization. These experiences enable to develop a dynamic, sustainable primary and Meta-capability to play a great role in the SN. Companies can recognize the essence of Lean adaptation and its link with non-routinized practices or DC. The dissertation identifies the basic problem of PS adaptation and determines the challenges of incompatibility of the new method in a number of conditions. In exploiting the context, a technique of manipulating cultural dynamics and culture-fit management technique is introduced, which dampens the incompatibility of new methods with contexts. This approach, apart from motivating innovation, enables to develop an inimitable context-specific methods and context-free universal PS scenarios.

Moreover, the experiences of surveyed industries in Lean implementation exposed the trends in the transfer of Lean, familiarity with its notions, techniques. This information on industries gives lessons on the importance of addressing essential adaptation phases, balanced utilization of the techniques, importance of contextualization of the method and adaptation capabilities. Besides, it encourages industries to commence adapting new method and rectifying setbacks in a Lean journey already started.

## **8.4. Future Outlook**

The PS adaptation framework and the context-oriented method framed in this dissertation are broad and lie down research inquiries for further investigation. The context-oriented approach is a relatively new research area and much remains to be done. The domains of the framework

breed many interesting research themes on the influential contexts in the adaptation process. Hence, the natural direction of future research is to push existing domains in this research by developing more conceptual theory and specifying enabling application techniques. As prior future work, the following research outlooks are perceived:

- ❖ *Developing efficient PS for emerging economies:* The increasing migration of production operations from industrialized nations to emerging economy and developing countries through global footprint, outsourcing and the development of domestic firms raise the demand for efficient production approaches that fit in these contexts for better production resource utilization. Based on the identified themes in the PS adaptation framework, customized PS approaches for industries in emerging economies is essential. Related literatures, empirical cases on global companies and industry surveys in these countries could enable to develop efficient PS generalizable for such contexts. Under the context-oriented Lean journey, mechanisms can be developed to differentiate some contexts based on national and international phenomenon. Questions can be raised for centrally managed global companies, which operate in multiple contexts.
- ❖ *Identifying contextually replicable indigenous methods:* Investigating Lean adaptation experiences along indigenous methods or independent of Lean in different developing countries help derive a lesson for others. In this respect, the emerging economies and others in the similar track could have a reach experience to be explored for determining those features of indigenous method entities that enhance productivity and those of non-productive ones. Reframing the procedures for indigenous method development and involving multidisciplinary research team, the selective indigenous method entity inventories with strong conceptual bases could be identified.
- ❖ *The role of German production methods and Lean implementation:* The German production methods can be considered as a standalone system embedded in a typical socio-technical context. However, its transferability is not given due attention, at least in English papers. The potential contribution to the knowledge of PS, like that Toyota, is not exploited much. Thus, characterizing this model could provide alternative ways for other industries. The investigation of Lean evolution in German industries could also give good insight on PS contextualization.



- ❖ *Verifying the identified as-is capability and contextual factors:* Though the organization conditions and potential capabilities are identified, the way to inculcate them is still untouched research theme. Hence, verifying these factors and their practical role in selected case companies is essential. The future PS adaptation model needs to consider such contexts, indigenous methods and management of emerging process.
- ❖ *Devising mechanisms for capabilities development:* The interrelation between the identified capability for success can be verified using expert opinion and survey. The outlined PS adaptation capabilities and as-is capabilities require enhancing mechanism. The industries (local and global) require ways how to develop capabilities. A deeper investigation is essential to formulate mechanisms for developing these capabilities.
- ❖ *The link between context and emerging PS scenarios:* The contextual influence on the emerging PS may be different from the Lean context as the complex natural phenomenon of these approaches may complicate the interacting factors. Thus, projecting influential factor on Lean and using the characteristics of these methods, contexts for emerging PS can be analyzed.

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## Appendix 1: Questionnaires for German Industries

### Otto-von-Guericke University Magdeburg– Institute of Factory Automation and Ergonomics (IAF)

#### A Questionnaire to assess Lean Adaptation and Implementation in German Industries

This survey is being conducted by IAF-OVGU in order to assess the extent of implementation of Lean Production and its Supply network techniques in medium and large German Lean Industries. The project is part of a PhD research dealing with the development of appropriate Adaptation Methodologies and Capabilities for Lean manufacturing system in industries. The purpose of this questionnaire is to assess the implementation of Lean Production in medium and large German Industries, which are already, are practicing Lean Paradigm. The focus areas of Survey include:

- I. General information
- II. The Lean notions, adaptation methodologies,
- III. The extent of tools and techniques use, performances and challenges
- IV. The Lean Supply Network Practices
- V. Contextual supports and/or barriers for adaptation,

The intended respondents are peoples with full information about the Lean transition activities in respective industries, (i.e. production/ middle managers, Lean consultants, Transformation team members) which are involved in Lean implementation.

#### Notes:

- All responses will remain strictly confidential with the data combined to provide an aggregate indication of the status of the industries practicing Lean Transformation.
- Please read all questions thoroughly, including these instructions, which will assist you in completing the survey and providing accurate answers.
- Please note that your participation in this survey is of value to us.
- The whole sections of the survey may take up to 45 minutes to complete.
- You will need to respond to the questions by selecting an appropriate box, and in some case writing in your comments.
- All survey respondents will receive a brief summary of the results as a token of our appreciation of your participation.

#### How to complete the survey

1. Launch survey by clicking on the <http://www.iaf-bg.ovgu.de/> LIGQ
2. Complete online survey.
3. Select 'Send' to submit the survey.

#### I. General Information

- General manger
- Production Manager
- Production system engineer
- Lean consultant
- Leann transformation Team Leader
- Others (please specify) \_\_\_\_\_

[1-2] How long have you been participating in Lean implementation?

- . Less than one year
- . 1 years
- . 2 years
- . 3 years
- . More than 3 years

[1-3] How long has it been since your organization practicing Lean approaches?

- .Less than one year
- .1- 2 years,
- . 2-3 years
- . 3-4 years
- . 5 or more years,

[1-4] what is the principal industry category of your organization?

- .Manufacturing
- .Logistics, storage and communication
- .Agriculture, hunting, forestry and mining
- .Electricity, gas and water supply
- .Construction
- .Whole sale and retail trade
- .Health and social work
- .Others (specify) \_\_\_\_\_

[1-5] Number of Employees

- . Less than 50
- . 51 to 250
- . 251 to 500
- . Greater than 501

## II. Lean Notions

[2-1] What do you associate with the Lean philosophy? (You may choose more than one)

- Responsiveness to change
- A toolbox of techniques to improve manufacturing and operations
- The use of teamwork and continuous improvement
- The consequent elimination of non-value adding tasks to reduce lead time
- A fully integrated management philosophy
- A system for organizing and managing product development, operation, suppliers and customer relations
- A way to reorganize the firm by product family and value stream
- A system to make products with fewer defects in order to strive for perfection
- A philosophy that absolutely focuses on customer value
- Others (please indicate)

[2-1] Which Lean Transformation phases have been employed in your Lean Journey? Choose any of the items.

