UNIVERSITY OF SOUTHAMPTON

FACULTY OF BUSINESS AND LAW

Southampton Business School

The Impact of Lean Approaches to Support Quality Developments in Thailand:

"An Investigation of a Claim of Universality of Lean Thinking"

by

Udomlak Srichuachom

Thesis for the degree of Doctor of Philosophy

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ABSTRACT

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Lean Thinking has been highlighted as one of the significant quality improvement approaches that focuses on the fulfilment of customer value and the elimination of waste. It has also been suggested as the major concept that can help an organisation to achieve the implementation of Total Quality Management (TQM) and receive the National Quality Awards (NQAs). Thus, Lean Thinking and TQM could be combined in order to solve problems continually and improve the whole of an organisation. This thesis, therefore, investigates how Lean Thinking was implemented alongside TQM in award winning organisations in Thailand.

The ultimate outcome of this study provides a conceptual academic model of Lean Thinking implementation, which demonstrates a high comprehensiveness of significant Lean elements – prioritising of Lean tools, decision criteria and supporting factors. Construction of the model was preceded by a systematic literature review and a field study, where both online questionnaires and interviews were applied to gather relevant data from 22 award winning organisations in Thailand. The developed model was tested by academics and practitioners who are professionals in Lean Thinking and quality management and subsequently refined.

The key contributions of this research are to the theory of Lean Thinking and its applicability to various industrial settings as well as providing a model of Lean Thinking which has been developed and refined. The model was also validated for its theoretical soundness and potential for practical application from both the comparative analysis and the review by experts. Finally, a model for Lean Thinking implementation as a new theoretical construct is suggested for each industrial sector and incorporates a comparative view between the implementation in manufacturing and service sectors.

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DECLARATION OF AUTHORSHIP

I, Udomlak Srichuachom

declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

The Impact of Lean Approaches to Support Quality Developments in Thailand: "An Investigation of a Claim of Universality of Lean Thinking"

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission.

Signed:.....

Date:.....

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Definitions and Abbreviations

5S	Seiri (Sifting), Seiton (Sorting), Seiso (Sweeping), Seiketsu (Standardise), Shitsuke (Sustain)
BE	Business Excellence
CRM	Customer Relations Management
CSR	Corporate Social Responsibility
DP	Deming Prize
EFQM	European Foundation for Quality Management
EQA	European Quality Award
FM	Flow Management
FTPI	Foundation of Thailand Productivity Institute
GDP	Gross Domestic Product
HR	Human Resource
HRM	Human Resource Management
IMVP	International Motor Vehicle Program
JIT	Just-in-time
JPM	Japanese Production Management
JUSE	Union of Japanese Scientists and Engineers
KPI	Key Performance Indicator
KSF	Key Success Factor
LEs	Large Enterprises
LM	Lean Manufacturing
LPS	Lean Production System

MBNQA	Malcolm Baldrige National Quality Award
NIST	National Institute of Standards and Technology
NQAs	National Quality Awards
NSTDA	National Science and Technology Development Agency
NVA	Non-value-added
PDCA	Plan-Do-Check-Act
QFD	Quality Function Deployment
QM	Quality Management
SMED	Single Minute Exchange of Dies
SMEs	Small and Medium Enterprises
SOPs	Standard Operating Procedures
SQA	Singapore Quality Award
TLA	Thailand Lean Award
TPM	Total Productive Maintenance
TPS	Toyota Production System
TQA	Thailand Quality Award
TQC	Thailand Quality Class
TQM	Total Quality Management
VA	Value-added
VSM	Value Stream Mapping
WM	Waste Minimisation

Chapter 1: Introduction

This chapter introduces the research context which identifies the background of the study, the research gap and problems. It also outlines the research aims, questions and objectives, together with the research scope. The research design is briefly explained and the structure of the thesis is finally described.

1.1 Research Context

As a developing country, the Thai economy depends on both domestic and international markets. Particularly in the global market, Thailand has exported high quantities of goods which account for approximately two thirds of the Gross Domestic Product (GDP) (NESDB, 2012). In order to succeed against the international competition, standards of quality and cost need to be developed (Tannock *et al.*, 2002) and improved. According to Porter (1985), cost leadership, differentiation and focus are key strategies that assist an organisation to develop its competitiveness. Cost leadership and differentiation can be achieved by implementing quality management. In the study of Kumar *et al.* (2009), Total Quality Management (TQM) has been recognised as a key strategy in improving organisational performance and competitiveness. Additionally, a number of literatures (Wisner and Eakins, 1994; Hendricks and Singhal, 1997; Boulter *et al.*, 2013) identified a reduction of costs and/or an increase of sales after TQM implementation.

Since 1992, many organisations in Thailand have begun their quality management journey by implementing ISO certification (Krasachol *et al.*, 1998). This certification standard was considered to be an effective initial approach which can lead to further business process improvement (Bendell, 2005; Punnakitikashem *et al.*, 2010). The majority of the ISO certified companies in Thailand continued their improvement journey by TQM implementation (Krasachol *et al.*, 1998; Punnakitikashem *et al.*, 2010). Although different organisations applied TQM in ways appropriate to them, they shared a number of common aspects which included the commitment of top management, effective communication, use of problem solving tools and techniques, teamwork, training and development of employees (Krasachol and Tannock,

1999). The Deming idea of TQM (Walton, 1986) was the most popular in Thailand (Krasachol *et al.*, 1998). According to Das *et al.* (2008), Thailand was ranked in the middle of Southeast Asian countries in terms of their TQM positioning.

Success in TQM implementation could be assessed by an achievement in the national quality awards (NQAs) (Ghobadian and Woo, 1996). By 2010, 86 countries had created their own NQAs after the success of the Deming Prize, Malcolm Baldrige National Quality Award (MBNQA) and European Foundation for Quality Management Model (EFQM) Excellence Award (Mann *et al.*, 2011b). In fact, these three well-known quality awards are considered as the initial framework of several NQAs which either applied the features entirely or modified these famous award criteria (Talwar, 2011). In Thailand, the NQA, which is named the Thailand Quality Award (TQA), was established in 1996 to support the implementation of the Business Excellence (BE) criteria to improve competitive capability as well as increase learning and encourage a sharing environment in the nation (TQA, 2013b). The TQA has adopted the criteria for performance excellence from the MBNQA in its entirety.

Although there was evidence that TQM implementation resulted in cost reduction in the studies of Wisner and Eakins (1994), Hendricks and Singhal (1997, 2001) and Boulter *et al.* (2013), it was difficult to distinguish which parts of the financial improvement came from TQM implementation (Bergquist *et al.*, 2005). In addition, it was possible that award winning organisations could lose their financial performance after the quality award achievement (Iaquinto, 1999). According to Bergquist *et al.* (2005), two groups of TQM criticism suggested a failure in the implementation process and in the general management approach. Although TQM was recognised as a basic quality management approach, a key weakness of TQM was a lack of clear explanation on how to organise an improvement programme (Bergquist *et al.*, 2005; Soare, 2012; Tatsana-iam and Ngaoprasertwong, 2013). A lack of clear definition might lead to a lack of a common theoretical basis which finally results in a failure in quality development (Bergquist *et al.*, 2005).

According to Chorn (1991), TQM requires a particular environment for implementation. A company could apply this quality initiative successfully if it operated under conditions of low competitive pressure and low strategic risk which allowed a slow strategic formulation process in a mature market. In other

words, TQM implementation is appropriate within a stable environment (Asif *et al.*, 2009). Additionally, TQM was considered to be the single-loop learning in which immediate problems were solved but there was no challenge to base assumptions (Argyris, 1994). TQM could therefore only reach an incremental improvement. Hence, changes through innovation and self-renewal could not be achieved in these TQM applications.

Soare (2012) suggested that, in order to achieve quality improvement, an organisation should have a long-term focus by not only implementing TQM elements but also by applying holistic approaches on continuous improvement such as supported by Lean Thinking. Soare (2012) further explained that Jidoka (Autonomation) and Just-in-time (JIT) were two critical aspects of Lean Thinking that led to high innovation which could fill a gap in TQM application. Innovation, indeed, had led to the development of processes (Clark and Stoddard, 1996) and the effective use of resources (Aoun and Hasnan, 2013). Lean Thinking focuses on process improvements similar to TQM; however, this thinking plans to further develop an organisational system (Bozdogan, 2010).

In fact, Lean Thinking and TQM have shared a similar root from the statistical quality control of Shewhart and Just-in-time (JIT) from the Toyota Company in the Japanese quality evolution. They have common ideas on continuous improvement (Pettersen, 2009) and JIT management (Brown, 1998c) as well as no conflict between their objectives (Dahlgaard and Dahlgaard-Park, 2006).

Lean Thinking is therefore not a replacement for TQM. It is, indeed, a roadmap to support overall TQM principles and objectives (Dahlgaard and Dahlgaard-Park, 2006). TQM is highly focused on continuous improvement of quality (Bozdogan, 2010) which could be achieved through the waste elimination processes of Lean Thinking. According to Stamm *et al.* (2009), TQM focuses on the reduction of variation while Lean Thinking concerns both material and information flow. An organisation could indeed achieve a systematic flow if it could reduce variations in its processes. Consequently, when an organisation has a stable process without any variance, it could apply Lean Thinking's pull system successfully. Furthermore, a culture of continuous learning included in Lean Thinking (Bozdogan, 2010) could be reached by supporting education and training for employees continuously in a TQM implementation. Therefore, it can be said that

TQM and Lean Thinking are complementary and can mutually support each other.

According to Motwani (2003), Lean Thinking and TQM could be combined in order to solve problems continually and improve the whole of an organisation. It was evident that the implementation of a hybrid approach could improve organisational performance more than that obtained by using only a one-sided application (Tatsana-iam and Ngaoprasertwong, 2013). Indeed, a number of writers have provided evidence that the combination of Lean Thinking and TQM application was one of the more effective quality approaches in improving quality, cost, delivery (Ho, 2010b), processing time (Tatsana-iam and Ngaoprasertwong, 2013) and revenue (Ho, 2010a). Duarte and Cruz-Machado (2012) suggested that a success in TQM implementation was a good start in applying Lean practices due to the similar criteria between most quality award assessments and the Lean approach to leadership, people, strategic planning, stakeholders, processes, resources and results. On the other hand, Bozdogan (2010) criticised TQM as only requiring a high focus on the operational level while Lean Thinking covered not only operational but also tactical and strategic management.

It can be supposed that an organisation should implement TQM as the foundation for quality development. Under TQM implementation, an organisation mainly focuses on an improvement at the operational level. After that, it could go further to aim for development on the overall scale of an organisation through the application of Lean Thinking. Therefore, it might be interesting to further investigate how Lean Thinking is implemented alongside TQM. The findings might support an academic debate on benefits of a hybrid approach.

Lean thinking, indeed, is highlighted as one of the significant management approaches and focuses on the elimination of waste. It was initially known as the Toyota Production System (TPS) at the Toyota Motor Corporation in Japan before it was introduced as Lean by Womack *et al.* (1990). Lean Thinking could be applied not only in automotive manufacturing but also in other industries (Womack and Jones, 1996) similar to the universal application of TQM (Sitkin *et al.*, 1994). Five key principles of Lean Thinking are value, value stream, flow, pull and perfection that should be implemented together to eliminate waste.

According to Liker (2004), waste includes overproduction, waiting time, unnecessary transport, over processing, excess inventory, unnecessary movement, defects and unused employee creativity. Waste is considered to be a serious problem in Japan, therefore a high quality of management is required (Schonberger, 1982). The elimination of waste is related to the reduction of variance in TQM principles. If waste is eliminated, variation in processes will be decreased which finally leads to an improvement of organisational processes (Furlan *et al.*, 2011).

Despite being a general principle and having a universal application (Womack and Jones, 1996), TPS is considered to be a system that can be a success in a market requiring a high volume of standardised products (Lander and Liker, 2007). A number of researchers believe that Lean Thinking could not be applied universally due to limitations based on business conditions, industry structures, social and political institutions (e.g. Cooney (2002)). However, Lean Thinking has moved application areas to organisations in other manufacturing and service sectors; for example, agricultural processing plants (Simons and Zokaei, 2005), ceramic tile manufacturers (Bonavia and Marin, 2006), hospitals (Bowen and Youngdahl, 1998; Kim *et al.*, 2006; De Souza, 2009), financial institutions (Allway and Corbett, 2002; Piercy and Rich, 2009), telecommunication organisations (Cuatrecasas, 2002) and government departments (Erridge and Murray, 1998; Radnor and Walley, 2008; Barraza *et al.*, 2009). All of these Lean proponents indicate a number of benefits that include cost reduction, quality improvement, delivery speed or revenue increase after applying this concept. It is interesting to ask whether there are any similarities and/or differences in Lean Thinking implementation among different businesses, particularly given the supposed unique implementations in the manufacturing and service sectors.

Due to the success of reported improvement programmes, a number of scholars and practitioners have become interested in Lean Thinking implementation. However, there is still a question on how to implement Lean tools and techniques in a way suited to the particular needs of the business. In other words, it is difficult to identify what significant elements in Lean Thinking implementation that managers need to be concerned about and where to begin in a business that operates in a different environment from the automotive industry.

According to Pavnaskar *et al.* (2003), misapplication comes from a vagueness in the definition of tools, purpose and implementation which leads to ineffectiveness of resource utilisation and the reduction of employee confidence about Lean Thinking application. An inappropriate framework was regarded as a critical cause of ineffective implementation and misunderstanding of the Lean concepts (Anand and Kodali, 2010). In contrast, a proper model can assist a manager as a guideline to be successful in Lean Thinking implementation (Anand and Kodali, 2010).

The literature review shows a number of frameworks for Lean Thinking implementation which were developed in order to guide a practitioner to apply this thinking successfully. However, the limitations of current frameworks of Lean Thinking application included an incomplete list of Lean elements and lack of a suggested implementation of Lean aspects in practical application (Anand and Kodali, 2009). The existing frameworks of Lean Thinking implementation provide a low level of comprehensiveness (Anand and Kodali, 2010). In addition, selection criteria which are used in making a decision on which Lean elements should be used in an organisation are also rarely presented. Therefore, it can be argued that there are still shortcomings within the Lean Thinking framework as it still does not provide a complete list of Lean tools and reasons why certain tools are used in a specific environment.

Lean Thinking has been implemented not only in manufacturing companies but also service organisations. However, both conceptual and implementation frameworks in the service industry are very rare. The existing literature is focused on only Lean Manufacturing which might not work in the service industry as it has a different environment compared to production. Hence, existing frameworks for Lean Thinking implementation in services are limited by being both low in their comprehensiveness and highly abstract at the same time. In addition, there are few, if any, researches that compare and contrast Lean Thinking frameworks in the manufacturing sector with those in the service industry. Here again we can see a significant research gap.

Lean Thinking implementation focuses not only on a set of tools but also on human resource management. It is important to integrate processes, people, and tools to create a coherent system in Lean Thinking implementation (Liker and Morgan, 2006). However, a number of existing frameworks have had little

discussion about the human resource in Lean Thinking implementation (Pettersen, 2009). Indeed, very few of them have pointed out how people play roles in supporting the application of Lean Thinking. Furthermore, the current frameworks which have combined Lean approaches with selection criteria in making a decision on Lean Thinking application are very rare. Therefore, there is still a question of which elements or features of Lean Thinking are best implemented and in what sequence in order to achieve in quality improvement programmes.

1.2 Research Problems

Using the concept of "problematization" (Alvesson and Sandberg, 2011), the two key assumptions of universality of possible application areas and the implied assumption that all elements of Lean Thinking implementation are always required, have been addressed in this study.

Although Womack *et al.* (1990) claimed that Lean principles could be applied in any industries, there is still a belief that environments that are a best fit for the implementation of Lean Thinking have low demand variability, low product variety (Lander and Liker, 2007) and high volume of repetitive production (Hines, 2009). In other words, an argument about the universality of Lean Thinking application is still a live issue among scholars and practitioners. Therefore, it is worthwhile to investigate whether there are any similarities and/or differences in Lean Thinking implementation among different businesses.

In the second assumption, the research tested what are the particular important elements and why they were chosen in the context of the implementation of Lean Thinking in different environments.

Due to the reported successes of improvement programmes, a number of both academics and practitioners have become interested in Lean Thinking implementation. However, there is still a question of why it is important to do quality improvement, how to be successful in Lean Thinking application and what Lean tools should be selected to be fitted with an organisational circumstance. Additionally, there is still a basic question of where and how to begin.

Furthermore, there is still an academic debate on benefits of a hybrid approach between TQM and Lean Thinking. It might be interesting to further investigate how Lean Thinking is implemented alongside TQM. The findings might support an argument for a hybrid approach. In addition, they might guide an organisation that currently applies only one approach to further improvement through an integration approach between Lean Thinking and TQM.

1.3 Research Gaps

It can be argued that the existing frameworks on Lean Thinking implementation still have a number of shortcomings. These deficiencies include lack of clarity for an implementation sequence and lack of a comprehensive list of Lean elements which are included in the overall toolbox as well as little, if any, discussion of the role of the human resource. The selection criteria in deciding what Lean elements can fit in the specific circumstance are still rarely presented. Additionally, there are very few frameworks for the service sector. Indeed, a comparative study on the differences between frameworks in the manufacturing companies and those in service organisations is rare. In Thailand, the existing framework for Lean Thinking implementation is rarely presented. Even if there were good frameworks that have been developed in other countries, they might not be applicable in Thai contexts. Thailand might have different issues to be managed which might lead to differences in implementation.