- Adopt Lean vision
- Define value and establish value stream
- Develop supplier network strategic plan
- Establish Lean culture and infrastructure
- Create and refine implementation plan
- Implement Lean initiatives
- Strive for continuous improvement
- If different, please indicate.....

### III. The implementation extent for Lean Techniques and Tools

[2-2] To what extent of Lean techniques are implemented in the organization? (On scale of 1-5; 1 = no implementation; and 5 = full implementation)

Nr.	Used techniques in Kaizen Implementation	Levels of Implementation				
		1	2	3	4	5
1	5S– House keeping					
2	Total Productive Maintenance (TPM)					
3	Setup time reduction (SMD)					
4	Flow lines and/ or Cellular Manufacturing					
5	Kaizen					
6	‘Error-proof’ equipment (Poka yoke)					
7	Process capability, SPC					
8	Use of state of the art technology					
9	7 Waste Elimination					
10	Standardization of Job (Takt time)					
11	Leveled production (Heijunka)					
12	Product design simplicity					
13	Small lot sizing					
14	Visual control of the shop floor (Andon)					
15	Pull Production (Kanban)					
16	Project Management					
	<i>(If other techniques are used, please indicate)</i>					

[2-3] To what extent Lean is implemented in matters of suppliers and customers relationship? (on scale of 1-5; 1 = no implementation; and 5 = full implementation)

Nr.	Used techniques in Kaizen Implementation	Levels of Implementation				
		1	2	3	4	5
1	JIT deliveries					
2	Quality at the source					
3	Inventory integration with supplier					
4	Supplier training and education initiatives					
5	Reliable and timely supply					
6	Customer involvement in product development					
7	Capability of sales network					
8	Early information on customer need					
9	Service-enhanced product					
10	Suppliers and customers involvement to improvement activity					
	<i>(If other techniques are used, please indicate)</i>					

[2-4] Please indicate the extent of Lean implementation in Human Resource and Teamwork (on scale of 1-5; 1 = no implementation; and 5 = full implementation (on scale of 1-5))

Nr.	Used techniques in Kaizen Implementation	Levels of Implementation				
		1	2	3	4	5
1	Multifunctional workers					
2	Autonomy and empowerment of workers and teams					
3	Flat organization					
4	Teams and teamwork					
5	Worker training					
6	Job stability					
7	Employee commitment and motivation					
8	Environment, health and safety (EHS)					
	<i>(If other techniques are used, please indicate)</i>					

#### IV. Supply Network Practices

[3-1] To which Lean transition category belongs your supply network orientation, Select one

- Traditional - little awareness of Lean supply chain management principles or practices;
- Adopter -limited link of supplier strategy to corporate vision, goals and objectives
- Performer -supplier strategy is linked to corporate vision, goals and objectives;
- Reformer -shared strategic vision across the supplier network;
- Transformer -Supplier strategy is seen as a core competence for competitive advantage;

[3-2] As part of integration of your supply chain , which mechanisms has been put in place? (Please choose one)

- Focus on internal capabilities, with little cognizance of tacit or explicit knowledge across suppliers.
- Established internal organizational structures and processes to leverage supplier-based knowledge and innovation.
- Technology roadmaps include suppliers in pursuance of common strategic vision. Shared metrics for continuous improvement are utilized.
- Knowledge transfer mechanism is created for open and rapid access throughout the supplier network.
- Mutually-beneficial arrangements are established to foster innovation across suppliers. A process for on-going communication of needed changes in vision, strategy, metrics are in place.

#### V. Cultural and other contextual supports and/or difficulties for adaptation

[5-1] How do you rate the following aspects of German work culture in facilitating Lean implementation? (1) has less facilitating effect; (2) has little effect; (3) has no effect; (4) has little positive effect; (5) has Strong positive effect

Nr.	Common constraints/ obstacles	Effect level				
		1	2	3	4	5
1	Ordnung - defined and regulated system structures					
2	Focus on Facts- in decision and problem-solving;					
3	Focus on Tasks- at hand in plans, Performance orientation					
4	Communication - seemingly confrontational					
5	Individualist, yet consensus-seeking approach - own goals and successes for “the good of the community;”					
6	Uncertainty avoidance and assertiveness,					
7	Low levels of humane orientation (low compassion, straightforward interpersonal relations at work).					
8	High degree of specialization among skilled workers					
9	Functional orientation of managers					
10	Worker union					
11	Time management					
12	Standard orientation					
13	Others					

[5-2] Lean Production success/ failure is often associated with attitudinal and other constraints. On scale of 1- 5, how do you rate the difficulty level of the following factors?

(1 for easy, and 5 for very difficult)

Nr.	Common constraints/ obstacles	Effect level				
		1	2	3	4	5
1	Lack of top management support					
2	Lack of shared vision among all the employees					
3	Lack of understanding on Lean production concept					
4	Lack of time to implement					
5	Lack of know-how to implement					
6	Employee resistance					
7	Backsliding to the old ways of working					
8	Failure of past projects					
9	Others, Please indicate					



## VI. Performance Rate

[6-2] How do you rate the performances achieved from Lean practice? *Insignificant (less than 10%); Little (10 - 30%); Some (30 - 50%); Significant (50 - 75%); Very high (75 - 100%)*

Kaizen Performance indicators	Improvement in Percent (%)				
	< 10	10-30	30-50	50-75	75-100
1) Overall customer/ Stakeholder Satisfaction					
2) Changeover time					
3) Quality Yield - scrap/ rework rate					
4) Flow/ CycleTime- from Development to Delivery					
5) Overall productivity					
6) Delivery time					
7) Product quality					
<i>(If there are other performances , please indicate)</i>					

## ***Umfrage - Deutsch Version***

### **Erläuterungen**

Lean Produktion ist eines der einflussreichsten Paradigmen in Fertigung und Montage und hat über die ursprünglichen Anwendungsfelder hinaus Zuspruch erfahren. Die Erweiterungsfähigkeit wurde durch erfolgreiche Lösungen in unterschiedlichsten Branchen, die ihre Produktionssysteme an Lean-Prinzipien angepasst haben, unter Beweis gestellt.