Hence, an effective implementation in a real situation is still not proved with good supporting evidence. Therefore, a further study to develop a comprehensive model with high clarity is still needed. In order to address the above problems and gaps, this study will develop (based on an extended literature review in the next chapter) an academic framework as a new theoretical construct. This will be used to evaluate current practices by identifying key components and sequences of Lean Thinking implementation in a number of Thai environments where companies have used this thinking as part of their quality improvement journey.

1.4 Research Aims

1. This research aims to contribute to the academic debate about the supposed universality of Lean Thinking applications and to identify whether there are particular choices of Lean tools and implementation sequences which make business sense in the particular context of the selected businesses in Thailand. These businesses are already committed to making progress on the quality improvement journey through their achievement of the National Quality Award.

2. This study will generate a conceptual academic model which supports the analysis of how Lean Thinking was implemented alongside Total Quality Management.

3. Using information from fieldwork data collection, the research will refine the conceptual model and validate its theoretical soundness and potential for practical application.

1.5 Research Questions

1. What are the patterns in the application of Lean Thinking and tools in the processes used by the target organisations in Thailand?

2. Why do the Thai business excellence organisations make a decision on choice of lean tools to use and can we identify the justifications for the choices made?

3. How do the business excellence organisations in Thailand manage factors that contribute to success in quality improvement through Lean Thinking implementation?

4. What are significant elements in the academic debate that contribute to a complete conceptual model for implementing Lean practices?

In order to address these questions, five research objectives are proposed.

1.6 Research Objectives

- To determine and compare which aspects of the Lean toolbox are widely implemented in the Business Excellence (BE) organisations.
- To identify key decision criteria of the BE managers in selecting Lean toolbox implementation.
- To explore how these managers support human resource roles and manage other important factors in their implementation of Lean Thinking.
- To define critical Lean elements that support an achievement in quality improvement in these contexts.
- To refine, validate and develop the research framework for Lean Thinking implementation.

1.7 Scope of the Research

The scope of this research includes the following:

- This research is mainly focused on the implementation of Lean Thinking in the business excellence organisations in Thailand in order to contribute to the academic debate about the supposed universality of Lean Thinking application.
- The development of a conceptual academic model of Lean Thinking implementation is targeted in order to support the analysis of how Lean Thinking was implemented alongside Total Quality Management.
- A comparative analysis and a review by professionals (who are both academics and practitioners) are used to refine the conceptual model and validate its theoretical soundness and potential for practical application.

1.8 Research Design

The processes in this research are divided into four stages in eight chapters. These four stages (which will be discussed in more detail in Chapter 3) include establishing the conceptual model, designing the research structure, developing an implementation model of Lean Thinking, and finally refining and validating

the developed model. All of these four stages are designed to associate with the above research objectives. In Stage 1 (Chapter 1 and Chapter 2), literature on TQM, BE and Lean Thinking implementation were critically evaluated to understand the current state of the academic debate in order to identify the research gaps and problems, propose the research propositions and questions and develop the conceptual framework.

In Stage 2 (Chapter 3, Chapter 4 and Chapter 5), the selection of the research philosophy and research design is explained. The targets of this study are managers who operate in the organisations that received a Thailand Quality Award (TQA) and/or Thailand Quality Class (TQC) during 2002-2012. Three key kinds of data collection, which are the questionnaire, semi-structured interview and documentation review, are applied in this stage to understand how Lean Thinking was implemented alongside TQM in the BE organisations in Thailand. This stage also provides a discussion of the quality management, motives, critical success factors and barriers to implementation.

In Stage 3 (Chapter 6), the findings in the previous stage are evaluated and used in proposing the model as a new theoretical construct. The developed model identifies not only critical Lean elements but also the decision criteria which should be used when making a decision on implementation and the supporting factors that should be thoroughly managed in order to achieve quality improvement. A different model for each of the service and production sectors is also introduced and explained.

In Stage 4 (Chapter 7 and Chapter 8), key literatures, i.e. the five principles of Womack and Jones (1996) and the Toyota Way of Liker (2004), are compared and contrasted to the model of this research. Furthermore, the developed model is refined by interaction with professionals in Lean Thinking and TQM. All the gathered data are then used to refine the model and experts' feedback is compared and contrasted to establish the validation of the developed model. As a result, a finalised model for Lean Thinking implementation as a new theoretical construct is developed for each industrial sector and a comparative view between the manufacturing and service sectors is produced.

1.9 Structure of the Thesis

This thesis is divided into eight chapters as follows:

- Chapter 1- Introduction:
  Introduces the reader to the research background and defines the research questions, aims and objectives. It also provides the scope of this research and a brief of the research design.

- Chapter 2- Literature Review:
  Reviews the literature that is related to TQM, BE and Lean Thinking implementation. The research problems and gaps are identified and a new conceptual framework created to provide a foundation for the subsequent analysis of the field data to address the issues of theory building and the development of a conceptually validated implementation model.

- Chapter 3 - Research Philosophy and Design:
  Explains and justifies the options and choices made in the research philosophy and research design. It also identifies the research approach which includes the methods of both data collection and analysis. This is based on triangulation of data collection, together with both quantitative and qualitative data analysis.

- Chapter 4 - Data Collection and Analysis:
  Reports on how the empirical data of Lean Thinking implementation in the selected manufacturing and service organisation units were collected. The triangulation of data collection is used in this study. The selection of the participants in this study is also explained. In the data analysis, both quantitative and qualitative approaches are applied.

- Chapter 5 - Research Findings:
  These collected data are analysed using the conceptual academic model generated from the literature review. The results of the findings are used to critique the model and suggest improvements in concepts and extensions used to develop an effective model on Lean Thinking implementation as part of the next chapter.

- Chapter 6 – Developing a model of Lean Thinking:
  Develops a model for Lean Thinking implementation. The developed model provides not only Lean elements and sequences in the application but also the decision criteria and supporting factors for implementation.

- Chapter 7 - Model Validation:
  The validation of the model from a comparative analysis with the existing literature and the effectiveness in the implementation of the case study organisations is described.
  Subsequently, academic and consultant experts' knowledge in Lean Thinking are used alongside the participating managers to examine the new model from an academic viewpoint (does it advance the academic argument of the universality or particularity of Lean Thinking application) as well as asking the participating managers for their view of whether it can be easily operationalized and if it has the potential to improve the implementation process.

- Chapter 8 - Conclusion and Contribution:
  Concludes the thesis by discussing the research outcomes against the research objectives and propositions as well as the logic of the implementation process of the developed model. This chapter highlights the contribution to new knowledge creation. It also points out the limitations of the study and suggests possible future research.

Chapter 2: Literature Review

In this chapter, the existing literature that is related to total quality management (TQM), business excellence (BE) and Lean Thinking implementation is reviewed and critically analysed in order to identify the research gap and to discuss the issues of problematization (Alvesson and Sandberg, 2011). A new conceptual framework is also created to provide a foundation for the subsequent analysis of the field data to address the issues of theory building and the development of a conceptually validated implementation model.

2.1 Total Quality Management and Business Excellence

The increases in global competitiveness and customer expectations have been witnessed in many of the world's markets. A number of organisations have to pursue more effective approaches to focus on customer value which is considered to be one of the sources of competitive advantage (Woodruff, 1997). In order to do that, an organisation needs to search for customers' requirements, and satisfy them by increases in the quality of products or services in parallel with continuously trying to reduce costs. According to Porter (1985), cost leadership, differentiation and focus are key strategies that assist an organisation to develop its competitiveness. Particularly, cost leadership and differentiation can be achieved by implementing quality management (QM). In fact, quality can be used as strategic competitiveness in order to satisfy customers (Brown, 1994). A manager has to listen to the 'voices of customers' before transforming them into quality initiatives. In the study of Kumar *et al.* (2009), TQM has been recognised as a key strategy in improving organisational performance and competitiveness. In fact, TQM is "a way of life" in an organisation that has a good performance in QM (Brown, 1997, 1998). Additionally, a number of authors (Wisner and Eakins, 1994; Hendricks and Singhal, 1997; Hendricks and Singhal, 2001; Boulter *et al.*, 2013) have identified a reduction of costs after TQM implementation.

TQM has been implemented not only by private companies but also public organisations. At present, a number of countries have created their own national quality awards (NQAs) that are mainly based on the original TQM concepts

(Ghobadian and Woo, 1996). According to Khoo and Tan (2003), NQAs aim to support quality of product/service by using the TQM framework to improve organisational performance and promote long-term achievement. In other words, the key objective is to promote awareness of quality and implement good quality practice. However, it is important to develop the criteria or framework of an NQA so that it is appropriate within the changing environment of a competitive world (Tan, 2002). A number of organisations have applied the NQAs framework to do self-assessment and benchmark their performances against best practices (Ghobadian and Woo, 1996; Khoo and Tan, 2003; Sampaio *et al.*, 2012).

An achievement in the NQAs is considered to be a success in the TQM implementation (Ghobadian and Woo, 1996). The term 'Business Excellence' (BE) is used interchangeably with TQM (Boulter *et al.*, 2013). Additionally, BE is used as the synonym of a quality award in the studies of Lee (2002), Mann *et al.* (2011a), Mohammad *et al.* (2011) and Sampaio *et al.* (2012). According to Mann *et al.* (2011b), there were 86 NQAs in 2010. Forty of them applied the framework of the European Foundation for Quality Management Model (EFQM) in its entirely and 17 modified the Malcolm Baldrige National Quality Award (MBNQA). In fact, the Deming Prize (DP), MBNQA and EFQM are considered to be the initial framework of several NQAs (Talwar, 2011).

2.2 The Quality Awards

2.2.1 The Deming Prize (DP)

The DP was founded in 1951 by the Japanese Union of Scientists and Engineers (JUSE). This award was established in order to honour Dr. William Edwards Deming who played a significant role in quality improvement in Japan after World War II (JUSE, 2013). After the war, Japanese products were regarded as very low quality (Austenfeld, 2001). At that time, Deming assisted a number of Japanese firms to develop their quality of product by teaching them statistical quality control. Under the recommendations of Deming, Japanese companies have developed their products remarkably and these have now been accepted as of the highest quality at a global level (Excellence Matters, 2010). The DP, indeed,

is the oldest quality award that has inspired a number of other NQAs including the Malcolm Baldrige National Quality Award in the USA.

The Deming award provides four categories of prize: the Deming Prize for Individuals, the Deming Distinguished Service Award for Dissemination and Promotion (Overseas), the DP, and the Deming Grand Prize (JUSE, 2013). In the third category, the award has been granted annually to an organisation that has a capability in TQM implementation. The DP is not a competitive prize. In other words, there is no maximum number of award recipients per year. After examination of the documentary submission, the qualifying applicant will receive an on-site assessment as the second step, while an organisation that does not meet the criteria will receive feedback from the assessment. In the on-site visit, there are three parts: Schedule A, Schedule B and an Executive Session. Schedule A is comprised of a presentation on the TQM implementation, operational site visit and material review. The evaluation at the operational site, as well as the question and answer session, are key parts of Schedule B. In this stage, an assessor may require an examination which includes a discussion with suppliers, sub-contractors, distributors and customers of the applicant company. The Executive Session is used to evaluate top management roles in supporting TQM implementation.

2.2.2 The Malcolm Baldrige National Quality Award (MBNQA)

The MBNQA was established in 1987 and is managed by the National Institute of Standards and Technology (NIST) in the USA under the Malcolm Baldrige National Quality Improvement Act of 1987 (NIST, 2013a). The key goal of this award is to increase American competitiveness. In fact, this quality movement was enforced in order to respond to the significant success in quality development of the Japanese companies in the global market (Excellence Matters, 2010).

Both public and private organisations that have their headquarters in the USA can apply for this quality award. Initially, there were three categories of prize: manufacturing, service and small business. Prizes for education and healthcare were added in 1998 while an award for non-profit organisations was introduced in 2007. There is no limit to the number of awards in each category; however,

only 18 awards per year can be given covering all six categories. The MBNQA uses seven assessment criteria for performance excellence: Leadership; Strategic Planning; Customer Focus; Measurement, Analysis, and Knowledge Management; Workforce Focus; Operations Focus; and Results. In the evaluation process, the application document is firstly reviewed independently and consensually during June-August. The judging panel plays a role in deciding which applicant company goes to the next step while an organisation that is not allowed to progress receives feedback from the evaluation. The on-site examination is done in October. After that, the judges meet in November to review the results from the site visit. The outcome of the assessment and the recommendations for award recipients are sent to the NIST Director/Secretary of Commerce. To ensure that the winners were appropriate for the award, a number of record checks, which include legal and regulatory requirements, are also done. The MBNQA is traditionally presented by the President of the USA (NIST, 2013a).

2.2.3 The European Foundation for Quality Management (EFQM) Excellence Award

The European Quality Award (EQA) which is now referred to as The EFQM Excellence Award was initially granted in 1992 to European for-profit organisations. The EFQM was founded by 14 European leading organisations to improve competitiveness and sustainable development of the European organisations (EFQM, 2013b). The EFQM Excellence Award is given to an organisation that achieves in adding value for customers, creating a sustainable future, developing organisational capability, harnessing creativity and innovation, leading with vision, inspiration and integrity, managing with agility, succeeding through the talent of people and sustaining outstanding results. The EFQM Excellence model has focused on five enablers and four results. The model requires an organisation to apply five enablers which are leadership, people, strategy, partnership and resources, as well as processes, products and services in order to improve and apply its strategies. In addition, the EFQM model has assessed the applicants' performance on people, customer, society and business outcomes. In the evaluation process, an applicant has to provide a written submission in January. After that, the assessment team will review applications

during March to April. The qualifying organisation will receive the on-site evaluation in June. Generally, the examiners spend one week in visiting the applicant organisations. In July, the EFQM Jury (comprised of top management from leading organisations) does the final review before the award is presented annually in October (EFQM, 2013a).

2.2.4 National Quality Awards (NQAs)

After the success of DP, MBNQA and the EFQM Excellence Award, a number of countries have established their own quality awards (Tan, 2002). In 2010, there were 86 NQAs around the world (Mann *et al.*, 2011b). A number of them have either applied entirely or modified the assessment criteria from the MBNQA and/or the EFQM model. The NQAs generally aim to increase awareness of quality, understand the quality excellence requirements and share the successful strategies and benefits. Different quality awards provided different award categories for different organisation sizes, industry sectors, organisation purposes and quality levels. Most NQAs are operated by their governments' institutes which provided an examiner from both public and private sectors (Tan, 2002).

2.2.5 Thailand Quality Award (TQA)

Thailand Quality Award (TQA) was founded in 1996 as an agreement between the Foundation of Thailand Productivity Institute (FTPI) and the National Science and Technology Development Agency (NSTDA). In order to support the Award recognition, it was implemented as part of the 9th National Economic and Social Development Plan. The TQA aims to support an organisation in Thailand to implement the BE criteria to improve competitive advantage as well as increase learning and a sharing environment (TQA, 2013b). The Office of Thailand Quality Award under the FTPI plays an important role in managing this NQA. Both public and private organisations in either manufacturing or service industries are encouraged to apply for the Award.

The TQA has applied the criteria for Performance Excellence of the MBNQA entirely (TQA, 2013a). Therefore, seven main criteria of the MBNQA, i.e. leadership, strategic planning, customer focus, measurement, analysis and knowledge management, workforce focus, operations focus and results, are used in the TQA assessment procedure. However, these criteria have been scored differently from the American version (Talwar, 2011). During August-November, an assessment is done in three steps: independent, consensus and site-visit reviews. The Award is announced annually in January. Although the TQA has applied the entire criteria from the MBNQA, it has no limit on numbers of award recipients. The applicants with scores of more than 650 out of 1000 points will be honoured with the Thailand Quality Award (TQA); however, those with scores of 350-650 out of 1000 points will be granted the Thailand Quality Class (TQC) Award. From 2002 to 2012, there were a total of 38 award winning organisation units. Four of them achieved the first prize, the TQA.

2.2.6 Similarities and differences among quality awards

Although several NQAs have similar key objectives of promoting quality development, a number of factors in achieving these awards are different (Ghobadian and Woo, 1996; Tan, 2002; Khoo and Tan, 2003; Kumar, 2007; Talwar, 2011; Sampaio *et al.*, 2012) and modified from time to time (Kumar, 2007). Lee (2002) claimed that the DP focused on the application of the sequence 'plan-do-check-act' (PDCA) in an organisation. While the European Quality Award (EQA) considered the causal relationship on not only financial results but also the satisfaction of customers, employees and society. The MBNQA emphasised the effects of drivers, systems, progress measures and goals on maximizing customer satisfaction. The framework of the BE, indeed, could be used as a guideline for implementing strategies and predicting the performance of the organisation (Sampaio *et al.*, 2012). However, an organisation has to personalise the implementation due to the uniqueness of each company. An achievement in the NQAs is considered to be a success in TQM implementation (Ghobadian and Woo, 1996).

2.2.7 National Quality Awards (NQAs) or Business Excellence (BE) implementation

BE is considered as being the significant criteria which an organisation can apply to achieve, not only the world class quality award but also the assessment of performance improvement. After the establishment of the NQAs, a number of organisations have a high rate of awareness of the importance of quality development. From the study of Mann *et al.* (2011a), approximately 90% of survey respondents in India, Japan, the Republic of China, Singapore and Thailand had a good or very good understanding of BE. However, the senior managers had an awareness level higher than other employees. From the survey, 83% of respondents considered that BE was essential to increase the competitive advantage of the organisation. The impact of BE adoption was positive by improving from average to above average in both practices and outcomes.

Similarly to Mann *et al.* (2011a), 57% of survey respondents from the study of Mann *et al.* (2011b) were confident that BE was very important in increasing the competitiveness of their organisations. However, self-assessment was done annually by only 52% of participating organisations. The majority of BE organisations believed that BE was one of the significant tools in improving the organisational performance in both short-term and long-term operations.

However, Mann *et al.* (2011b) found that a lack of clarity in BE advantages, cost of BE, inability to integrate BE as a framework, short-term focus on profits and the time consuming nature of BE development, were critical barriers to BE commitment in the long term. In order to solve these problems, education and training, the involvement of senior management, support from government and BE promotion were all suggested. Although the NQAs' institutions provided several initiatives to increase the BE awareness, clear explanations and precise benefits of BE were required in order to gain not only the awareness but also the understanding of BE (Mann *et al.*, 2011a).

In order to achieve the BE, Lee (2002) developed a framework in TQM practices from four Singapore Quality Award (SQA) organisations. The SQA applied and created its assessment criteria from three key quality awards: the DP, MBNQA and EQA. The framework for the excellence model was created based on the PDCA cycle and ten core values: visionary leadership, valuing people, customer driven quality, agility, system perspective, knowledge management, valuing

partners, societal responsibility, result orientation, and continuous learning and innovation. In order to utilise this model, an organisation should create goals for core values before applying PDCA. In each PDCA phase of the framework, TQM programmes were suggested in order to implement this technique effectively.

In addition, Mohammad *et al.* (2011) suggested a developed framework for improving performance. The model was based on the implementation areas and BE maturity levels with 900 improvement initiatives. A QM system, benchmarking and/or improvement team had to be applied at the beginning stage. When an organisation reached a higher level, it was possible to decide on either implementing further initiatives or using existing tools. Importantly at the highest level, 'the role model', an organisation was required to integrate, align and fit all initiatives within its operation. This model would be applied as a roadmap to make a decision on BE implementation.

2.2.8 Financial performance of quality award winners

As explained above, a number of countries have modelled their NQAs that are mainly based on the original TQM concepts, in order to promote quality awareness in their countries. Indeed, an achievement in the NQAs is considered to be a success in TQM implementation (Ghobadian and Woo, 1996). According to Hendricks and Singhal (1997), TQM implementation leads to growth in sales and an achievement in cost control. However, high investment costs in the awards process, use of possibly inappropriate indicators and poor financial performance at the business level were considered to be key weaknesses in applying a quality award (Jacob *et al.*, 2004). If the quality award is an appropriate indicator of BE, the award recipients should have an excellent performance, not only in operational quality measures but also be excellent from a financial perspective. The relationship between winning a quality award and financial performance is still questioned.

It has been possible that award winning organisations could lose their financial performance after the quality award achievement. In the study of Iaquinto (1999), the majority of the DP recipients had a significantly negative relationship between award winning and financial performance. In the study of Wisner and

Eakins (1994), mixed findings were presented. Although four MBNQA organisations had an improvement in sales growth, return on sales and return on assets, two of them had experienced a decrease in profitability (Wisner and Eakins, 1994).

On the other hand, several writers have identified positive relationships between quality award achievement and financial performance (Hendricks and Singhal, 1997; Ramasesh, 1998; Hendricks and Singhal, 2001; Hansson and Eriksson, 2002; Jacob *et al.*, 2004; Boulter *et al.*, 2013; Zhang and Xia, 2013). A number of them have pointed out improvements in financial perspectives after winning quality awards. Indeed, the study of the relationship between financial outcomes and award winning can be categorised into two groups. The first category is a comparison of the financial performance before and after the award achievement while the second is that between the award recipients and the control groups, which consist of organisations that are the same size, industry or location, but have not achieved the quality awards.

It was evident that the award winning organisations have better financial outcomes than the control groups before the award achievement on operating income (Hendricks and Singhal, 1997; Hendricks and Singhal, 2001; Zhang and Xia, 2013), operating margin (Hendricks and Singhal, 1997), sales (Hendricks and Singhal, 2001; Hansson and Eriksson, 2002; Boulter *et al.*, 2013; Zhang and Xia, 2013), return on sales (Hansson and Eriksson, 2002), cost per sale (Hendricks and Singhal, 2001; Boulter *et al.*, 2013; Zhang and Xia, 2013), profit (Jacob *et al.*, 2004), total assets (Hansson and Eriksson, 2002; Boulter *et al.*, 2013) and inventory turnover (Ramasesh, 1998; Jacob *et al.*, 2004). Additionally, several literatures have focused on not only financial performance but also shareholder wealth. According to Ramasesh (1998), there was a positive relationship between the announcement of an award and the financial return on stock. Similarly, there were positive results and higher performance of the award recipients in share price (Boulter *et al.*, 2013)

It can be seen that there are both positive and negative relationships between quality award achievement and financial performance. Therefore, an achievement in a quality award could not guarantee a better performance from a financial perspective. It can be said that the relationship between the award achievement and the financial outcomes is still unclear and questionable.

2.3 Drawbacks of Total Quality Management

Although there was evidence that TQM implementation resulted in cost reduction in the studies of Wisner and Eakins (1994), Hendricks and Singhal (1997), and Boulter *et al.* (2013), it was difficult to distinguish which parts of the financial improvement came from TQM implementation (Bergquist *et al.*, 2005). In addition, it was possible that award winning organisations could lose their financial performance after the quality award achievement (Iaquinto, 1999). According to Bergquist *et al.* (2005), two groups of TQM criticisms suggested a failure in the implementation process and in the general management approach. Although TQM was recognised as a basic QM approach (Soare, 2012), a key weakness of TQM was a lack of clear explanation on how to organise an improvement programme (Bergquist *et al.*, 2005; Soare, 2012; Tatsana-iam and Ngaoprasertwong, 2013). A lack of clear definition might lead to a lack of a common theoretical basis which finally results in a failure in quality development (Bergquist *et al.*, 2005).

According to Chorn (1991), TQM requires a particular environment for implementation although it was considered to be a universal application. A company could apply this quality initiative successfully if it operated under conditions of low competitive pressure and low strategic risk which allowed a slow strategic formulation process in a mature market. In other words, TQM implementation is appropriate within a stable environment (Asif *et al.*, 2009). Additionally, TQM was considered to be a form of single-loop learning (Argyris, 1994) in which immediate problems were solved but no challenge to base assumptions or double loop learning takes place and therefore this could only reach an incremental improvement. Hence, changes through innovation and self-renewal could not be achieved in these TQM applications.

Soare (2012) suggested that in order to achieve quality improvement an organisation should have a long-term focus by not only implementing TQM elements but also by applying holistic approaches on continuous improvement, such as supported by Lean Thinking. Soare (2012) further explained that Jidoka (Autonomation) and Just-in-time (JIT) were two critical aspects of Lean Thinking that led to high innovation which could fill a gap in TQM application. Innovation has indeed led to the development of processes (Clark and Stoddard, 1996) and the effective use of resources (Aoun and Hasnan, 2013). Lean Thinking focuses

on process improvements similar to TQM; however, this thinking further plans to develop an organisational system (Bozdogan, 2010).

2.4 Total Quality Management (TQM) and Lean Thinking

2.4.1 Historical background of TQM and Lean Thinking

Lean Thinking was first introduced as the "Toyota Production System (TPS)" at the Toyota Company which is a large automotive company in Japan. The TPS was initiated from an experiment of Taiichi Ohno over thirty years in the Toyota Company (Shah and Ward, 2007). Key basis of TPS is an elimination of wastes (Ohno, 1988). According to Liker (2004), waste includes overproduction, waiting time, unnecessary transport, over processing, excess inventory, unnecessary movement, defects and unused employee creativity. Wastes are considered to be a serious problem in Japan, therefore a high quality of management is required to eliminate them (Schonberger, 1982).

The Toyota Company began its quality development process in 1949 by applying statistical quality control methods which were supported by the Union of Japanese Scientists and Engineers (JUSE) as shown in Figure 2-1 (Dahlgaard and Dahlgaard-Park, 2006). At the same time, Taiichi Ohno visited the USA to learn how cars were produced in the world largest plant, Ford's Rouge plant in Detroit. Although he found that mass production at Ford was not applicable in the Japanese context (Womack *et al.*, 1990), Ohno developed some ideas that were learnt from batch production (Voss, 1995a). After his return to Japan, Ohno persuaded employees to work in a team with a better performance. This was finally developed to an idea of "quality circles" (Dahlgaard and Dahlgaard-Park, 2006).

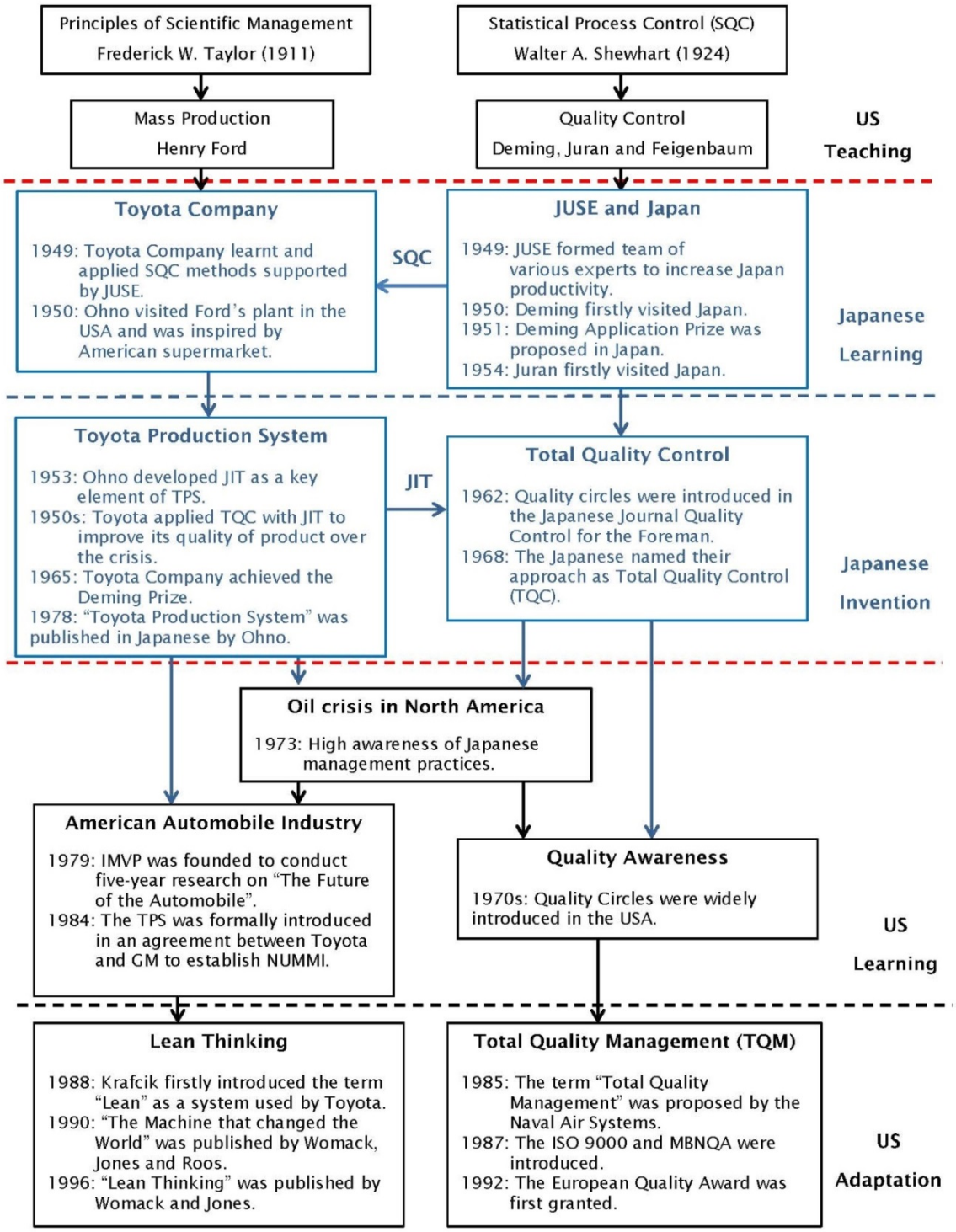


Figure 2-1: Timeline of key events of Lean Thinking and TQM

Additionally, Ohno developed Just-in-time (JIT) which idea came from the modern supermarket in the USA (Dahlgaard and Dahlgaard-Park, 2006). Under the JIT, right parts are available at the right time and the right amount but only when

they are needed (Ohno, 1988). Therefore, it could be used to not only reduce inventory levels but also make visible and allow rectification of any defects produced in the manufacturing processes (Dahlgaard and Dahlgaard-Park, 2006). However, this production system of Ohno was not widely implemented in the Toyota Company in that time due to a focus on mass production.

In 1950s, the Toyota Company had to apply total quality control (TQC) with the JIT in order to improve its quality of product. Key influences in this implementation were a rejection from the US market and pressure from foreign competitiveness (Dahlgaard and Dahlgaard-Park, 2006). By applying TQC together with JIT, the Toyota Company had better performance and achieved the Deming Prize in 1965.

The idea of quality control was indeed initiated from the western experts, i.e. Deming and Juran who played significant roles to help the Japanese companies to improve their organisational performance. Since 1950s, the Japanese organisations had evolved from the statistical quality control in the manufacturing areas to the total quality control at an entire company (Vuppalapati *et al.*, 1995). Total quality control (TQC) of the Japanese was finally developed to be total quality management (TQM) in the USA in 1988 (Dahlgaard and Dahlgaard-Park, 2006).

According to Voss (1995b), JIT initiated by the Toyota Company has evolved into TPS and TQM. It can be said that Lean Thinking and TQM have shared the same root from not only the statistical quality control of Shewhart but also JIT that was initiated by the Toyota Company.

Therefore, TPS was an integrating invention by learning from the western ideas and developing its own management approaches to be compatible with the Japanese contexts. The Toyota Production System is recognised for its impact on company competitiveness as an entire management system that creates a link between internal processes to supplier and customer management (Womack *et al.*, 1990).

Two key elements of TPS are autonomation (human attention is only needed when a machine stops due to any disruptions) and Just-in-time (Ohno, 1988). These resulted from a consideration that large batch, mass production caused a high inventory level and an inability to respond to variety in customer demand

(Holweg, 2007). According to Holweg (2007), a key success of TPS was its ability to learn and integrate benefits of small-lot production to economies of scale; however, the Toyota Company spent a long time in learning and developing this quality improvement approach.

In 1973, the Japanese management practices were of interest to the western automotive companies during the oil crisis in North America. This was followed by the foundation of the International Motor Vehicle Program (IMVP) to conduct a five-year research on "The Future of the Automobile" in 1979. Although the research of the IMVP did not mainly focus on the Japanese management approaches, it inspired a further study to identify why the Japanese were successful. Subsequently, the TPS was formally introduced into the USA in an agreement between Toyota and General Motor (GM) to establish NUMMI (New United Motor Manufacturing) as a joint venture in 1984. However, an application of TPS in the USA in the beginning stage was mainly focused on particular aspects rather than as a holistic system of TPS (Shah and Ward, 2007). Therefore, a transfer of this Japanese management practice to the American companies was an interest of researchers to understand how to apply the TPS successfully in the context of the western companies.

2.4.2 Similarities and Differences between TQM and Lean Thinking

Lean Thinking is not a replacement for TQM; indeed, it is a roadmap to support overall TQM principles and objectives (Dahlgaard and Dahlgaard-Park, 2006). Similarly, according to NIST (2013b) and Corbett (2011) Lean Thinking has been introduced as one of the significant concepts that can help an organisation to be successful in quality improvement as well as achieve the TQM implementation or the MBNQA. A number of researchers (Andersson *et al.*, 2006; Dahlgaard and Dahlgaard-Park, 2006) believe that TQM and Lean Thinking are comprised of both similarities and differences. Both of them had the same origin from the evolution of quality in Japan (Andersson *et al.*, 2006; Dahlgaard and Dahlgaard-Park, 2006) and shared common concepts on continuous improvement (Pettersen, 2009).

In the study of Dahlgaard and Dahlgaard-Park (2006), there was a consistency between the objectives of Lean Thinking with those of TQM. In fact, TQM is

highly focused on continuous improvement of quality (Bozdogan, 2010) which could be achieved through the waste elimination processes of Lean Thinking. Both TQM and Lean Thinking similarly place emphasis on the management of JIT (Brown, 1998c). According to Stamm *et al.* (2009), TQM focuses on the reduction of variation while Lean Thinking concerns both material and information flow. In other words, flow and pull systems in Lean Thinking are related to the elimination of barriers in the TQM concept (Dahlgaard and Dahlgaard-Park, 2006).

An organisation, indeed, could achieve a systematic flow if it were to reduce variations in its processes. Consequently, when an organisation has a stable process without the variance, it could apply Lean Thinking's pull system successfully. Furthermore, a culture of continuous learning included in Lean Thinking (Bozdogan, 2010) could be reached by supporting education and training for employees continuously in TQM implementation. Therefore, it can be said that TQM and Lean Thinking are complementary and can mutually support each other.

According to Motwani (2003), Lean Thinking and TQM could be combined in order to solve problems continually and improve the whole of an organisation. It was evident that the implementation of a hybrid approach could improve organisational performance more than that obtained by only using a one-sided application (Tatsana-iam and Ngaoprasertwong, 2013). Indeed, a number of writers provided evidence that the combination between Lean Thinking and TQM application was one of the more effective quality approaches in improving quality, cost, delivery (Ho, 2010b), processing time (Tatsana-iam and Ngaoprasertwong, 2013) and revenue (Ho, 2010a).

Duarte and Cruz-Machado (2012) suggested that success in TQM implementation was a good start in applying Lean practices due to the similar criteria between most quality award assessments and the Lean approach to leadership, people, strategic planning, stakeholders, processes, resources and results. However, Bozdogan (2010) criticised TQM as only requiring a high focus on the operational level while Lean Thinking covered not only operational but also tactical and strategic management. Therefore, it can be supposed that an organisation should implement TQM as the foundation for quality development. Under TQM implementation, an organisation mainly focuses on an improvement

at the operational level. After that, it could go further to aim for development on the overall scale of an organisation through the application of Lean Thinking.