### **Umfrage zum Lean Produktion**

Stand der Einführung, Einführungswiderstände sowie Erfahrungen werden von uns mittels einer Frage-bogensystematik erhoben. Insbesondere das Wissen von Fertigungsleitern, Beratern auf dem Gebiet des Lean-Management, Betriebspraktikern, Culture Change Verantwortlichen sowie mit dem Thema befasster Einzelpersonen ist für die Beurteilung des Standes unabdingbar. Mittels des nachfolgenden Fragebogens werden die folgenden Parameter erhoben:

- Fortschritte bei der Lean-Implementierung (Methoden und Instrumente)
- Wahrnehmung von Lean-Produktion in den Betrieben
- Lieferantennetzwerke und –fähigkeitsniveaus
- Anpassungs- und Implementierungsmethoden
- Rolle kultureller Einflüsse bzw. Restriktionen bei der Implementierung

### **Hinweis:**

- das Ausfüllen des Fragebogens nimmt ca. 20-25 Minuten in Anspruch
- alle Antworten bleiben streng vertraulich und bilden einen Gesamtauswertungsbestandteil in stark aggregierter Form
- Sie erhalten die Zusammenfassung aller Resultate inklusive unserer Anmerkungen zu Ihrer freien Verwendung

### **Anleitung:**

1. Rufen Sie die Befragung „Next“ auf
2. Wählen Sie aus und klicken Sie und / oder an und füllen Sie die entsprechende Box aus
3. Beenden Sie die Session mit „Close window“

**Vielen Dank!**

## **I. Allgemeine Informationen**

[1-1] Ihre Position in der Organisation

- Geschäftsführer
- Fertigungsleiter
- Produktionssystem Ingenieur
- Lean-Betrater
- Lean-Umsetzungsgruppenleiter
- andere, bitte angeben \_\_\_\_\_

- [1-2] Wie lange ist Ihre Organisation mit der Lean-Thematik  
 \_\_\_\_\_ befasst?  
 \_\_\_\_\_ Unter einem Jahr  
 \_\_\_\_\_ 1-2 Jahr  
 \_\_\_\_\_ 2-3 Jahre  
 \_\_\_\_\_ 3-4 Jahre  
 \_\_\_\_\_ 5 oder mehr Jahre

- [1-3] Zu welcher Branche zählt Ihre Firma?  
 \_\_\_\_\_ .Agrarwirtschaft, Jagd- und Forstwirtschaft,  
 \_\_\_\_\_ .Fertigungsindustrie  
 \_\_\_\_\_ .Elektrizität, Gas und Wasser Bereitsteller  
 \_\_\_\_\_ .Bauindustrie  
 \_\_\_\_\_ .Groß- und Einzelhandel  
 \_\_\_\_\_ .Gesundheits- und Soziale Arbeit  
 \_\_\_\_\_ .Logistik, Lagerung und Kommunikation  
 \_\_\_\_\_ .Andere \_\_\_\_\_

- [1-4] Anzahl der Mitarbeiter  
 \_\_\_\_\_ .Unter 50  
 \_\_\_\_\_ .50 bis 250  
 \_\_\_\_\_ .251 bis 500  
 \_\_\_\_\_ .Über 500

## II. Lean Notions

Question: [2-2] Welche Lean-Phasen wurden auf dem Weg zu Lean durchschritten? *Sie können wählen, mehr als ein Ziel*

- \_\_\_\_\_ .Anpassen der Lean Vision  
 \_\_\_\_\_ .Wertschöpfung definieren und Methode Value Stream Mapping einführen  
 \_\_\_\_\_ .Entwicklung einer Lieferantennetzwerksstrategie  
 \_\_\_\_\_ .Aufbau einer Lean-Kultur mit Infrastruktur (Training, Methoden, ...)  
 \_\_\_\_\_ .Implementierungsplan mit Verfeinerung  
 \_\_\_\_\_ .Lean-Initiativen  
 \_\_\_\_\_ .Verankerung von kontinuierlicher Verbesserung

[2-3] Was verbinden Sie mit der Lean-Philosophie? (*ggf. mehrere Antworten*)

- \_\_\_\_\_ .Anpassungsfähigkeit (hinsichtlich Veränderungen)  
 \_\_\_\_\_ .Einsatz von Teams und kontinuierliche Verbesserung  
 \_\_\_\_\_ .Konsequente Vermeidung nicht wertschöpfender Fähigkeiten  
 \_\_\_\_\_ .Integriertes Management Philosophie  
 \_\_\_\_\_ .Methodenbaukasten zur Verbesserung von Prozessen  
 \_\_\_\_\_ .effektive Ressourcennutzung  
 \_\_\_\_\_ .Prinzipien zur Organisation, zu Produktentwicklung, zu Betrieb für Lieferanten und Lieferantenbeziehungen  
 \_\_\_\_\_ .Gemeinsame Vision in einer Organisation  
 \_\_\_\_\_ .Philosophie, die absolut konzentriert ist auf den Kundennutzen  
 \_\_\_\_\_ .Art und Weise der Produktfamilien und Wertschöpfung  
 \_\_\_\_\_ .Art und Weise Produkte mit wenigen Fehlern, wenigem Ausschuss herzustellen und Perfektion anzustreben

### III. Lean-Implementierung (Methoden und Instrumente)

[3-1] In welchem Maße sind Lean-Techniken intern eingeführt? (Skala), 1 = gar nicht; 5 = ganz

Lean-Techniken	Maße				
	1	2	3	4	5
Arbeitsplatzorganisation (5S)					
Total Productive Maintenance (TPM)					
Rüstzeitreduzierung					
Flussprinzip und Fertigungszellen					
Kaizen					
Fehlervermeidungsvorrichtungen (Poka yoke)					
Prozessfähigkeit, Statistical Process Control (SPC)					
Fortschreitende Einführung neuer Technologien					
Ausschuss-Minimierung					
Standardisierung von Arbeitsabläufen					
Ausgeglichene Produktion (Heijunka)					
Produktvereinfachung					
Verkleinerung der Losgröße					
Visuelles Management (Andon)					
Pull Prinzip (Kanban)					
Project Management					
Andere, indizieren sie bitte					

[3-2] In welchem Maße sind Lean-Techniken extern eingeführt? (Skala)

Lean-Techniken	Maße				
	1	2	3	4	5
Just-in-Time Lieferungen					
Qualität am Ursprung					
Bestandsführungsintegration beim Lieferanten (VIM)					
Lieferantentraining und Qualifizierungsinitiativen					
Zuverlässige und sofortige Lieferungen					
Kundeneinbezug in die Produktentwicklung					
Verkaufsnetzwerksfähigkeiten					
Frühindikatoren zu Kundenwünschen					
Dienstleistungserhöhung am Produkt					
Einbeziehung von Kunden und Lieferanten in die KVP Aktivitäten					
Andere, indizieren sie bitte					

[3-3] Bitte markieren Sie den Stand der Lean-Implementierung in Personalbereich generell sowie im Team. (Skala), 1 = gar nicht; 5 = ganz

Lean-Techniken	Maße				
	1	2	3	4	5
Mehrfach qualifizierte Mitarbeiter/ Qualifikation					
Selbstständigkeit und Verantwortung (Empowerment)					
Flache Hierarchie des Management					
Arbeiten in Teams					
Mitarbeitertraining					
Arbeitsplatzsicherheit					
Mitarbeitermotivation und Engagement					
Environment, Health and Safety (EHS)					
Andere					

#### IV. Lieferantennetzwerke

[4-1] Welcher Stufe der Lean-Fortschritte würden Sie Ihr Lieferantennetzwerk hinsichtlich der strategischen Orientierung zuordnen? Bitte die am nächsten liegende Kategorie auswählen.