2.4.2.1 Critical evaluation

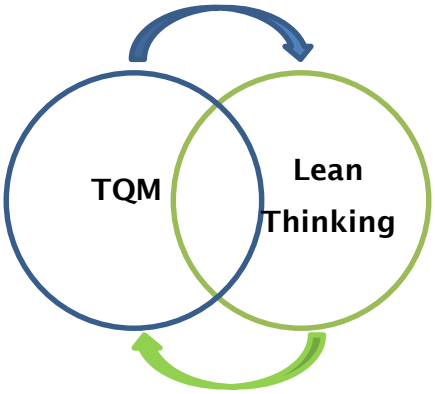


Figure 2-2: Relationship between TQM and Lean Thinking

It was found that Lean Thinking and TQM have shared a similar root from the statistical quality control of Shewhart and JIT from the Toyota Company in the Japanese quality evolution. They have common ideas on continuous improvement (Pettersen, 2009) and JIT management (Brown, 1998c) as well as no conflict between their objectives (Dahlgaard and Dahlgaard-Park, 2006). Motwani (2003) suggested that Lean Thinking and TQM could be combined in order to solve problems continually and improve the whole of an organisation. Thus, it can be said that TQM and Lean Thinking share some similarities and support each other as shown in Figure 2-2. In order to achieve in quality improvement effectively, an implementation of both TQM and Lean Thinking might be a good combination to deliver better organisational performance.

Therefore, it will be worthwhile to find out how Lean Thinking was implemented alongside TQM to complement and mutually support each other in the context of the business excellence (BE) organisations.

2.5 Lean Production

The term "Lean Production" was first used by Krafcik (1988) who was the first American engineer to work in NUMMI. After that, the term "Lean Production" was used by Womack *et al.* (1990) in their first book "The Machine That Changed the World". According to Shah and Ward (2007), Lean Production is still mainly focused on an elimination of wastes by minimising any variability in suppliers, customers and internal processes. Lean Production, therefore, needed to be considered as a development of high-skilled workers and suppliers to improve quality and productivity performance (Krafcik, 1988).

After awareness of better performance of Lean organisations, a number of western companies attempted to apply Lean Production in their shop floor. However, they found that it was not easy to transplant Lean production that has a deep root from TPS which has a different cultural context from the western companies. According to Hines *et al.* (2004), Lean Production was limited to a focus of tool application in the automotive business but with an inability to cope with any demand variability. In a traditional TPS, the environments were low demand variability, fixed cycle time, low product variety, long production runs with stable batch sizes and highly skilled employees (Lander and Liker, 2007) whereas several companies which tried to apply Lean had different situations. Therefore, there was a question on how to implement this concept in different environments, cultures, and countries.

2.6 Lean Thinking

Womack and Jones (1996) introduced their later book "Lean Thinking" to extend the application to other industrial sectors. They defined Lean Thinking as "a way to do more and more with less and less". This aims to serve a requirement of a customer by using a small amount of resources which included human resource, equipment and time. According to Hines *et al.* (2004), Lean Production was mainly implemented at the operational level while Lean Thinking is at the strategic level by considering an organisation as a whole. Therefore, it can be said that Lean production is a part of Lean Thinking as shown in Figure 2-3.

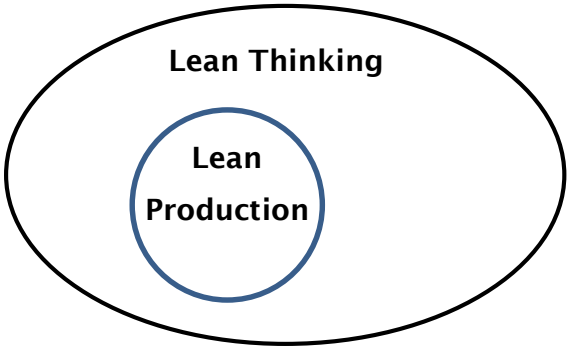


Figure 2-3: Lean Production and Lean Thinking

Lean Thinking is "a way of thinking" that focuses on a holistic system which supports an organisational culture to do continuous improvement (Taj, 2005). In order to achieve quality improvement through the implementation of Lean Thinking, an organisation needs to consider an integrated system from raw material to finished products (Lamming, 1996) as "a strategic model" (Lamming, 1993). Lean Thinking therefore considers not only an improvement in an entire organisation but also a development of its supply chain.

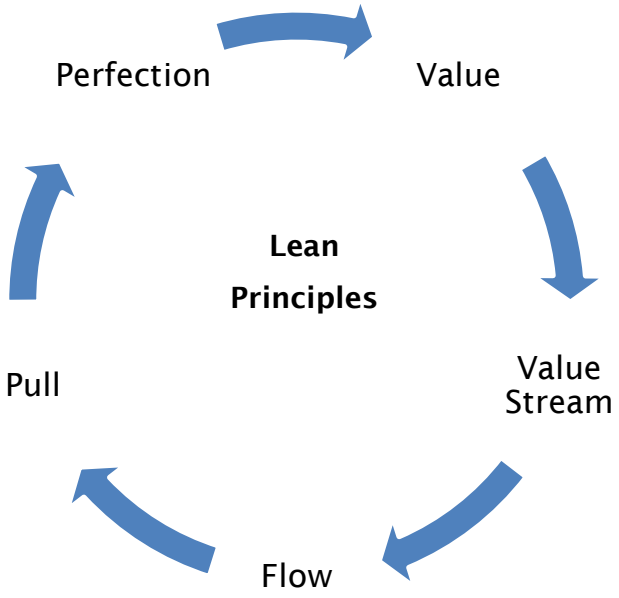


Figure 2-4: Five principles of Lean Thinking

In the "Lean Thinking" book, five principles of Lean Thinking are value, value stream, flow, pull and perfection which should be implemented together in order to eliminate wastes as shown in Figure 2-4. Value is at the heart of Lean Thinking and should be defined by an end customer for a particular product (Womack and Jones, 1996). It is therefore important to identify the exact requirements of customers in order to satisfy them at a reasonable price at a right time. In the second principle, value stream describes the processes which include problem solving, information management and transformation tasks (Womack and Jones, 1996) to deliver value to the customer, as defined by them. A consideration of an entire supply chain is recommended in order to understand the "demand network" (Bicheno and Holweg, 2009).

The third principle, flow, emphasises how to process raw material into finished product without defect, stoppage and repetition of work. Furthermore, an important point in making value flow is a clear vision of top management that guides and supports an organisational strategy to respond to customer's value (Bicheno and Holweg, 2009). The next principle of Lean Thinking is pull. Womack and Jones (1996) explained that a product should be pulled from the manufacturer by customers when they want it. In other words, a company starts a production only if receiving a customer demand rather than pushing an unwanted product to a market. Therefore, an organisation needs to respond to customers' demand with low inventory (Bicheno, 2008).

The last principle is perfection in which zero defects and transparency are the important aspects. Defects are one of the seven wastes that cause not only unnecessary costs but also unreliable customer service (Bicheno and Holweg, 2009). Following the first four principles of Lean Thinking can assist Lean implementers to attain the defect-free output (Womack and Jones, 1996). In addition, a system which prevents any defects needs to be installed in all processes from marketing to after-sales service (Bicheno, 2008). Furthermore, transparency requires a clear relationship and communication among stakeholders in the entire supply chain in order to receive value information which is used in proposing effective strategic planning. In addition, the management is able to provide positive feedback to employees who will then improve their performance to reach customers' value expectations.

Lean Thinking is indeed an integrated system (Bicheno and Holweg, 2009) that concentrates on a whole supply chain (Lamming, 1996; Brown, 1998c). It is comprised of process, people and tools which are integrated into the system model (Liker and Morgan, 2006). The Toyota philosophy was based on a good process that had good principles as well as considering the human element as a competitive resource that could not be duplicated (Liker and Hoseus, 2010). Tools and technology should be installed in supporting people to continuously improve their work (Liker and Morgan, 2006). Indeed, Toyota built a strong culture by investing in developing people and creating deep relationships based on trust (Liker and Hoseus, 2010). Therefore, it is important to integrate process, people, and tools to create a coherent system in Lean Thinking implementation. This would result in continuous improvement and a learning organisation.

According to Womack *et al.* (1990), Lean principle could be applied in any industries. In their book "The Machine that Changed the World" (1990, p.9), Womack *et al.* described that:

> *"We believe that the fundamental ideas of lean production are universal – applicable anywhere by anyone – and that many non-Japanese companies have already learnt this."*

In other words, Lean Thinking could be transferred and applicable to an organisation regardless of businesses and countries. Therefore, Lean Thinking has moved application areas to organisations in other manufacturing and service sectors; for example, agricultural processing plants (Simons and Zokaei, 2005), ceramic tile manufacturers (Bonavia and Marin, 2006), hospitals (Bowen and Youngdahl, 1998; Kim *et al.*, 2006; De Souza, 2009), financial institutions (Allway and Corbett, 2002; Piercy and Rich, 2009), telecommunication organisations (Cuatrecasas, 2002) and government departments (Erridge and Murray, 1998; Radnor and Walley, 2008; Barraza *et al.*, 2009). All of these Lean proponents indicate a number of benefits that include cost reduction, quality improvement, delivery speed or revenue increase after applying this concept.

However, TPS is considered to be a system that can be a success in a market requiring high volumes of standardised products (Lander and Liker, 2007). Due to having a particular history and location, the Toyota Company could achieve quality improvement through an application of JIT (McIvor, 2001). A number of researchers therefore believe that Lean Thinking could not be applied universally

due to limitations based on business conditions, industry structures, social and political institutions (Cooney, 2002). In order to be lean, an organisation has to create its own way in an application of Lean Thinking (Taj, 2005). In other words, Lean implementers need to adapt the concept to be consistent with their contextual influences (Bicheno and Holweg, 2009; Pettersen, 2009). Therefore, in order to achieve success in Lean Thinking implementation an adaptation needs to consider any specific differences in environment between the particular organisation and the Toyota Company, along with restructuring the organisation to become more flexible in adopting new ideas.

Therefore, there is still an argument about the universality of Lean Thinking application. It is interesting to ask whether there are any similarities and/or differences in Lean Thinking implementation among different businesses.

2.7 Lean Thinking Implementation

In this study, the term "Lean Thinking implementation", "the implementation of Lean Thinking", "Lean Thinking application" and "the application of Lean Thinking" are used to refer to a process of putting Lean Thinking into action in order to improve organisational performance.

According to Schonberger (2007), Lean Manufacturing (LM) is one of three key elements of Japanese Production Management (JPM). It is focused on both tool implementation and the soft side of management. In the Toyota culture, JIT, visual management, and standardised work were the foundations to identify problems which could be solved by people (Liker and Hoseus, 2010).

Although Lean Thinking is not a set of tools (Bicheno and Holweg, 2009), tools and technology should be installed in supporting people to continuously improve their work (Liker and Morgan, 2006). In order to achieve quality improvement, Lean tools should be combined as the inter-related elements (Liker, 2004). Significant Lean tools which were frequently mentioned in key literature, i.e. Ohno (1988), Womack *et al.* (1990), Womack and Jones (1996), Liker (2004) and Bicheno and Holweg (2009), are Kaizen, Single minute exchange of die (SMED), Just-in-time (JIT), Kanban (Pull system), Heijunka (Level scheduling), Andon (Visual management) and Five Ss as shown in Figure 2-5.

Therefore, it might be said that these set of tools are vital and should be integrated in the implementation of Lean Thinking.

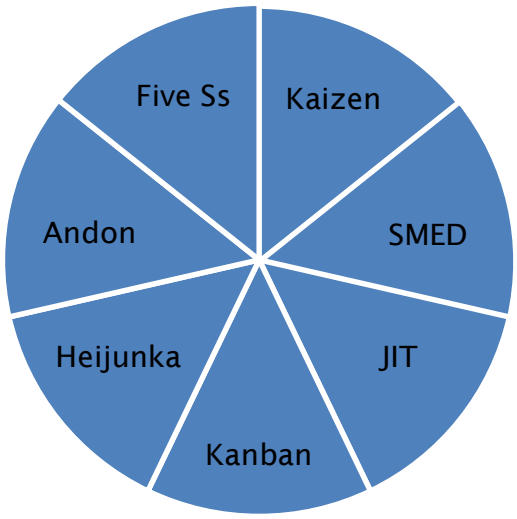


Figure 2-5: Significant tools in key literature

However, it was found that a number of Lean tools were weighted differently in the above key literature. Poka-Yoke (Error proofing), Standardisation, Total productive maintenance (TPM) and Jidoka (Autonomation) were included in the work of Ohno (1988), Liker (2004) and Bicheno and Holweg (2009). While, Hoshin Kanri (Policy deployment) and Value stream mapping (VSM) were mentioned in the books of Womack *et al.* (1990), Womack and Jones (1996), Liker (2004) and Bicheno and Holweg (2009). Thus, it might be assumed that Lean tools should be selected to be appropriate with the contextual factors of different organisations.

2.7.1 Lean Thinking in Manufacturing

The literature review highlights that Lean Thinking has evolved from Toyota Production System in the Japanese company to the western organisations. However, it was not easy to transfer Japanese culture to the western workplace. According to Liker and Hoseus (2010), continuous improvement via PDCA, which was the responsibility of all people in the Toyota culture, was the most difficult

application in the Toyota Company in the USA. Liker and Hoseus (2010) suggested that restructuring of Human Resource Management (HRM) was required to improve a collaboration and integration between HR and manufacturing. Therefore, an implementation of Lean Thinking in a different culture and country might need a particular strategy to be fitted with the unique circumstances.

However, a number of studies have suggested that when Lean Thinking is implemented in an organisation which has a different environment from the Toyota Company, it could still assist that company to make improvements. Although TPS is considered to be a system that can be a success in a market requiring a high volume of standardised products with stable batch sizes (Lander and Liker, 2007), Lean Thinking has been successfully implemented in the aerospace business which runs its business through a project-based process that creates low volume of product (Crute *et al.*, 2003).

Similar to the study of Bonavia and Marin (2006), industrial housekeeping, standardisation, Total Productive Maintenance (TPM) and quality control were implemented by the majority of firms which had large batches with few different products and long set-up times. Although none of them implemented cellular manufacturing plants, Kanban (visual controls) or pull system, some organisations applied set-up time reduction, multi-function employees, and graphs or panels for visual factory display and problem solving. Group technology and set-up time reduction were rarely applied. This might indicate that Lean Thinking could be applied in different businesses but based on a selection of particular tools.

In fact, Lean Thinking has been moved not only to industrial processing companies but also to the processing of agricultural products. Although it was difficult to apply Lean Thinking in the agricultural industries due to product characteristics, an understanding of the concept and an adaptation to the business were significant in making Lean Thinking implementation possible in these industries (King and Venturini, 2005).

Kaizen and standardisation were implemented in the Brazilian sugar and alcohol factory to solve problems of waiting time, excessive stocks and excessive movement in transportation processes in the study of Marquesini *et al.* (2008), who provided evidence that harvest and transportation costs were decreased

from 34% to 22.6%. Additionally, Lean Thinking was successfully applied in the UK red meat industry. Simons and Zokaei (2005) suggested that Takt Time (to schedule the production rate) and standardized work could be used to improve industry performance. With Lean Thinking implementation, better performance was identified, particularly including higher operator activity and lower labour cost.

In addition, value stream mapping (VSM) could be applied to identify both waste and opportunities for improvement. According to Lehtinen and Torkko (2005), VSM is the first step to leanness which supported cost reduction and continuous improvement. The VSM was applied in not only the distribution company (Jones *et al.*, 1997; Hines *et al.*, 1998) but also the automobile industry (Wu, 2003), textile company (Comm and Mathaisel, 2005), cottonseed oil industry (Seth *et al.*, 2008) and food industry (King and Venturini, 2005; Lehtinen and Torkko, 2005; Zarei *et al.*, 2011). It might be said that the VSM was used to identify not only value-added activities but also non-value-added processes which should be eliminated from an operation. However VSM, similarly to other Lean tools, might have weaknesses in its implementation. When an organisation decides to apply this tool, it is essential to think about its constraints and adapt it to be consistent with organisational conditions.

In a labour-intensive industry, Lean Thinking could also be applied under a wide range of products and operated in batch production in China (Comm and Mathaisel, 2005). Small batch size, value stream mapping and JIT production were applied to solve problems of long lead times, delayed delivery, the inventory of work-in-progress and the inability to calculate production time. As a result, there were improvements in waiting time, throughput, processing time and lead time. Comm and Mathaisel (2005) further suggested Level production should be implemented to continually improve the operations.

2.7.1.1 **Critical evaluation**

From the above literature, it is obvious that Lean Thinking has been implemented in not only industrial sectors but also the agricultural processing industry in both developed and developing countries. Although each business has a unique set of circumstances, a number of Lean tools could be used to solve problems and

develop improved organisational performance. Therefore, it might be said that Lean Thinking could be applied in a variety of businesses.

PDCA (Plan, Do, Check and Act) (Liker and Hoseus, 2010), VSM (King and Venturini, 2005; Lehtinen and Torkko, 2005; Zarei *et al.*, 2011), Five Ss (Simons and Zokaei, 2005; Bonavia and Marin, 2006), standardisation (Bonavia and Marin, 2006), TPM (Bonavia and Marin, 2006), quality control, Kaizen (Continuous Improvement) (Marquesini *et al.*, 2008), Takt Time (Simons and Zokaei, 2005) and JIT (Comm and Mathaisel, 2005) are Lean tools which were applied in the literatures above. Indeed, JIT and standardised work were considered to be the foundations of Lean Thinking (Liker and Hoseus, 2010). These tools therefore might be key Lean tools in the manufacturing industry as shown in Figure 2-6.

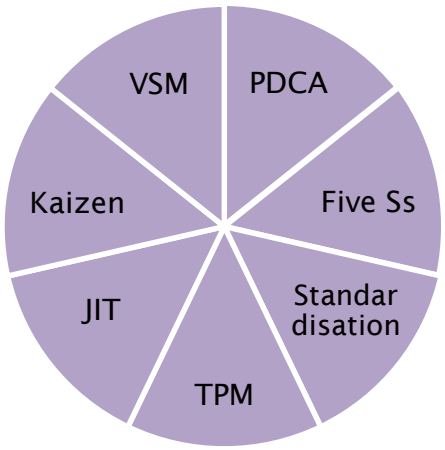


Figure 2-6: Important Lean tools in the manufacturing businesses

However, it was also found that a number of Lean tools, i.e. cellular manufacturing plants and Kanban had never been implemented in the study of Bonavia and Marin (2006). In contrast, these tools are suggested as important elements in Lean Thinking implementation in the study of Bhasin and Burcher (2006). Hence, different studies ranked Lean tools differently. Thus, it might be supposed that with so many choices of Lean tools, an organisation has to select and prioritise tools that are appropriate to their circumstances. The question is what tools should be selected and where to start?

In addition, the above literature has focused on the implementation approaches and/or Lean tools differently. The majority of them have investigated very few numbers of Lean tools. Therefore, the literature does not actually reflect a complete picture of the implementation of Lean Thinking. Only a few performance indicators were used, despite the fact that the main problems included issues concerned with quality, cost, time and movement. This might not reflect a comprehensive indicator of the improvement from the implementation. In addition, almost all researchers did not provide a reason why the implemented Lean tools were selected to solve a problem and/or improve performance in a case study. Further study, therefore, is still needed.

2.7.2 Lean Thinking in Service

After its successful implementation in the manufacturing industry, Lean Thinking has moved to the service sectors. Lean methods which were successful in a manufacturing environment could be applied and achieved in the service industry (Bowen and Youngdahl, 1998). Although manufacturing and service industries have similarities in some structures and common problems, there are several differences between these two industries which include not only the difference between tangible and intangible products but also cultures, practices, organisation goals, process changes, laws and regulations, and customers (Scorsone, 2008). In a service organisation, a customer is unique and has flexible demands (Cuatrecasas, 2002) while Lean Thinking application in a manufacturing sector is easier with a standard and low variety of products. Each service organisation applies these principles differently by adapting them to their operations (Radnor and Walley, 2008; Barraza *et al*., 2009).

In the study of Bowen and Youngdahl (1998), JIT, which is one of key elements of TPS, was applied in both fast food restaurants and an airline company. Flow and pull processes are important choices of Lean Thinking implementation in the Southwest Airlines and the Shouldice Hospital (Bowen and Youngdahl, 1998). In addition, Lean management actions, which included Takt Time, linear flow arrangement, small production batch and quality assurance, were applicable to solve problems of low productivity in workstations and low flexibility in the telecommunication service (Cuatrecasas, 2002). In UK financial service

companies, five principles of Lean Thinking were applied to identify customer expectation, examine the operational system, create a single organisation unit, change the performance indicators and support changes by HRM to solve problems of poor quality service and operational costs (Piercy and Rich, 2009).

The public sector organisations could also receive improvement benefits although they operate with a number of rules and regulations which could be considered to be constraints to Lean Thinking implementation (Erridge and Murray, 1998; Scorsone, 2008). In fact, government and business organisations had several significant differences in customers, organisation goals, process changes, choice and equity, and the value equation (Scorsone, 2008). However, Kaizen (Radnor and Walley, 2008; Barraza *et al.*, 2009), Five Ss (Radnor and Walley, 2008; Barraza *et al.*, 2009), Standardisation (Barraza *et al.*, 2009), Value Stream Mapping (VSM) (Radnor and Walley, 2008), Kanban (Radnor and Walley, 2008) and Lean supply (Erridge and Murray, 1998) were applied in the public sector organisations similar to those in the private companies. Thus, government could receive benefits from Lean Thinking implementation by the reduction of cost and still be subject to administrative law and civil service constraints.

Hence, service industries could be successful in Lean Thinking implementation just like the Toyota Company had been. Fact-based analysis, structured problem solving, Takt Time and standardisation all played important roles in Lean transformation processes in the service business (Allway and Corbett, 2002). An implementation of kaizen (Continuous Improvement) was considered to be the initial technique which led to further implementation of JIT, Kanban (Pull System), Poka-Yoke (Error Proofing), Andon (Visual Management), Single Minute Exchange of Dies (SMED or Quick Changeovers), TPM, and Heijunka (Level Scheduling) (Barraza *et al.*, 2009).

In addition, customer value, HRM (Bowen and Youngdahl, 1998; Radnor and Walley, 2008), change management (Piercy and Rich, 2009), leadership skill, communication at all organisation levels (Allway and Corbett, 2002), teamwork and innovation (Radnor and Walley, 2008) need to be focused together with making an appropriate adaptation in implementing Lean tools.

2.7.2.1 Critical evaluation

From the literature review, the majority of researchers support Lean Thinking as a universal method which can be applied in service sectors. However, it is significant that they suggest the need to adapt this concept to the service environment (Allway and Corbett, 2002; Radnor and Walley, 2008; Barraza *et al.*, 2009) which is quite different from manufacturing conditions (Erridge and Murray, 1998; Cuatrecasas, 2002; Scorsone, 2008).

Generally, the Lean tools which were implemented in the services environment were JIT (Bowen and Youngdahl, 1998; Barraza *et al.*, 2009), pull system, flow processes (Bowen and Youngdahl, 1998), Five Ss (Radnor and Walley, 2008; Barraza *et al.*, 2009), Standardisation (Barraza *et al.*, 2009), value stream mapping (Barraza *et al.*, 2009) and Kanban (Radnor and Walley, 2008; Barraza *et al.*, 2009). In particular, Kaizen has been of interest to a number of organisations (Radnor and Walley, 2008; Barraza *et al.*, 2009). These might be significant choices of Lean tools in the service industry as shown in Figure 2-7.

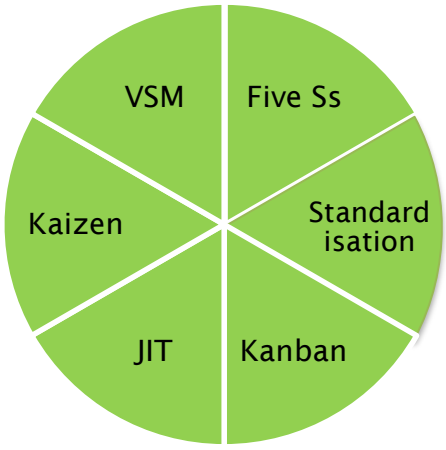


Figure 2-7: Significant Lean tools in the service industry

However, similar to an application in the manufacturing sector, the service organisations selected one or more Lean tools from many choices to implement in their organisations. Key reasons in a selection might be appropriateness to their business circumstances. The question is what tools are fitted and where to begin in the service industry?

Although a number of businesses in the service industry have been studied regarding the possibility of implementing Lean Thinking, there is little literature that explains the actual implementation approaches and reasons why Lean tools and/or techniques were selected to be applied in a particular case study. In addition, there are a limited number of Lean tools that were used in each study. Therefore there still remains the question of whether there can be a universal application of Lean Thinking in the service industry.

2.7.3 Lean Thinking Implementation in Thailand

Since 1992 many organisations in Thailand have begun their QM journey by implementing ISO certification (Krasachol *et al.*, 1998). This certification standard was considered to be an effective initial approach which can lead to further business process improvement (Bendell, 2005; Punnakitikashem *et al.*, 2010). According to Krasachol *et al.* (1998), the number of organisations that have applied International Organization for Standardisation (ISO) certification has increased significantly since 1996. The majority of ISO certified companies in Thailand continue their improvement journey by TQM implementation (Krasachol *et al.*, 1998; Punnakitikashem *et al.*, 2010).

Although different organisations applied TQM in ways appropriate to them, they share a number of common aspects which include the commitment of top management, effective communication, use of problem solving tools and techniques, teamwork, training and development of employees (Krasachol and Tannock, 1999). Similarly, commitment of top management, supplier management, continuous improvement, product innovation, benchmarking, employee involvement, reward and recognition, education and training, customer focus and quality of product, should all be considered in TQM implementation (Das *et al.*, 2008). The Deming idea of TQM (Walton, 1986) has been the most popular in Thailand (Krasachol *et al.*, 1998). According to Das *et al.* (2008), Thailand was ranked in the middle of Southeast Asian countries in terms of their TQM positioning.

According to Rahman *et al.* (2010), Lean practices could be applied successfully in an Asian environment. In fact, Japanese management approaches could be

implemented successfully in the Thai cultural environment (Krasachol and Tannock, 1999).

Table 2-1: Three categories of Lean techniques in the study of Rahman *et al.* (2010).

Categories	Lean tools
Just-in-time (JIT)	Preventive maintenance, cycle time reduction, inventory reduction, new process equipment, quick changeover and setup time reduction
Waste minimisation (WM)	Bottleneck removal, pull system, Poka-Yoke (Error Proofing) and waste elimination
Flow management (FM)	Lot size reduction, single supplier and continuous flow

In the study of Rahman *et al.* (2010), thirteen Lean tools were categorised into three groups as shown in Table 2-1. The Rahman *et al.* (2010) approach was further investigated in the study of Laosirihongthong and Techawiboonwong (2009). Similar results were found in both studies that JIT played a significant role in the operations of Thai large organisations (LEs). In the operations of SMEs, Rahman *et al.* (2010) showed that only WM had a high level of impacts while Laosirihongthong and Techawiboonwong (2009) indicated that both JIT and WM were important tools. However, JIT was applied significantly in Thai-owned and joint venture corporations (Laosirihongthong and Techawiboonwong, 2009; Rahman *et al.*, 2010). These findings reflect that Lean Thinking in different circumstances, i.e. size and/or type of the organisations has particular choices in an implementation.

The study of Pradabwong *et al.* (2012) also found that different Lean tools were implemented at the different levels in Thai manufacturing companies as shown in Table 2-2. Although both internal operations and external relationships were concerned in these companies, supplier involvement was applied in only half of

the participants due to a lack of trust between organisations and suppliers. In addition, Pradabwong *et al.* (2012) found that JIT was implemented by few companies due to using raw material from overseas which had to be delivered in larger batches. They had to concentrate on the transportation cost, lot size and delivery issues.

Table 2-2: An implementation of Lean elements in the study of Pradabwong *et al.* (2012).

Number of participants	Lean elements
All	Mistake Proofing , senior management, quality circles, PDCA and employee involvement
Majority	pull, Kanban (visual control) and visual control systems, safety improvement programmes, reward and recognition and communication
Few	JIT, Five Ss, SMED, supplier involvement and long-term supplier relationships

It can be noticed that JIT which is considered as key Lean tool was rarely implemented in Thai manufacturing companies. This might confirm that among many choices of Lean tools an organisation selects tools that are appropriate to its circumstances.

According to Tatsana-iam and Ngaoprasertwong (2013), hybrid approach could improve organisational performance more than that obtained by using only a one-sided application. The implementation of Lean-TQM could reduce processing time more than that of only one approach alone (Tatsana-iam and Ngaoprasertwong, 2013) while that of Lean and Agile could reduce inventory level and waiting time (Khongsup and Wasusri, 2006). Therefore, it might be interesting to further study to find out how Lean Thinking is implemented alongside TQM in organisations in Thailand.

2.7.3.1 Critical Evaluation

It was found that among many choices of Lean tools, organisations in Thailand selected tools which might be appropriate to their business circumstances. In addition, different tools were implemented at different levels in these companies. Some tools, i.e. JIT which are considered as significant element in Lean Thinking in one literature were rarely implemented in other studies. It might be said that different organisations placed an emphasis on particular tools. Therefore, it might be a question on what Lean tools should be selected in the beginning stage of quality improvement through Lean Thinking implementation.

According to Khongsup and Wasusri (2006) and Tatsana-iam and Ngaoprasertwong (2013), hybrid approach could be applied in Thai organisations and resulted in an improvement in organisational performance. It might be interesting to further investigate how Lean Thinking is implemented alongside TQM. The findings might support an academic debate on benefits of a hybrid approach. In addition, they might guide an organisation that currently applies only one approach to further improvement through an integration approach between Lean Thinking and TQM.

From the above literature, it is obvious that there are very few studies on Lean Thinking implementation in Thailand. All literatures focus on only one industry which is either manufacturing or the service sector. No researcher has done a comparative study on whether Lean tools have been implemented differently between the manufacturing and service businesses. In addition, there is only one research in Thailand that emphasised the benefit of a hybrid approach between TQM and Lean Thinking (Tatsana-iam and Ngaoprasertwong, 2013).

Although there are a number of literatures that investigate Lean Thinking implementation in several countries, Thailand might have a unique environment when compared to other countries which might lead to a difference in Lean Thinking implementation. In addition, a study on Lean Thinking implementation in the BE organisations in Thailand has rarely existed. Therefore, further study on Lean Thinking implementation is still needed, particularly a study of how the BE organisations in Thailand apply Lean Thinking as an integration approach to continuous improvement.

2.7.4 Goals and benefits of Lean Thinking implementation

According to Pettersen (2009), goals of Lean Thinking implementation could be categorised into internal and external focuses. The first goal places emphasis on cost reduction while an external focus is based on an improvement of customer satisfaction. Lean Thinking would also benefit from a development of internal processes. These included fewer defects (Womack *et al.*, 1990; Womack and Jones, 1996), flow process (Liker, 2004), a reduction of wastes (Ohno, 1988; Womack *et al.*, 1990; Womack and Jones, 1996; Liker, 2004; Bicheno and Holweg, 2009) and inventory reduction (Womack *et al.*, 1990; Womack and Jones, 1996; Liker, 2004).

In the practical application, a number of improvements were reported. In the manufacturing business, after the Lean Thinking implementation there are developments on lead time (Crute *et al.*, 2003; Comm and Mathaisel, 2005), inventory turnover (Crute *et al.*, 2003), rework (Crute *et al.*, 2003), labour productivity (Crute *et al.*, 2003) continuous improvement (Crute *et al.*, 2003), waiting time (Comm and Mathaisel, 2005; Marquesini *et al.*, 2008), throughput time (Comm and Mathaisel, 2005), processing time (Comm and Mathaisel, 2005), setup time (Taj, 2005), inventory level (Comm and Mathaisel, 2005; Taj, 2005; Marquesini *et al.*, 2008), excessive movement (Marquesini *et al.*, 2008), on-time delivery (Comm and Mathaisel, 2005), labour cost (Simons and Zokaei, 2005), transportation costs (Marquesini *et al.*, 2008), team-work (Taj, 2005) and supplier relationship (Taj, 2005). It can be noticed that most literature mainly focused on the improvement in an internal process but less emphasised on a whole supply chain.

In the service business, a number of improvements were evident similar to the manufacturing industry. The development include cost reduction (Bowen and Youngdahl, 1998; Erridge and Murray, 1998; Cuatrecasas, 2002; Piercy and Rich, 2009), lead time (Cuatrecasas, 2002), processing time (Piercy and Rich, 2009), flexibility (Cuatrecasas, 2002), inventory level (Erridge and Murray, 1998), waste elimination (Cuatrecasas, 2002; Barraza *et al.*, 2009), process work flow (Barraza *et al.*, 2009), productivity (Radnor and Walley, 2008), speed (Radnor and Walley, 2008), quality (Erridge and Murray, 1998; Cuatrecasas, 2002; Radnor and Walley, 2008), customer involvement (Barraza *et al.*, 2009) and relationships with both customers and suppliers (Erridge and Murray, 1998). Similar to improvements in

the manufacturing organisation, the service industry mainly focused on the development on the internal process which included cost, time and quality but had less concerned on the improvement in a whole supply chain.

Benefits of the implementation of Lean Thinking might be categorised into three groups which are internal process, cost reduction and customer-supplier relationship as shown in Figure 2-8.

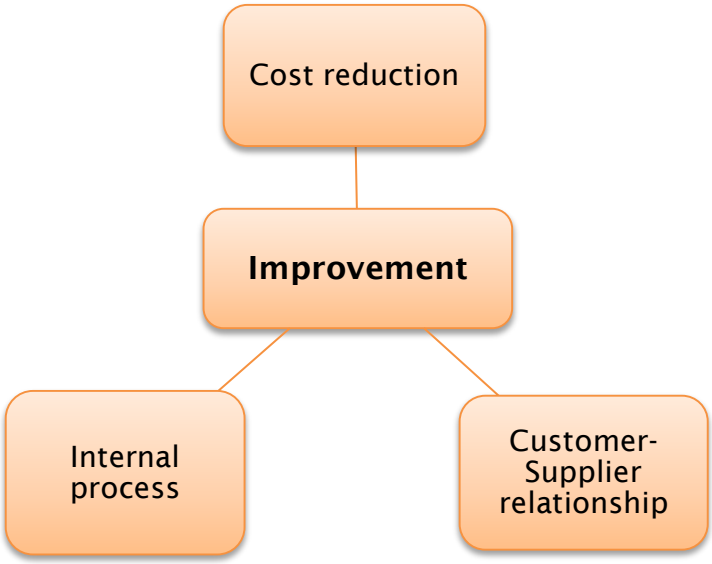


Figure 2-8: Three categories of improvement after the implementation of Lean Thinking

2.7.5 Key Success Factors (KSFs) in Lean Thinking implementation

In order to reach an achievement in Lean Thinking implementation, a number of researchers have suggested key aspects that should be included as part of an application. In fact, it is important to begin with an awareness of key concepts and benefit allocation in the degree of openness and trust among firms (Simons and Taylor, 2007). A commitment for change of senior management had the most importance before starting Lean transformation (Brown, 1998c; Allway and Corbett, 2002; Thawesaengskulthai, 2010; Jaaron and Backhouse, 2011). In fact, top management needs to propose clear and consistent targets in quality development before communicating to employees in order to have a clearer understanding of implementation (Crute *et al.*, 2003). Importantly, quality improvement plans need to be consistent with and link to corporate strategies

(Voss, 1995b). In other words, an alignment in strategies of all management levels has to be carefully considered and implemented prudently.