- Traditionell - gering ausgeprägtes Bewusstsein für schlanke Beschaffungsprinzipien oder Praxis
- Einführer - erste Verbindungen von Lieferantenstrategien zur Unternehmensvision, den Zielen und Zielmarken
- Aktiv - die Lieferantenstrategie ist voll in die Firmenvision, die Strategien und Zielmarken eingebunden
- Restrukturiert - Lieferantenstrategie wird als Kernkompetenz für den Wettbewerbsvorteil gesetzt
- Strukturiert - gemeinsame strategische Vision und Auffassungen über das gesamte Lieferantennetz

[4-2] Um Innovation und Wissensbasen im Lieferantennetzwerk aufzubauen sind welche Mechanismen im Einsatz. (bitte für eine entscheiden)

- Schwerpunkt auf eigene Fähigkeiten und Kompetenzen mit wenig Beachtung von impliziertem und expliziertem Wissen der Lieferanten
- Aufbau von Organisationsstrukturen und Prozessen, um Lieferantenwissen und Innovationen zu nutzen
- Technologiekalender unter Einbeziehung der Lieferanten bei gemeinsamer Vision. Indikatoren für kontinuierliche Verbesserungen
- Wissenstransfermechanismen für offene und schnelle Zugänge zum Lieferantennetzwerk
- Gemeinsame Nutzungsvereinbarungen um Innovationen über die Lieferantenkette hervorzubringen. Laufende Kommunikationsprozesse über erforderliche Veränderungen in Strategievision, Kennzahlen und Implementierungspraxis

#### V. Rolle kultureller Einflüsse bzw. Restriktionen bei der Implementierung

[5-1] Welchen Wert würden Sie die folgenden Aspekte der deutschen Arbeitskultur bei der Einführung von Lean zumessen?

Arbeitskultur	Maße				
	hat eine stark beschränkende Wirkung	hat eine beschränkende Wirkung	hat keinen Einfluss	hat einen unterstützenden Wert	hat einen starken unterstützenden Wert
Ordnung - definiert als formale Systeme					
Faktenorientiert - in Entscheidungs- und Problemlösungen					
Arbeitsaufgabenorientierte Sicht bei Leistungs- und Aufgabenerfüllung					
Regelmäßige Kommunikation - anweisungsorientiert					
Individuell - aber konsensorientierter Ansatz, eigene Ziele und Erfolgsmaßstäbe für gute Leistungen in der Belegschaft					
Vermeidung von Ungewissheit und Formalstandpunkten					
Niedriger Stand der weichen Faktorentwicklung (niedrige Begeisterung, formaler Umgang am Arbeitsplatz)					
Hohe Spezialisierung bei der Qualifizierung					
Funktionaldenken der Manager					
Betriebsrat					
Zeitwirtschaft					
Standards					
Andere					

[5-2] Der Lean-Implementierungserfolg wird oft in Zusammenhang gebracht mit kulturellem Umfeld oder anderen Gegebenheiten. Wie schätzen Sie die Schwierigkeit bei der Verankerung von Lean ein, bezogen auf die nachstehenden Gegebenheiten?

Lean-Techniken	Schwierigkeit				
	1	2	3	4	5
Fehlende Unterstützung des Topmanagements					
Fehlen der gemeinsamen Vision					
Mangelndes Verständnis von Lean					
Zu geringe Implementierungszeiträume					
Zu geringer Wissensstand bei der Implementierung					
Mitarbeiterblockaden					
Rückfallen in alte Arbeitsmuster					
Andere, indizieren sie bitte					

## VI. Zielerreichung

[6-2] Wie schätzen Sie die Zielerreichung ein?

Lean-Techniken	Zielerreichungen				
	unbedeutend (unter 10%)	wenig (10 - 30%)	befriedigend (30 - 50%)	erheblich (50 - 75%)	sehr gut (75 - 100%)
Kunden/Stakeholder Zufriedenheit					
Dauer der Einführung					
Ausschuss/Nacharbeit					
Durchlaufzeit					
Produktivität					
Lieferzeit					
Produktqualität					
Andere					

## Appendix 2: Questionnaires for Ethiopian Industries

**Mekelle University -Ethiopian Institute of Technology**

**and**

**University of Magdeburg -Institute of Factory Automation and Ergonomics, (Germany)**

***A Questionnaire to assess Kaizen Adaptation and Implementation in Ethiopian Industries***

The survey assesses the adaptation and extent of implementation of Lean/ Kaizen Production and the supply chain techniques in medium and large Ethiopian Industries. The study is part of a PhD work dealing with the Development of Appropriate Adaptation Methodologies and Capability Model for Lean Production system in industries.

The general aim is to examine the strengths and weaknesses of kaizen adaptation and implementation with a purpose of developing mechanisms that can alleviate the weaknesses and further improve the strengths. The focus areas are:

- Recognizing the kaizen understanding level,
- Evaluating the extent of kaizen implementation (the techniques) and its result,
- Examining the methodologies employed for Kaizen adaptation,
- Identifying work culture and attitude related problems and other challenges
- Deriving constructive ideas that can facilitate designing better methods for adaptation
- Evaluating the Supply chain practices and competencies

The intended respondents are peoples who have better know-how about the kaizen within respective industries, such as production/ technical managers, kaizen champions/ representatives, quality circle team leaders, Quality Management system officers and similar personnel who have involved in kaizen activities.

**Dear Respondents,**

- The objective of the questionnaire is to gather information for the study and your participation in this survey is of great value for us.
- All specific organizational and personal information will remain confidential.
- Please confirm your full participation in the study by answering all questions.
- Please respond by making 'X' mark on the space provided corresponding to your choice, and writing on the blank space as necessary.

(For further explanation on any questions, please make a miss-call to Idris Zehrudin on 0910046616; you will get clarification)

## I. General Information

[1-1 – 1-4] Please mark on the space corresponding to your choice.