According to King and Venturini (2005), transparency and open environments were required across the supply chain in a Lean Thinking implementation. Additionally, a positive attitude of employees (Crute *et al.*, 2003; Thawesaengskulthai, 2010), transparency in communication (Crute *et al.*, 2003; Thawesaengskulthai, 2010; Jaaron and Backhouse, 2011), organisational culture (Crute *et al.*, 2003) team building (Jaaron and Backhouse, 2011), and the structure of rewards and recognitions (Thawesaengskulthai, 2010) were considered as critical success factors in Lean Thinking application.

In the service industry, key factors which make Lean Thinking applicable were teamwork and innovation (Radnor and Walley, 2008), process change structure (Piercy and Rich, 2009), managerial culture (Cuatrecasas, 2002), staff empowerment and continuous improvement (De Souza, 2009). Lean Thinking application in services, however, was based mostly within an organisation rather than across organisations. In the study of Radnor and Walley (2008), they suggested a culture of employee involvement and change management should be developed in order to succeed in Lean Thinking implementation. An achievement of Lean Thinking application was driven by not only senior management but also everyone who worked as a team in an organisation. Thus, Lean Thinking required a consideration both of the enabling conditions and the whole system.

According to Cuatrecasas (2002), structure, managerial culture, human resources, formation, and promotion were significant factors that had an impact on Lean Thinking implementation in the service industry. Firstly, structure should focus on process management, with a horizontal and flat organisational structure. Managerial culture needed upstream and downstream communication with participation built in, while human resource should be polyvalent and have functionality over multiple processes with motivation and a future improvement goal. Next, formation should be done continuously, and permanently, on training and working in a team. The last issue was the promotion of individual initiatives and decision making.

Lean Thinking has been interesting not only to large organisations but also SMEs. However, different companies are faced with different environments

(Hines *et al.*, 2004). In order to achieve in Lean Thinking implementation, SMEs have to restructure their organisations to become more flexible in adopting new ideas. Additionally, four critical success factors in the application in the SMEs are leadership and management, finance, skill and expertise, and organisational culture (Achanga *et al.*, 2006).

2.7.5.1 Critical Evaluation

It can be argued that in order to achieve Lean Thinking implementation, an organisation should begin a programme with the commitment of top management to an open and transparent policy. One thing that has to be recognised is that quality improvement requires participation from the whole organisation rather than only one department. In addition, the implementation of Lean Thinking needs to consider good management of the supply chain rather than focus only within an organisation. In other words, intercompany management should be done in order to achieve quality improvement in an entire supply chain. It can therefore be concluded that key success factors in the implementation of Lean Thinking can be categorised into three groups which are organisational management, intercompany management and human resource management as shown in Figure 2-9.

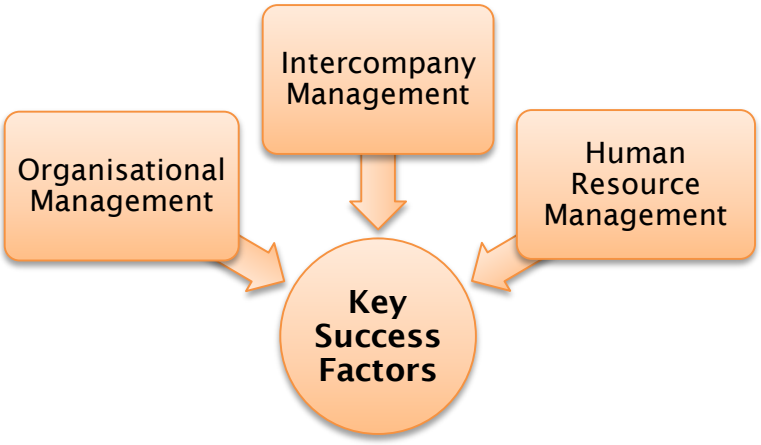


Figure 2-9: Key success factors in the implementation of Lean Thinking

2.7.6 Barriers and solutions in Lean Thinking implementation

From the literature review, it is notable that a number of organisations have experienced several barriers in QM and Lean Thinking implementation. These led to failure and/or the discontinuing of an application. In general, key barriers when implementing QM initiatives were resistance to change, lack of employee cooperation and lack of resource (Thawesaengskulthai, 2010). According to Pradabwong *et al.* (2012), leadership, culture change, skill level and employee expertise, and financial support were barriers to Lean Thinking implementation. In order to overcome these problems, management support, education and training as well as rewards and recognition programmes were suggested as solutions.

In the service sector, significant barriers were: lack of clear customer focus; too many procedures; people working in silos; excessive targets; lack of awareness of strategic direction; lack of understanding of variations, system thinking and process flow; lack of a culture of employee involvement and change management (Radnor and Walley, 2008). A lack of understanding of the service sector by external consultants, as well as poor levels of internal involvement and supported attributes were also mentioned (Barraza *et al.*, 2009).

In Lean healthcare, arguments about an applicable implementation, hospital environment, professional differences and misunderstandings among workforces were considered to be cultural and practical barriers. These could be solved by better communication and cross-functional departmental working (Kim *et al.*, 2006). A lack of understanding and poor cultural fit were considered to be barriers in the implementation of Lean supply in local government (Erridge and Murray, 1998). Lean Thinking application can be successful if a service organisation utilises the abilities and skills of its workforce to adapt and apply Lean tools and techniques to their operations in systematic processes (Bowen and Youngdahl, 1998). It requires not only senior management commitment (Allway and Corbett, 2002) but also everyone to work as a team in an organisation (Allway and Corbett, 2002; Radnor and Walley, 2008).

2.7.6.1 Critical Evaluation

From the above literature, it can be seen that a number of barriers were found in several organisations during Lean Thinking implementations. The barriers were common among businesses while some were unique problems to each organisation.

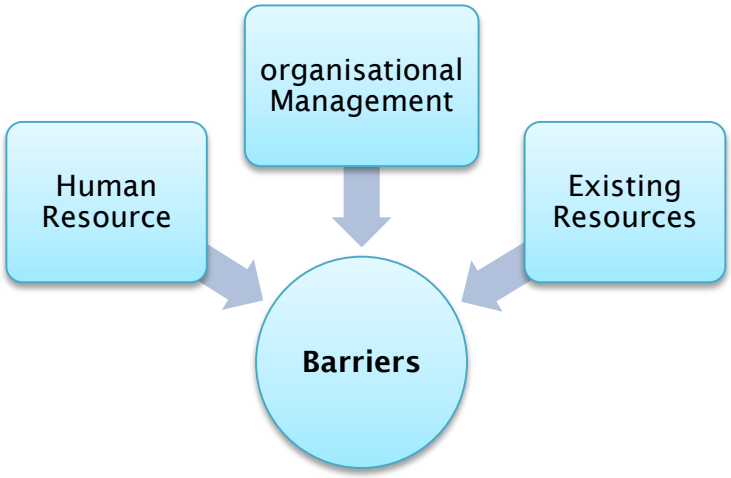


Figure 2-10: Barriers in the implementation of Lean Thinking

These barriers can be categorised into three groups which are problems on human resource, organisational management and existing resources of the organisation as shown in Figure 2-10. It can be seen that human resource and organisational management can be both key success factors that support an achievement in quality improvement and barriers that lead to a failure in the implementation of Lean Thinking. Therefore, it is important to thoroughly plan and manage these elements to be in a good position to support quality development in an organisation.

However, a study on barriers to implementation in Thailand has rarely taken place. This topic needs to be further studied. Although organisations might have had the same QM approach, they may face different problems in Lean Thinking application due to their unique organisational environment. Therefore, it is interesting to look at what significant barriers there are to Lean Thinking implementation in organisations in Thailand.

2.7.7 The existing frameworks in Lean Thinking implementation in the extant literature

2.7.7.1 Framework on Lean Thinking implementation

Due to the reported successes of improvement programmes, a number of practitioners have become interested in Lean Thinking implementation. However, there is still a question of how to implement Lean tools and techniques appropriately. According to Pavnaskar *et al.* (2003), misapplication from any vagueness of which suitable tool to use, definition, purpose, and implementation will lead to ineffective utilisation of resources and the reduction of employee confidence in Lean Thinking application. Additionally, a misunderstanding by managers and a lack of employee education were two critical reasons which caused failures in Lean Thinking implementation (Anand and Kodali, 2009). In contrast, a proper model can assist a manager, as a guideline to successful implementation (Anand and Kodali, 2010).

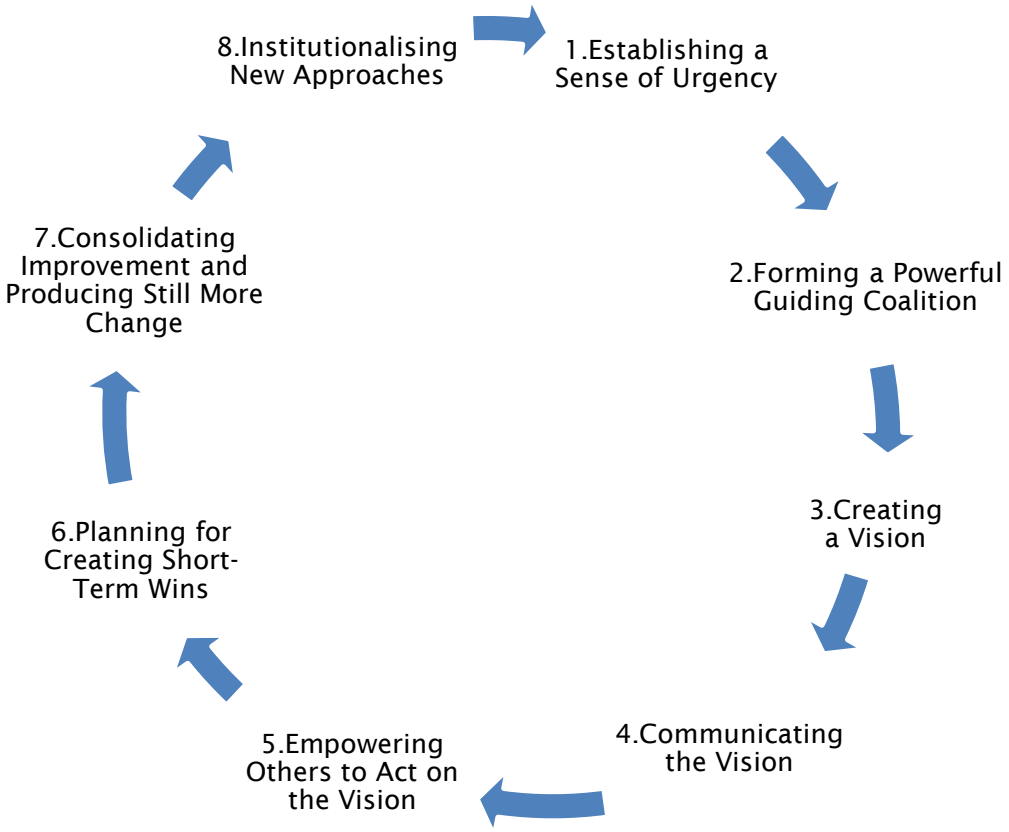


Figure 2-11: Kotter's 8-Step Process for Leading Change

One of the well-known change models is the Kotter's 8-Step Process for Leading Change as shown in Figure 2-11. Although this model is not directly the Lean Thinking model, it is worthwhile to understand what should be considered in a change process. The 8-Step Process of Kotter was first introduced in 1995. A change should begin from a recognition on a need of an improvement to cope with a competitive position (Kotter, 1995b). A change should be initiated from a good leader who commits to the better performance and is able to build a good team. After that, a change leader needs to propose and communicate a clear vision to an entire organisation. In order to change effectively it is important to eliminate any barriers which might obstruct a better performance. However, it takes time to reach an actual improvement which should be rooted into organisational culture and values.

Therefore, key elements in a change process are leadership, teamwork, management vision, communication, time and organisational culture and value. If the Lean Thinking model is comprised of these elements, it is more likely that the model can be used to assist an implementer to apply the model easily and sustain an improvement process.

A fundamental framework on Lean Thinking implementation includes five key principles – value, value stream, flow, pull and perfection (Womack and Jones, 1996). It was initially known as the Toyota Production System. Thus, another key framework that is equally important to the five key principles is the 4P model of the Toyota Way. Philosophy, Process, People and Partners, and Problem Solving are four categories of the Toyota Way which focuses on the whole system of Lean Thinking (Liker, 2004). It was believed that following these frameworks might lead to a success in quality improvement through Lean Thinking implementation.

However, Hines (2009) found the five principles of Lean Thinking limited. He therefore developed the 8Ps model which is comprised of eight elements: purpose, process, people, pull, prevention, partnering, planet and perfection. Hines (2009) claims that his 8Ps model is a complete framework which provides more "contingent and sustainable" approaches than the original framework. Furthermore, the Sustainable Lean Iceberg Model was later suggested by Hines *et al.* (2011). This model places emphasis not only on process management,

technology, tools and techniques, but also on strategy, alignment, leadership, behaviour and engagement.

From the above key frameworks, it can be seen that five principles of Lean Thinking places emphasis on significant elements in Lean Thinking while the remainder provide not only important Lean aspects but also other supporting factors, i.e. leadership and strategic management which are similar to the 8-step model of Kotter. Therefore, it might be said that in the beginning stage it is important to understand what are the key elements in Lean Thinking implementation. After that, other factors that might support a success in an application need to be considered and managed thoroughly.

Furthermore, it might be worthwhile to investigate a framework that was created from an actual implementation in order to understand how to implement Lean Thinking successfully. In the study of Pavnaskar *et al.* (2003), a classification scheme of 101 Lean Manufacturing (LM) tools could be used in both tool-based and problem-based approaches to identify a tool's character and its application, as well as to define problems or sources of waste and match them with proper LM tools respectively. This framework provides an application level for each LM tool; however, it was found that this classification was designed to present an implementation of one LM tool in one picture. Therefore, it might be difficult to compare an implementation of several tools in a real application.

The framework of Kettinger and Grover (1995) in implementation of LM was adapted by Motwani (2003). Five main aspects of the framework were strategic initiatives, learning organisation, cultural factors, information technology and network relationship. In fact, the management had a commitment to make LM implementation a top priority by initiating an open door policy which led to trust among employees. These aspects are consistent with the Kotter 8-step model that suggests good change processes. However, the framework of Motwani (2003) did not provide guidance about what the appropriate Lean tools are that should be applied to reach quality improvement.

Anand and Kodali (2009) developed a framework for LM systems in which the five key components were foundation, pillars, decision level, stakeholders' roles and lean elements. In foundation, leadership, cultural and human aspects as well as the commitment of management and employees were required as prerequisites before implementation. Lean Thinking implementation should

begin from the elimination of waste and this could be done only if the foundations were strong. At the decision level, although most Lean elements were based on the operational decision level, the commitment of top management was still required. This framework, indeed, required an integration of all Lean elements rather than a stand-alone application.

In their later work, Anand and Kodali (2010) further developed a framework for LM implementation in order to identify steps in the implementation to be consistent with a number of Lean aspects. They suggested ten levels in the implementation from evaluation to continuous improvement. However, both frameworks which were developed by Anand and Kodali (2009) and Anand and Kodali (2010) focused on only LM rather than Lean Thinking. In addition, the selection criteria that need to be considered when making a decision on the implementation of Lean tools were not included. However, leadership, cultural and human aspects which are considered as key elements in change process (Kotter, 1995b) are presented in these frameworks.

Furthermore, a fundamental mind-set that drives improvement toward Lean production was suggested by Yamamoto and Bellgran (2010). Four steps in the mind-set were Reduce, See, Think and Act to set a parameter, discover the cause of the problem, propose a solution and solve a problem, respectively. Cultural change and a learning organisation could be reached by implementing this mind-set. However, this fundamental mind-set was relatively simple and omitted Lean aspects, i.e. Lean tools and reasons in an implementation which might lead to a question on how to implement Lean Thinking by following this framework.

Dombrowski *et al.* (2010) developed the adaptive configuration of a Lean Production System (LPS) in SMEs. It began from an awareness of LPS benefits, decision making on implementation, conceptual design by a steering team, planning for goals, training courses and resource utilisation, pilot project, implementation process and continuous improvement. The framework of Dombrowski *et al.* (2010) is similar to that of Kotter (1995) with a start from a recognition of the importance of an improvement. However, there was little discussion about what Lean tools should be implemented in SMEs and how this configuration was applied.

It can be seen that the above frameworks were developed based on LM in the production industries instead of focusing on Lean Thinking in both the

manufacturing and service organisations. In the study of Jaaron and Backhouse (2011), a model of Lean Thinking which was developed from the service department in a manufacturing company was suggested. This model focused on the roles of top management in Lean Thinking implementation. However, Lean tools and other related factors which might have an impact on the application were omitted in this model. Thus, it might be only appropriate for the beginning stage of Lean Thinking implementation.

2.7.7.1.1 Critical evaluation

From the above literature, the existing frameworks have a separate focus rather than an integrated view. The studies of Pavnaskar *et al.* (2003), Motwani (2003), Anand and Kodali (2009), Anand and Kodali (2010), Yamamoto and Bellgran (2010) and Dombrowski *et al.* (2010), focused only on the frameworks of LM/Production instead of Lean Thinking. In addition, these frameworks have rarely provided information on how to select Lean tools to match specific situations.

However, it might be concluded that a good framework should comprise of not only Lean tools but also other supporting elements, i.e. leadership, human resource management and strategic management as shown in Figure 2-12.

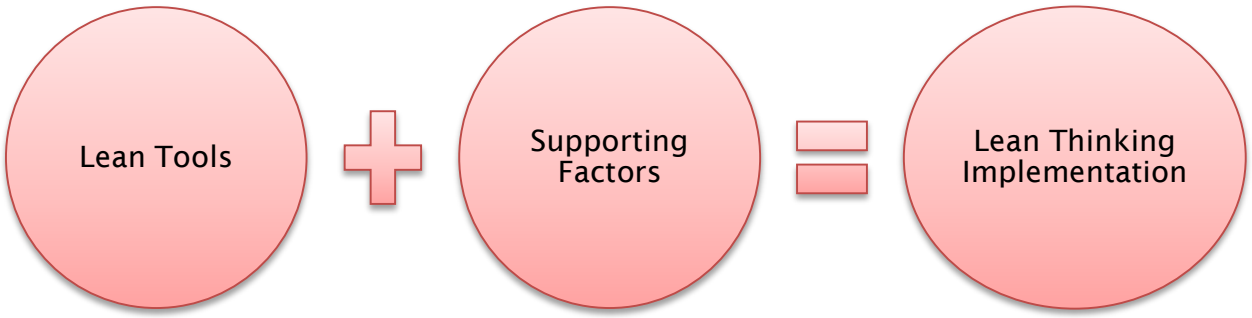


Figure 2-12: Significant Lean elements in a good framework

2.7.7.2 Framework on selection criteria in decision making on Quality Management (QM) implementation

The existing literature has suggested a framework for the selection criteria which is used to identify key aspects in decision making on QM implementation. However, all the literature focuses on various QM approaches, rather than deeply emphasising Lean Thinking.

According to Bendell (2005), when making a decision on implementation, an organisation should consider its current situation, environment, organisational goals and people perception. In general, an organisation should consider benefits and ease of implementation in the initial stage. After that, organisation interest and business requirements were considered as the selection criteria. However, key decision factors should be the primary needs of the organisation. It can be noticed that key reasons in making a decision on Lean Thinking implementation are future requirement and current situation of the organisation.

A selection framework on quality improvement initiatives was developed in the study of Thawesaengskulthai and Tannock (2008). Fashion setting, payoffs, strategic fit and organisation fit were four selection criteria which were used in the process of decision making as shown in Table 2-3.

Table 2-3: Selection criteria in the study of Thawesaengskulthai and Tannock (2008)

Selection criteria	Sub-criteria
Fashion setting	Expert suggestion and best practice
Payoffs	Benefits of shareholders, company performance, marketing performance, customer satisfaction, human resources, improvement of processes, and benefits of organisation
Strategic fit	Cost, quality, speed, dependability and flexibility
Organisation fit	Capability and readiness of company, possible achievement, national and organisational culture, communication and infrastructure

According to Thawesaengskulthai (2010), both rational and irrational aspects should be considered when making a decision on the application of QM. Key motivation factors in implementing QM approaches were derived from the external and internal environment. In fact, an expert played a significant role in the quality improvement programmes. The gap analysis approach, which was concerned with the organisation conditions and expectations, was suggested as a suitable method in the QM selection.

In the study of Kornfeld and Kara (2013), there were a number of organisations that failed in the project implementation. This might be because a consideration of the connection between organisation strategies and projects was misplaced. In fact, an organisation could achieve continuous improvement if it considered the right factors when making a decision on what project should be applied. Kornfeld and Kara (2013) found that the majority of practitioners generally applied brainstorming and cost-benefit analysis in prioritising the decision making process. Books, business forums and conferences were also used as sources of information on continuous improvement projects.

2.7.7.2.1 Critical evaluation

It can be said that due to a report of an improvement from Lean Thinking implementation, a number of organisations in both private and public sectors have been interested in this thinking. Therefore, it might be concluded that the first key reason that is considered in making a decision on Lean Thinking implementation is a requirement of an organisation to improve their performance.

Additionally, from the literature review, it was found that not all Lean tools were implemented in quality improvement processes. In fact, manufacturing and service organisations selected Lean tools which were appropriate to their circumstances. In order to be successful in Lean Thinking implementation, it is important to understand and adapt the concept to be fitted with business environment (King and Venturini, 2005). Therefore, it might also be said that a second reason for deciding what Lean tools should be implemented in an organisation is the current situation of the organisation.

Furthermore, a number of literatures suggested that consultant's suggestion, learning from best practices, books, business forums and conferences were also used as sources of references in Lean Thinking implementation. Thus, these aspects can be categorised into an other reason for an implementation of Lean Thinking and these are the external factors.

Therefore, it can be assumed that three important reasons in Lean Thinking implementation are future requirements, current situations of the organisation and external factors as shown in Figure 2-13.

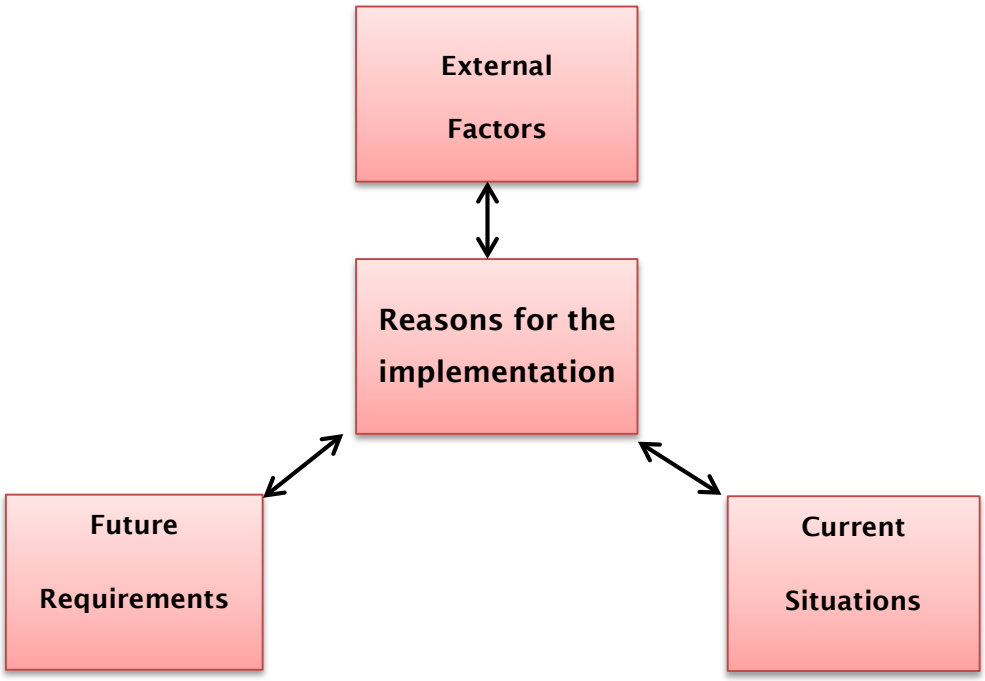


Figure 2-13: Three important reasons in Lean Thinking implementation

2.8 Overall critical evaluation

According to Alvesson and Sandberg (2011), research questions can be generated through both "gap-spotting and problematization". A focus on a research gap aims to fill shortcomings in the existing literature while "problematization" is a way of challenging the assumptions of the literature (Alvesson and Sandberg, 2011). It was believed that this approach could be used to make a research more meaningful (Sandberg and Alvesson, 2011). This study,

therefore, identified research questions through both approaches which have no conflict between them.

2.8.1 Evaluating "Problematization"

In order to evaluate "problematization", there are six principles in challenging assumptions of the existing literature (Alvesson and Sandberg, 2011) as shown in Figure 2-14. In the first step, literature on total quality management, business excellences and Lean Thinking implementation were identified as the key bodies of the literature. This current literature was reviewed and evaluated as discussed in all above sections

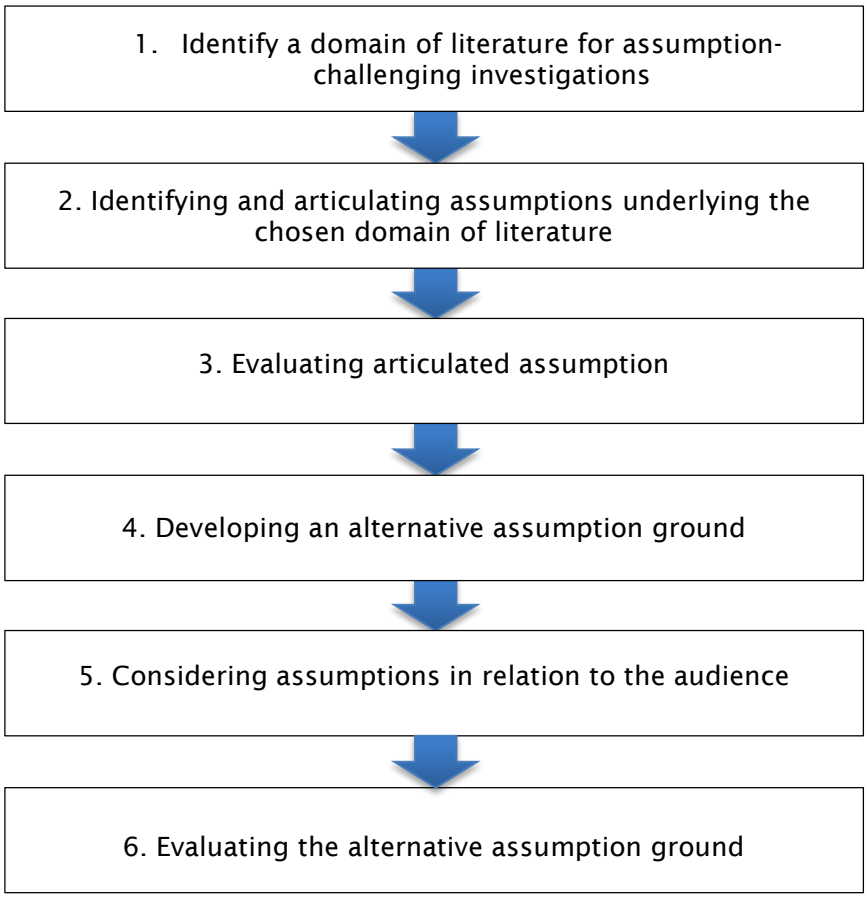


Figure 2-14: Six principles for identifying and challenging assumptions

In stage 2, it is important to identify key assumptions that underlie the domain of literature. According to Alvesson and Sandberg (2011), there are five

categories of assumptions which include In-house, Root metaphor, Paradigm, Ideology and Field assumptions. However, the last three assumptions are not applicable to this study because the Paradigm assumptions underlie a specific body of literature on the methodological assumption which is not a main focus in this study. The Ideology assumptions refer to political, moral and gender-related assumptions while the Field assumptions represent a set of assumptions that share by a various theoretical schools on a specific discipline. Both Ideology and Field assumptions are therefore not related to contexts of this study.

Thus, the In-house and Root metaphor are key assumptions in this research. The In-house assumptions exist within a particular school of thought while the Root metaphor assumptions are broader images that are applied to conceptualise a particular subject matter (Alvesson and Sandberg, 2011). These assumptions need to be evaluated to identify their challenges in stage 3 then alternative assumptions should be developed in stage 4.

In this study, it was assumed that Lean Thinking exists is a specific thought in the quality management school. Therefore, this statement is related to the In-house assumptions. Womack *et al.* (1990) claimed that Lean principles could be applied universally. Lean Thinking could be transferred and applicable to an organisation regardless of businesses and countries. Therefore, key assumption of Lean school is on the universal application of Lean Thinking. However, TPS is considered to be a system that can be a success in a market requiring high volumes of standardised products (Lander and Liker, 2007). Lean implementers need to adapt the concept to be consistent with their contextual influences (Bicheno and Holweg, 2009; Pettersen, 2009). Hence, alternative assumption is Lean Thinking might not be applied universally.

In addition, Lean Thinking is based on manufacturing efficiency. Lean tools, technology (Liker and Morgan, 2006), organisation culture (Taj, 2005; Liker and Hoseus, 2010), human resource, relationship with trust (Liker and Hoseus, 2010) and selection criteria (Bendell, 2005; Thawesaengskulthai, 2010; Kornfeld and Kara, 2013) are key elements that lead to a success in Lean Thinking implementation. Thus, key assumption under the Root metaphor assumptions is that Lean tools, supporting factors and reasons in the implementation are key elements in Lean Thinking implementation. In contrast, an alternative

assumption is a selection of one or more of the above elements is adequate to reach quality improvement in the implementation of Lean Thinking.

In stage 5 of this research process, both academics and practitioners are key audiences in the theory of Lean Thinking. From the literature review, there is still an argument among scholars on the universal application and benefits of Lean Thinking. Additionally, practitioners still struggle to identify what significant elements in Lean Thinking implementation they need to be concerned about and where to begin. Therefore, it might be said that there is still a need to prove the applicability of Lean Thinking in order to clarify both academic debate and practical application.

The final stage in identifying and challenging assumptions is an evaluation of alternative assumptions. In order to do this, research methodologies and strategies were designed thoroughly which will be discussed in the next chapter (Research Philosophy and Design).

2.8.2 Identifying Research Gaps and Problems

While interest in Lean Thinking applications is high from practitioners and scholars, there is still a question of how to implement Lean tools and techniques in a way which is suited to the particular needs of the business. Additionally, there is the basic question of where to begin.

According to Pavnaskar *et al.* (2003), misapplication comes from a vagueness in the definition of tools, purpose, and implementation which leads to ineffectiveness of resource utilisation and the reduction of employee confidence about Lean Thinking application. An inappropriate framework was regarded as a critical cause of ineffective implementation and a misunderstanding of Lean concepts (Anand and Kodali, 2010). In contrast, a proper model can assist a manager as a guideline to be successful in implementation (Anand and Kodali, 2010).

The literature review shows a number of frameworks for Lean Thinking implementation which were developed in order to guide a practitioner to apply Lean Thinking successfully. Two categories of Lean Thinking frameworks (developed in the study of Anand and Kodali, 2009) are described as ‘conceptual

framework' and 'implementation framework'. They defined the former model as a debate on Lean elements to be included while the latter is categorised as an implementation method.

Anand and Kodali (2009) claimed that the limitations of a framework of Lean Thinking application included an incomplete list of Lean elements and lack of a suggested implementation of Lean aspects in a practical application. They therefore developed a framework to solve these shortcomings by creating a model which comprises 65 Lean elements, separates tools, techniques, procedures and practices, and identifies the relationship between Lean elements and management levels. However, the framework of Anand and Kodali (2009) has focused on only LM elements which might work for only the production sector. In "Lean elements", tools and human resources management are put together which might raise the question if this is really a complete list of Lean aspects. Additionally, Anand and Kodali (2009) do not suggest which Lean tools are so critical that they have to be applied as the first priority, and so on. They do not provide a comprehensive framework in Lean Thinking either for the manufacturing or service industries. Therefore, there is still a major gap in the existing literature which suggests that further study in needed.

In the further study of Anand and Kodali (2010), "comprehensiveness" and "abstractness" are two of the indicators used to identify the shortcomings of the existing frameworks. Anand and Kodali (2010) explained that the term "comprehensiveness" means the number of LM elements. If the framework contains more than 30 LM aspects, it is defined as high comprehensiveness. In contrast, a framework is described as having low comprehensiveness when it has fewer than ten elements. On the variable of "abstractness", Anand and Kodali (2010) judged this on whether a framework is easy to understand and provides an implementation sequence. If it has clarity, a framework is defined as low abstract.

Figure 2-15 is developed to present the shortcomings of the existing models or frameworks for Lean Thinking application by using the list of current models from the study of Anand and Kodali (2010). Most frameworks provide medium comprehensive degrees. Only two frameworks provide a high level of comprehensiveness with low abstractness. Both of them are "conceptual

frameworks". Interestingly, there is no implementation framework that has a low degree of abstractness. Most of them are highly abstract.