[1-1] Respondent position in the organization	<input checked="" type="checkbox"/> .Quality Circle Team member, (example)
	<input type="checkbox"/> . Quality Circle (development army) leader,
	<input type="checkbox"/> .Production or Technical Manager
	<input type="checkbox"/> .Kaizen Champions/ Representatives
	<input type="checkbox"/> .Quality Management system officer
	<input type="checkbox"/> .Others (specify) _____
[1-2] Industry sector	<input type="checkbox"/> .Agriculture and Agro related Industry
	<input type="checkbox"/> .Metals Industry
	<input type="checkbox"/> .Textile and Garmnet Industry
	<input type="checkbox"/> .Leather and Leather Products Industry
	<input type="checkbox"/> .Chemical and Process Industry
	<input type="checkbox"/> .Transport and Logistics Industry
	<input type="checkbox"/> .Mining and Quarrying Industry
	<input type="checkbox"/> .Others (specify) _____
[1-3] Number of employees	<input type="checkbox"/> . below 50
	<input type="checkbox"/> . 51- 250
	<input type="checkbox"/> . 251- 500
	<input type="checkbox"/> . Over 501
[1-4] Duration of Kaizen implementation	<input type="checkbox"/> .Less than one year
	<input type="checkbox"/> .1- 2 years,
	<input type="checkbox"/> .More than 2 years,

## II. Lean Notions

[2-1] In your opinion, which idea/s are associated with basic Kaizen principles:

- 1. Applying plan-do-check-act /PDCA/ cycle continually to improve work,
- 2. Satisfying Customer /Stakeholder through better quality products and services,
- 3. 7 Waste Minimization or Elimination,
- 4. Workplace organization, 5S,
- 5. Efficient Resource Utilization,
- 6. Company-wide improvement system through real participation of employees and management,
- 7. Problem solving technique that encourage Process- based thinking,
- 8. A technique that use smaller capable employees and reducing the rest,
- 9. Others (specify) \_\_\_\_\_

[2-2] In adapting Kaizen, what pre-implementation preparation has been done in your organization?  
Mark on 'yes' or 'No'

<i>Kaizen adaptation</i>	<i>Yes</i>	<i>No</i>
Kaizen vision Defined		
The management put a clearly defined policy		
Product value is defined from the customer perspective		
Awareness creation training and discussion took place		
Create and refine kaizen implementation plan		
The management has developed Implementation plan and practiced it		
Kaizen organizational structure established (5S committee, QC teams, ...)		
<i>(Please indicate if other adaptation methods are used)</i>		



### III. The implementation extent for Lean Techniques and Tools

[3-1] To what level/extent the quality circle team/ committee implement or use each of the following Kaizen techniques? (1) very little; (2) little; (3) some; (4) extensive; (5) very extensive

Nr.	Used techniques in Kaizen Implementation	Levels of Implementation				
		1	2	3	4	5
1	Kaizen policy deployment					
2	5S– House keeping					
	• Sorting					
	• Set-in-order					
	• Shine					
	• Standardize					
	• Sustain					
3	7 Waste Elimination					
4	7 Quality Control (7QC) tools					
5	Job Standardization					
6	Production based on Takt-time					
7	Suggestion system					
8	Total Productive Maintenance (TPM)					
9	Organized Quality Circle and supporting committees regular meetings					
10	Participating suppliers and customers in Kaizen activities					
11	JIT deliveries					
12	Multi-functional/ skill workers					
13	Workers training					
14	Autonomy and responsibility (empowerment)					
15	Job stability					
	<i>(If other techniques are used, please indicate)</i>					
16						

### IV. Supply Network Practices

[4-1] In the Design of Supply Network and aligning Core competencies across supplier network

- \_\_\_ 1. Large number of direct suppliers with little evidence of supplier strategy,
- \_\_\_ 2. Rationalized supplier base to focus on key strategic suppliers,
- \_\_\_ 3. Defined Supplier network based on value creation analysis across suppliers,
- \_\_\_ 4. Strategic outsourcing and combination of core competencies within supplier network,
- \_\_\_ 5. Supplier network is defined, developed and integrated to ensure efficient creation of value for stakeholders over the entire product lifecycle.

[4-2] In the effort to Optimize Network- wide Performance to achieve customer value:

- \_\_\_ 1. Supplier relationships are managed by purchasing department on short-term, lowest-bid contracts,
- \_\_\_ 2. Formal supplier assessment for long-term purchase on cost reduction basis,
- \_\_\_ 3. Established common objectives, roles and responsibilities with few suppliers and involvement of key suppliers in design,
- \_\_\_ 4. Strategic alliances emphasize information-, risk- and benefit sharing. Differentiated set of strategies and practices for others. Production and delivery are synchronized across the supplier network,
- \_\_\_ 5. Supplier capabilities are dynamically optimized to ensure efficient value creation and building durable competitive advantage, creating flexibility and responsiveness,

## V. Cultural and other contextual supports and/or difficulties for adaptation

[5-1] In your opinion, which of the following dimensions best reflect Ethiopians work culture. (Mark your choice)

<i>Dimensions (reflections) of work culture</i>	<i>Yes</i>	<i>No</i>
1) Long-term orientation		
2) short-term orientation		
3) Individualism		
4) Collectivism		
5) Power distance		
6) Uncertainty avoidance		
7) Wishing big results in short period of time		
<i>(If there are other reflections, please indicate)</i>		
8)		

[5-2] Factors related with managerial, work culture and attitude and other challenges make Kaizen implementation difficult; how do you see the negative effect of the following factors? (1) has no effect; (2); *little negative effect*; (3) *considerable negative effect*; (4) *very Strong negative effect*

Nr.	Common constraints/ obstacles	Effect level			
		1	2	3	4
1	Lack of top management support				
2	Backsliding to the old ways of working				
3	Failure of past projects				
4	Lack of time to implement				
5	Lack of know-how to implement				
6	Employee resistance				
7	Shared vision among all the employees				
8	Having a team orientation				
9	Empowering employees				
10	Participative leadership style				
11	Open two-way communications				
12	Multi-skill/ flexible workforce				
13	Management commitment and motivation				
14	Availability of resources				
15	(Others specify)				

## VI. Performance Rate

[6-1] Based on the following Kaizen performance indicators, how do you rate the performance improvement of the model work area or organization?

Kaizen Performance indicators	Improvement in Percent (%)				
	0-5	6-10	11-25	26-50	>50
Increase in quality					
Cost reduction					
Increasing Production volume					
Delivery time					
Workers motivation					
Set-up time reduction					
Defect and rework reduction					
Improvement in work flow					
Production based on Takt time					
Work place utilization and cleanliness					
<i>(If there are other performances , please indicate)</i>					

## VII. Expert Opinion

[7-2] What should be done to make Kaizen adaptation and implementation better in Ethiopian Industries?

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

1. What are the possible factors that make the adaptation and implementation of Kaizen unsuccessful in Ethiopian Industries?

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

***Thank you for your Participation in the study!!!***

# መቀሌ ዩኒቨርሲቲ - የኢትዮጵያ ቴክኖሎጂ ኢንስቲትዩት

## እና

### በጀርመን የማግኛቡርግ ዩኒቨርሲቲ

#### በኢትዮጵያ ኢንዱስትሪዎች የካይዘን ትግበራ አካሄድን የሚዳስስ ቃለ መጠይቅ

ይህ የጽሁፍ ቃለ መጠይቅ የካይዘን አገባብንና አፈፃፀምን የሚዳስስ ሲሆን፡ የጥናቱ አጠቃላይ ዓላማ በኢትዮጵያ ኢንዱስትሪዎች የካይዘን ማላመድና ትግበራ ጠንካራና ደካማ ኅኖች መገምገምና፣ ደካማ ኅኖች (ካሊ) የሚታረሙበትን፣ ጠንካራ ኅኖችም ይበልጥ የሚጠናከሩበትን አቅጣጫ መጠቀም ነው። ጥናቱ የተሻለ የሊን /ካይዘን (Lean /kaizen) የማላመድ (adaptation) ስልትና አካሄድን በመቅረፅ ላይ ያተኮረ የፒ.ኤች.ዲ ምርምር አካል ነው።

በዚህ አጠቃላይ የጥናት ዓላማ ስር፣ መጠይቁ የሚከተሉትን ዝርዝር ዓላማዎች ይይዛል።

- ስለካይዘን የተደረሰበትን የግንዛቤ ደረጃ ማወቅ፣
- ካይዘን በምን ያህል መጠን እየተተገበረ እንደሆነና ዉጤቱን መገምገም፣
- ካይዘንን ለመተግበርና ለማላመድ የተደረጉ አካሄዶችን ማጤን፣
- ከልማዳዊ የስራ ባህልና ዝንባሌ ጋር የተያያዙ ሌሎች ፈታኝ ሁኔታዎችን መለየት፣
- ካይዘንን ለማላመድና ለመተግበር የተሻሉ ስልቶችን ለመቀየስ ገንቢ ሀሣቦችን ማየት፣
- የአቅርቦት ሰንሰለትን (Supply chain) አሰራርና ብቃት መገምገም ናቸው።

ለጥናቱ አስፈላጊውን መረጃ ለመስጠት መጠይቅ በመሙላት እንዲተባበሩ የሚጠየቁት ሰዎች፣ በየኢንዱስትሪዎቹ የካይዘን ትግበራ ላይ ጥሩ ግንዛቤና ተሳትፎ ያላቸው አካላት ሲሆኑ እነሱም፣ በድርጅቱ የካይዘን ሻምፕዮን/ተወካይ፣ የምርትና ቴክኒክ ክፍል ሃላፊ፣ የኳሊቲ ሰርክል ቡድን (የልማት ሰራዊት) መሪ፣ የኳሊቲ አመራር ስርዓት (QMS) ሃላፊ እና የመሳሰሉት ናቸው።

#### ውድ መረጃ ሰጪ!

- የመጠይቁ ዓላማ ለጥናቱ መረጃ መሰብሰብ ብቻ መሆኑን እና የሚያደርጉት ተሳትፎም እጅግ ታላቅ ግምትና ዋጋ እንዳለው ይገንዘቡልን።
- የመጠይቆቹ መልሶች ግላዊም ሆነ ድርጅታዊ ምስጢር ይጠበቃል።
- መልስዎን በምርጫዎ አኳያ በተሰጠው ቦታ ላይ ይህን ምልክት 'X' በማድረግ ያመልክቱ፣ መጻፍ ለሚሹ ጥያቄዎች እንዳስፈላጊነቱ መልስዎን በባዶው ቦታ ላይ ይፃፉ።
- ሁሉንም ጥያቄዎች ሞልተው መጠይቁን በመመለስ ተሳትፎዎን ይግለጹ።

(ጥያቄ ካለዎት በ0910046616 ምልክት ቢያደርጉ ከኢ.ድ.ሪስ ዘሀሩዲን ማብራሪያ ያገኛሉ)

## I. አጠቃላይ ዳራዊ መረጃ

[1-1 – 1-4] መልስዎን በምርጫው አኳያ በተሰጠው ቦታ ላይ /X/ ምልክት በማድረግ ያመልክቱ።

[1-1] በድርጅቱ የመልስ ሰጭ ሀላፊነት	<input type="checkbox"/> X. የኋሊቲ ሰርክል ቡድን አባል (ምሳሌ)
	<input type="checkbox"/> የኋሊቲ ሰርክል ቡድን መሪ
	<input type="checkbox"/> የምርት/የቴክኒክ ክፍል ሃላፊ
	<input type="checkbox"/> የካይዘን ትግበራ ሃላፊ (Champion)
	<input type="checkbox"/> የኋሊቲ አመራር ስርአት (QMS) ሀላፊ
	<input type="checkbox"/> ሌላ (ይጻፉት) _____
[1-2] የድርጅቱ ሴክተር	<input type="checkbox"/> ግብርናና የግብርና ነክ ኢንዱስትሪ
	<input type="checkbox"/> የብረታብረት ኢንዱስትሪ
	<input type="checkbox"/> የጨርቃ-ጨርቅ ኢንዱስትሪ
	<input type="checkbox"/> የቆዳና የቆዳ ውጤቶች ኢንዱስትሪ
	<input type="checkbox"/> የኬሚካልና ፕሮሰስ ኢንዱስትሪ
	<input type="checkbox"/> ትራንስፖርትና ሎጂስቲክስ
	<input type="checkbox"/> የማዕድንና ኳሪ (Quarry)
	<input type="checkbox"/> ሌላ (ይጻፉት) _____
[1-3] የድርጅቱ ሰራተኛ ብዛት	<input type="checkbox"/> ከ 50 በታች
	<input type="checkbox"/> 51- 250
	<input type="checkbox"/> 251- 500
	<input type="checkbox"/> 501 በላይ
[1-4] ካይዘን መተግበር ከተጀመረ ስንት ጊዜ ሆነው፡፡	<input type="checkbox"/> ከአንድ ዓመት ያነሰ
	<input type="checkbox"/> ከአንድ እስከ ሁለት ዓመት
	<input type="checkbox"/> ከሁለት ዓመት በላይ

## II. የካይዘን ግንዛቤና አካሄድ

[2-1] በርሰዎ እይታ መሰረታዊ የካይዘን መርህን (Principles) ከሚከተሉት ከየትኛው ሀሳብ ጋር ያያይዙታል? (ከአንድ በላይ መልስ ሊኖረዎት ይችላሉ)

- 1. በቀጣይነት መልክ የ plan-do-check-Act /PDCA/ በመጠቀም አስራርን ማሻሻያ ነው
- 2. በተሻለ የምርት ጥራትና አገልግሎት ደንበኛን ማርካት ነው
- 3. የአሰራርና ምርት ብክነቶችን (7 wastes) ማስወገድ ነው
- 4. የሰራ ቦታን ለአሰራር እንዲመች ማድረግ ነው (5S workplace organization)
- 5. የሰራ ግብአቶችን ባግባቡ መጠቀም ነው
- 6. በሰራተኛና አመራር እውነተኛ ተሳትፎ የሚካሄድ ሁለንተናዊ የሰራ ማሻሻያ ዘዴ ነው
- 7. በሰራ-ሂደት ላይ ያተኮረ አስተሳሰብን (process-based thinking) የሚያበረታታ ነው
- 8. የጥቂት ሰዎችን ብቃት በመጠቀም፣ ሌላውን ሰራተኛ መቀነሻ መንገድ ነው
- 9. (ሌላ መልስ ካለዎት ይጻፉ) \_\_\_\_\_

[2-2] ወደ ካይዘን ሲገባ ድርጅታችሁ ያከናወናቸውን የቅደመ-ትግበራ ዝግጅቶችና እንቅስቃሴዎች “አዎ” ወይም “የለም” በሚለው ስር ምልክት በማድረግ ይመልሱ፡

የካይዘን አገባብ ቅደመ-ትግበራ ዝግጅቶች	አዎ	የለም
1) የካይዘን ራዕይ በድርጅቱ ተቀርጿል		
2) አመራሩ በጥንቃቄ የተሰራ ግልፅ የፖሊሲ ሀሳብ አስቀምጧል		
3) የድርጅቱ ምርት እሴት (Value) ከደንበኛ ፍላጎት አንጻር ተቃኝቷል		
4) የግንዛቤ ማስጨበጫ ስልጠናዎችና ምክክሮች ተደርገዋል		
5) የአፈፃፀም እቅድ ተዘጋጅቶ በውይይት በልጽጓል		
6) አመራሩ የአፈጻጸም ዕቅድ አዘጋጅቶ በአርያነትም እየተገበረ አሳይቷል		
7) የካይዘን በየደረጃው ተዋቅሯል (5s Committee, QC team.....)		
(የተለዩ የቅድመ-ዝግጅቶች ሂደቶች ካሉ ይጥቀሱልን)		

### III. የካይዘን ቴክኒክ የትግበራ መጠን

[3-1] እርስዎ ያሉበት የኳሊቲ ሰርክል ቡድን /ኮሚቴ/ (የልማት ሰራዊት) የሚከተሉትን የካይዘን ቴክኒኮች በምን ያክል ደረጃ ይጠቀማል? 1 = በጣም ዝቅተኛ, 2= ዝቅተኛ, 3= መጠነኛ, 4= ከፍተኛ, 5 = በጣም ከፍተኛ

	በጥቅም ላይ ያሉ ቴክኒኮች	የአጠቃቀም ደረጃ				
		1	2	3	4	5
1	የካይዘን ፖሊሲ ዘርግቶ ማስፈጸም (Policy deployment)					
2	5s (house Keeping/ የስራ ቦታ አያያዝና አጠቃቀም)					
	• ለይቶ ማወቅ (Sorting)					
	• በተገቢው ቦታ ማስቀመጥ (Set-in-order)					
	• አንድባንድ ማጽዳት (Shine)					
	• አሰራርን ወጥ ማድረግ (Standardize)					
	• ቀጣይነቱን ማረጋገጥ (Sustain)					
3	ሰባት የብክነት አይነቶችን ማስወገድ (7 waste elimination)					
4	ሰባት የጥራት ማሻሻያ ዘዴዎች (7 QC Tools)					
5	አሰራርን ወጥ ማድረግ (job Standardization)					
6	በደንበኛ ፍላጎት ላይ የተመሰረተ ያመራረት ቅልጥፍና (takt-time)					
7	የሰራተኛ የማሻሻያ ሃሳብ መስተናገጃ ስርአት (suggestion system)					
8	የአጠቃላይ የምርት መሳሪያዎችን ምርታማ አርጎ መጠበቅና ማቆየት (TPM)					
9	የተደራጀ ኳሊቲ ሰርክል እና ደጋፊ ኮሚቴዎች መደበኛ ስብሰባዎች					
10	ዕቃ አቅራቢ ድርጅቶችን እና ደንበኛ በካይዘን ማሳተፍ					
11	የሚያስፈልግ የጥሬ ዕቃ መጠን በሚያስፈልግ ጊዜ ከአቅራቢ መቀበል (JIT)					
12	ባለ ብዙ ክህሎት (Multi-skilled) ሰራተኛ መጠቀም					
13	የሰራተኛ ስልጠና					
14	ለሰራተኛ ወሳኝነትና ሃላፊነት መስጠት (Empowerment)					
15	የስራ ዋስትና (Job stability) ማረጋገጥ					
	(ሌሎች ቴክኒኮች ካላችሁ ይጥቀሱ)					

### IV. የአቅርቦት ሰንሰለት (Supply chain) አሰራር

[4-1] ድርጅታዊ ብቃትን (organizational competency) ከአቅርቦት ሰንሰለትን አቅም (supply chain capability) ጋር ከማስተሳሰርና ማጠናከር አንፃር ድርጅታችሁን ከሚከተሉት የትኛው ሁኔታ የበለጠ ይገልፀዋል? (በምርጫዎ አኳያ ያመልክቱ)

- \_\_\_ 1. ብዙ ቁጥር ያላቸው ቀጥታ አቅራቢዎችና ውስን የአቅራቢ ድርጅቶች መረጃ አለን
- \_\_\_ 2. ከውስን ስትራቴጂያዊ አቅራቢዎች ጋር ለመስራት የሚያስችል የአቅራቢ ዝርዝር አለ
- \_\_\_ 3. ከሁሉም የድርጅቱ አቅራቢዎች ጋር በእሴት አፈጣጠር ትንተና (Value creation analysis) ላይ የተመሰረተና የተጠና የአቅርቦት ሰንሰለት አለው።
- \_\_\_ 4. ስራን ለሁለተኛ ወገን የመስጠት (Outsourcing) ስትራቴጂ በመጠቀም በአቅርቦት መረብ ውስጥ በቅንጅት ይሰራል
- \_\_\_ 5. በአጠቃላይ የምርት አደገ (product life cycle) ውስጥ ቀልጣፋ የእሴት አፈጣጠርን ለማረጋገጥ፣ የአቅራቢ ሰንሰለት ተለይቷል፣ ዳብሯል፣ ተቀናጅቷል።

[4-2] የአቅርቦት ሰንሰለት አሰራርን በማጠናከር የደንበኛን እርካታን እውን ለማድረግ ካለው ጥረት (effort) አኳያ ድርጅታችሁ ምን እያከናወነ ይገኛል?

- \_\_\_ 1. ከአቅራቢ ድርጅቶች ጋር ያለው ግንኙነት በግዥ ክፍል እየተመራ በአጭር-ጊዜ (Short term) ስትራቴጂ እና በዝቅተኛ የጨረታ ዋጋ ዉል መሰረት ይፈፀማል።
- \_\_\_ 2. የምርት ግብአት ዋጋ ለመቀነስና የረጅም ጊዜ (long-term) የግዥ ስርአትን ለመከተል መደበኛ የአቅራቢዎች ጥናትና ግምገማ እያካሄደ ይገኛል።
- \_\_\_ 3. የጋራ ዓላማ፣ ሚናና ሃላፊነትን በመለየት ጥቂት አቅራቢዎችን በምርት ዲዛይን ላይ ለማሳተፍ መግባባት ላይ ተደርሷል።
- \_\_\_ 4. ጥቅምና ስጋትን (benefit&risk) በመጋራት፣ ማምረትና ለደንበኛ ማቅረብን (production and delivery) በአቅርቦት ሰንሰለት ውስጥ በቅንጅት ለመስራት፣ ስትራቴጂያዊ ውህደት (strategic alliance) ተፈጥሯል
- \_\_\_ 5. ቀልጣፋ የእሴት ፈጠራ፣ ከውድድር ተጠቃሚነትን፣ ከሁኔታዎች ጋር መለዋወጥን (flexibility)፣ ለገበያ ፈጣን ምላሽ ሰጭነትን ለማረጋገጥ፣ የአቅራቢ መረቡ አቅም እንደሁኔታው (dynamically) እየተሻሻለ ይገኛል

### V. ከየሥራ ባህልና ሌሎች ፈታኝ ሁኔታዎች

[5-1] ለካይዘን አፈፃፀም አለመሳካት ከሚጠቀሱ መሰናክሎችና ተፈታኝነት (challenging) የአመራር፣ የልማዳዊ የሥራ ባህልና ዝንባሌዎች (work culture and attitude)፣ ትግበራውን በምን ያክል መጠን ያስተንጉላሉ ብለው ይገምታሉ? 1 = ለውጥ አያመጡም, 2 = በዝቅተኛ መጠን 3 = በመጠነኛ ደረጃ, 4 = በከፍተኛ መጠን

በካይዘን አፈፃፀም ስኬት ላይ ተጽእኖ ያላቸው ምክንያቶች	የማስተንገል ደረጃ			
	1	2	3	4
1) የአመራር ድጋፍ መጥፋት (management support)				
2) ካይዘንን በቀጣይነት አለመተግበርና ወደ ዱሮ አሰራር መመለስ				
3) ያለፉና ያልተሳኩ አዳዲስ አሰራር ስልቶች የፈጠሩት አለታዊ ልምድ				
4) ለመተግበር የተመደበው ጊዜ ማጠር ወይም ጊዜ ማጣት				
5) የአፈፃፀም እውቀትና ክህሎት ማጣት (lack of know-how)				
6) ሰራተኛው ለመተግበር ፍቃደኛ አለመሆን (resistance)				
7) በሰራተኛ መሀከል የጋራ ራዕይ አለመኖር				
8) የቡድን ስራ መንፈስ ማጣት				
9) የሰራተኛ ሀላፊነትን ለመውሰድ (empowerment) አለመፈለግ				
10) ሰራተኛን አሳታፊ የአመራር ልምድ እጦት				
11) ነጻ ሁለትዮሽ መረጃ ልውውጥ (open two-way communication) አለመኖር				
12) ባለ ብዙ ክህሎት ሰራተኛ መሆን (multi-skilled worker) መፍጠር				
13) የአመራር ተነሳሽነትና ዝግጁነት (motivation and commitment)				
14) የግብአቶች መኖርና አለመኖር				
15) (ሌሎች ምክንያቶች ካሉ ይጥቀሱ)				

### VI. ከትግበራው የተገኙ ውጤቶች

[6-1] በሚከተሉት የካይዘን ትግበራ መመዘኛዎች (performance indicators) ሲለካ የድርጅቱ ወይም የናሙና ስራ ቦታው (Model work area) ውጤት በምን ያህል ፕሮሰንት ተሻሽሏል?

የካይዘን ውጤት መለኪያዎች	መሻሻል በፐርሰንት (%)				
	0-5	6-10	11-25	26-50	>50
1) የምርት ጥራት ዕድገት (quality increase)					
2) የወጪ መቀነስ (Cost reduction)					
3) የምርት መጠን መጨመር (Production volume)					
4) በቀጠሮ ለደንበኛ ምርት ማስረከብ (Delivery)					
5) የሰራተኛ ተነሳሽነት (Workers Motivation) መጨመር					
6) የማሸንፍ የሥራ ዝግጅት ጊዜ (Setup time) መቀነስ					
7) እንክፍማ ምርትና (defect) የዳግም ስራ (rework) መቀነስ					
8) የሥራ ፍሰትና (Flow) መሻሻል					
9) በ ፍላጎት ላይ የተመሰረተ ያመራረት ቅልጥፍና (takt-time)					
10) የሥራ ቦታ አጠቃቀምና ጽዳት መሻሻል					
(ሌሎች አሉ የሚሏቸው ውጤቶች ይጥቀሱ)					
11) _____					

### VII. የካይዘንን አተገባበርና ማላመድን በተመለከተ የተሰጠ አስተያየት

[7-1] በኢትዮጵያ ኢንዱስትሪዎች፣ ማላመድንና አገባብን (adaptation)፣ እንዲሁም አተገባበርን (implementation) የተሻለና የተቀላጠፈ ለማድረግ ምን መደረግ አለበት ይላሉ?

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

[7-2] በኢትዮጵያ ኢንዱስትሪዎች፣ የካይዘን ማላመድንና (adaptation) አተገባበርን (implementation) ስኬታማ እንዳይሆን የሚያደርጉት ምክንያቶች ምንዲን ናቸው?

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

በጥናቱ በመሳተፍዎ እጅግ በጣም እናመሰግናለን!!