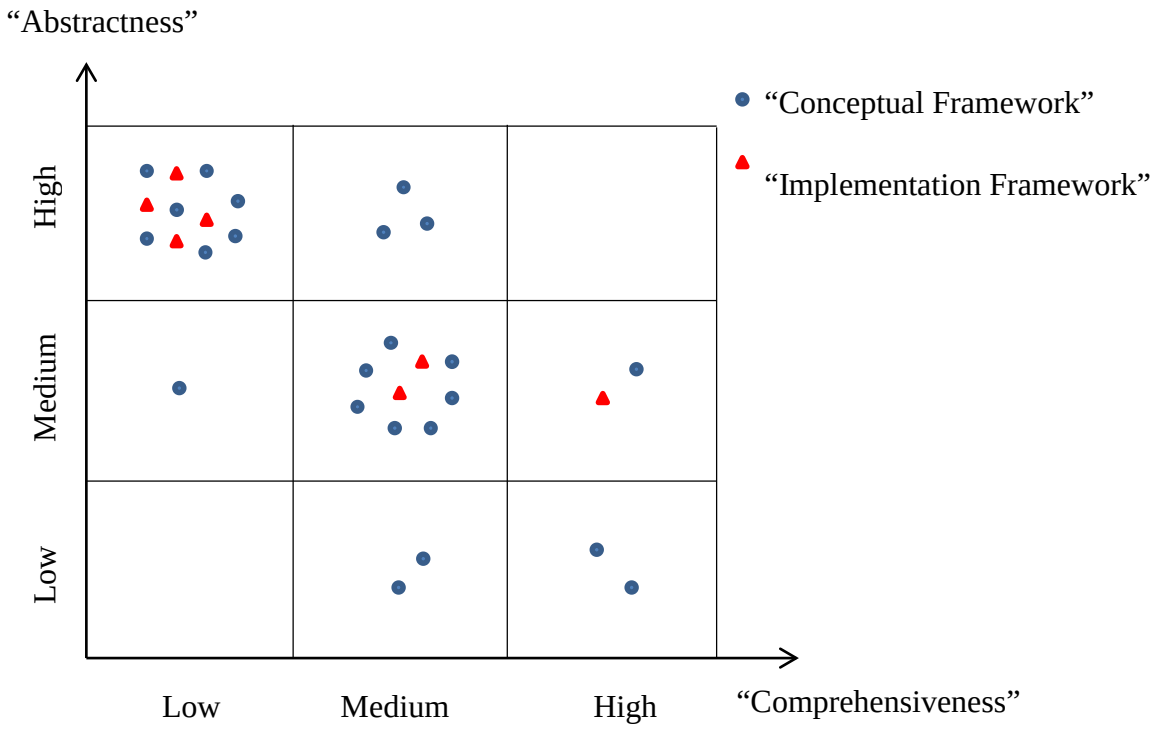


Figure 2-15: The comparative matrix of the comprehensiveness and abstractness of Lean Manufacturing Frameworks

(Adapted from Anand and Kodali (2010))

Although Anand and Kodali (2010) developed an implementation framework to address this shortcoming, by identifying steps in implementing Lean elements, some guidance as to what criteria should be considered in specific circumstances are not discussed. In other words, selection criteria which are used in making a decision on which Lean elements should be used in an organisation are not included in the framework of Anand and Kodali (2010). In addition, only LM elements are included in this framework rather than Lean Thinking aspects. Therefore, it is evident that there are still shortcomings in the framework as it still does not provide a complete list of Lean tools and reasons why certain tools are used in a specific environment.

Lean Thinking has been implemented not only in manufacturing companies but also service organisations. However, both conceptual and implementation frameworks in the service industry are very rare. The above literature focused

only on LM which might not work in the service industry as it has a unique environment compared to production. Hence, existing frameworks on Lean Thinking implementation in the service industry are limited by being both low in their comprehensiveness and highly abstract at the same time. In addition, there is no research that compares and contrasts Lean Thinking frameworks in the manufacturing sector with those in the service industry. Here again we can see a significant research gap.

Lean Thinking implementation focuses not only on a set of tools but also on HRM. It is important to integrate process, people, and tools to create a coherent system in Lean Thinking implementation (Liker and Morgan, 2006). However, a number of existing frameworks have little discussion of the human resource in the implementation (Pettersen, 2009). Indeed, very few of them have pointed out how people play roles in supporting the application of Lean Thinking.

Furthermore, the current frameworks which have combined Lean approaches with selection criteria in making a decision on Lean Thinking application are very rare. Therefore, there is still a question on which selection criteria should be used when making a decision on which elements or features of Lean Thinking are best implemented and in what sequence.

2.9 Research Problem

From an evaluation of "problematization", there are two alternative assumptions that are planned to be tested in this study. The first assumption is about the universal applicability of Lean Thinking while the second one is about significant elements in Lean Thinking implementation.

In the first assumption, there is still an argument about the universality of Lean Thinking application. Womack *et al.* (1990) claimed that Lean principles could be applied in any industries. Lean Thinking has therefore moved application areas from the automotive industry to organisations in other manufacturing and service sectors. However, there is still a belief that environments which fit to the implementation of Lean Thinking are low demand variability, low product variety (Lander and Liker, 2007) and high volume of repetitive production (Hines, 2009). Therefore, it is interesting to investigate whether there are any similarities

and/or differences in Lean Thinking implementation among different businesses.

The second assumption is planned to test what are important elements in Lean Thinking implementation. From the literature review, Lean tools, supporting factors and reasons in the implementation are elements that need to be considered in order to achieve quality improvement.

It was found that there are many choices of Lean tools to be implemented in quality improvement processes. Different organisations selected different Lean tools which were supposed to be appropriate with the organisational circumstances. However, the problem is it is difficult to know what tools should be selected and where to start.

In order to be successful in the implementation of Lean Thinking it is important to consider not only Lean tools but also other supporting factors. This study categorised and named these supporting factors as organisational management, intercompany management and human resource management.

In addition, it is also significant to consider the reason for the implementation in order to select Lean tools and techniques appropriately. From the literature review, three key reasons in the implementation were categorised and defined in this study as future requirements, current situations and external factors.

Thus, two key assumptions which are tested in this study are about the universality and key elements in Lean Thinking implementation.

2.10 Research Gaps

From the literature review, it can be concluded that the existing frameworks on Lean Thinking implementation still have a number of shortcomings. These deficiencies include lack of clarity for an implementation sequence and lack of a comprehensive list of Lean elements which are included in the overall toolbox as well as little if any discussion of the role of human resources. The selection criteria in deciding what Lean elements can fit in the specific circumstance are still missing. Additionally, there are very few frameworks for the service sector. Indeed, a comparative study on the differences between frameworks in the

manufacturing companies and those in service organisations is missing. In Thailand, there is no existing framework for Lean Thinking implementation. Even if there were good frameworks that have been developed in other countries, they might not be applicable in a Thai context. Thailand might have different issues to be managed which might lead to differences in implementation.

Hence, an effective implementation in a real situation is still not proved with good supporting evidence. Therefore, a further study to develop a comprehensive model with high clarity is still needed.

2.11 Propositions and Conceptual Framework

Lean Thinking is a systematic thinking that requires the implementation of a whole organisation (Bicheno, 2008). The Toyota philosophy was based on a good process that had good principles as well as considering the human element as a competitive resource that could not be duplicated (Liker and Hoseus, 2010). Although Lean Thinking is not a set of tools (Bicheno and Holweg, 2009), tools and technology should be installed in supporting people to continuously improve their work (Liker and Morgan, 2006). In order to achieve quality improvement, Lean tools should be combined as the inter-related elements (Liker, 2004).

However, it was found that, in the literature, both manufacturing and service organisations selected one or more Lean tools from many choices to implement in their organisations. Different studies ranked Lean tools differently. A key reason in a selection might be appropriateness to their business circumstances. The question is what tools are best suited to these circumstances and where to begin. Thus, it might be supposed that with many choices of Lean tools an organisation has to select and prioritise tools that are appropriate to their circumstances. Therefore, the first proposition is:

> *Thai BE managers from different organisational groupings prioritise different choices of Lean tools in the implementation of Lean Thinking.*

As discussed above, a key reason which is used in making a decision on the implementation of Lean tools is appropriateness to the organisational

circumstances. It might be said that the current situation of the organisation is one of the selection criteria which are used in making a selection in an implementation.

A second reason in Lean Thinking implementation is a requirement of an organisation to improve their business performance.

The other aspects which were used in making a decision on the implementation of Lean tools are consultant's suggestion, learning from best practices, books, business forums and conferences. This study therefore categorises these aspects as the external factors which is the third important reason in Lean Thinking implementation.

Thus, it is assumed that current situations, future requirements and external factors are considered to be significant reasons affecting the implementation of Lean Thinking. Therefore, the second proposition is:

> *Current situations, future requirements and external factors are key criteria used by different Thai BE managers when deciding on which Lean tools to implement.*

Furthermore, in order to be successful in quality improvement it is also important to carefully consider and manage other supporting elements, i.e. human resource and organisational culture. In fact, these factors can be both key success factors which support an organisation to achieve quality improvement and barriers which lead to a failure in the implementation of Lean Thinking.

From the literature review, a number of aspects were suggested as key success factors and barriers in Lean Thinking implementation. This study categorised those factors into three groups of key success factors which are organisational management, intercompany management and human resource management. Additionally, three categories of barriers are organisational management, human resource and existing resources of the organisations. Both sets of key success factors and barriers in Lean Thinking implementation are relatively similar. Therefore, the third proposition of this study is:

> *Organisational management, intercompany management and human resource management are significant factors which need to be*

thoroughly managed in order to achieve quality improvement in selected Thai BE organisations.

Thus, it can be assumed that in order to achieve Lean Thinking implementation it is important to consider not only a selection of Lean tools but also the reason for the implementation along with other supporting factors. This study therefore proposed the conceptual framework as shown in Figure 2-16.

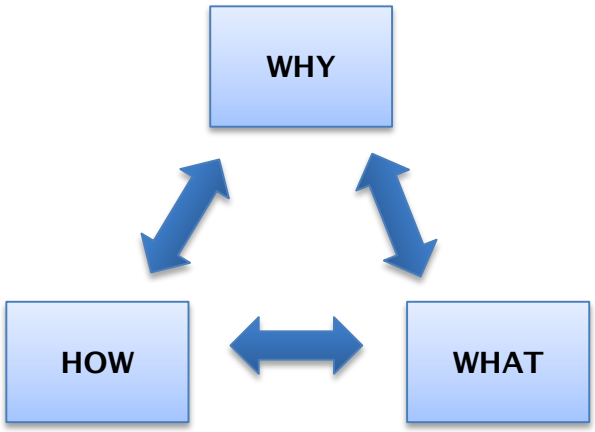


Figure 2-16: The conceptual framework of this study

The conceptual framework begins from **WHY** it is important to do quality improvement. Similar to the 8-step model of Kotter, the first important step in leading an organisation to better performance is being aware on a need of change (Kotter, 1995b). This study proposed that three possible reasons for doing quality improvement came from future requirements, current situations and external factors. By considering these aspects, a manager can identify a need for change or improvement in an organisation. After that, he or she could propose next effective steps in quality development.

The second element of the conceptual framework is **HOW** to be successful in Lean Thinking implementation. In order to reach this, it is significant to consider and manage other related elements thoroughly. This study proposed organisational management, intercompany management and human resource management as important elements in supporting a success in the implementation of Lean Thinking. These three elements are related to factors in

the 8-step of Kotter, i.e. communication, human resource management and strategic management that assist an organisation to achieve a change process.

The last element in the conceptual framework focuses on **WHAT** Lean tools should be implemented in an organisation. From the review, organisations selected one or more Lean tools from many choices to implement in their organisations. Different studies ranked Lean tools differently. It might be supposed that an organisation has to select and prioritise tools that are appropriate to their circumstances. However, the problem is what tools are fitted with the organisational circumstances and where to begin.

Therefore, the conceptual framework of this study is comprised of three key elements which are WHY, HOW and WHAT. Therefore, the fourth proposition of this study is:

> *In the implementation of Lean Thinking, selected Thai BE managers consider reasons why it is important to implement Lean Thinking, how to implement in order to achieve quality development and what tools should be implemented in an organisation.*

These three elements will result in a complete picture of Lean Thinking implementation which leads to a clear understanding on what elements constitutes a success in Lean Thinking implementation and how to proceed follow sequences of the implementation through a process model. In other words, this model might assist an implementer to understand what elements need to be considered in the implementation of Lean Thinking and how to start the process of quality improvement.

It is believed that the above four propositions can be used to answer the questions or problems of the key assumptions about the universality and key elements of Lean Thinking implementation. The results of the study will build on both academic debate and practical application of Lean Thinking. This also benefits not only scholars but also practitioners who are key audiences in the theory of Lean Thinking.

2.12 Chapter Conclusion

Due to an increase of customer expectations, a number of organisations have to pursue more effective approaches to focus on customer value in order to improve its competitive advantage through quality management. TQM and Lean Thinking have been recognised as key strategies in improving organisational performance and competitiveness in both public and private organisations. In fact, TQM and Lean Thinking share similar roots from the statistical quality control of Shewhart and JIT from the Toyota Company in the Japanese quality evolution. They have similar ideas on continuous improvement and JIT management as well as no conflict between their objectives. Lean Thinking and TQM could be combined in order to solve problems continually and improve the whole of an organisation. Therefore, it is interesting to investigate how Lean Thinking is implemented alongside TQM.

However, there is still an argument about the universality of Lean Thinking application among scholars and about what are the significant Lean elements that need to be considered in order to achieve in a quality improvement programme. Additionally, there is a question from the practitioners on the practical implementation, i.e. what Lean tools should be implemented and where to begin.

From the literature review, it was also found that there are still numerous shortcomings in the existing frameworks on Lean Thinking implementation. In general, the existing literature emphasises a separate framework rather than an integrated model that includes not only Lean tools and human aspects but also the selection criteria and other challenging factors to be recognised and dealt with.

This study, therefore, proposed four key propositions to address the research problems on the universality of possible applications and the most significant elements of Lean Thinking application. Additionally, research gaps will be filled by developing a conceptual integrated model which provides a comprehensive view of Lean Thinking implementation. It is believed that the findings of this study will provide more evidence to support the academic debate on both issues and the practical application on how to implement Lean Thinking successfully in the real circumstances.

Chapter 3: Research Philosophy and Design

This chapter explains and justifies the options and choices made in research philosophy and research design. It also identifies the research approach which includes the methods of both data collection and analysis. This is based on not only the methodological triangulation from survey, interview and documentation analysis but also the theoretical triangulation from various professionals in different positions. The selection of the research design and methodology is used to fulfil the aims and objectives of this study.

3.1 Research Methodology

Objectivism and subjectivism are the two fundamental philosophical assumptions which frame a research study. These research philosophies are then used to determine a research design to be followed in the overall process of a research project. Thus there are three elements which have to be considered in the early stage. These are the philosophical assumption, research methodology and research methods that will be used in the study (Creswell, 2003).

3.2 Research Philosophy

The research process of this study can be explained by Figure 3-1 which is adapted from Saunders *et al.* (2009), according to whom a researcher is able to create a research design which is appropriate to the research objectives if he or she understands the research philosophy clearly. Two key research philosophies or assumptions are the worldview of objectivism and subjectivism. The differences between these two worldviews are based on how they consider the nature of reality (Ontology) and what constitutes knowledge in the field of study (Epistemology).

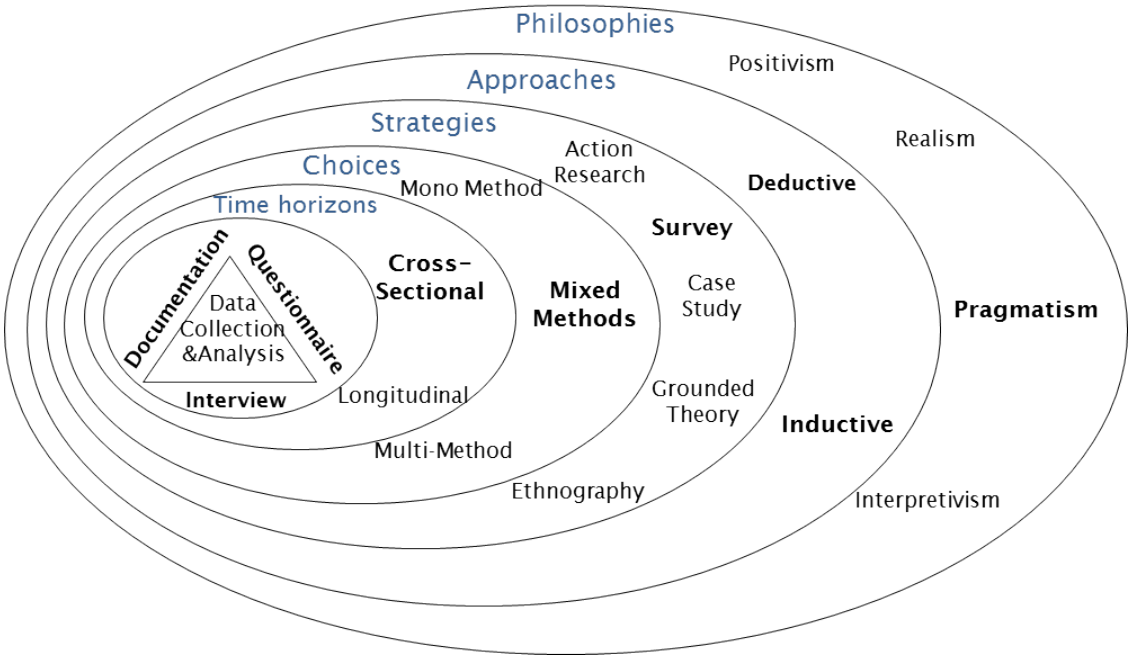


Figure 3-1: An overall research design
Adapted from Saunders *et al.* (2009) (The choices made are shown in bold)

The research approaches and processes are indeed influenced by both the ontological and epistemological assumptions (Saunders *et al.*, 2009). Ontology assists a researcher to identify the reality that exists within the environment of the study (Maylor and Blackmon, 2005). Objectivist ontology is appropriate to a study of physical reality while subjectivist focuses on a reality that has been socially constructed into a pattern concerned with social actors. In addition, another aspect that needs to be considered is epistemology which focuses on the consideration of acceptable knowledge in a field of study. Two extreme epistemological positions in management research are positivism and interpretivism (Saunders *et al.*, 2009).

Positivism was derived from the philosophy of science (Maylor and Blackmon, 2005). In this philosophy, a researcher is independent from the subject of the research which is based on an observation of social reality. This external reality is capable of uninvolved observation by the researcher. The existing theories are used to develop the hypotheses before formulating a research strategy in the data collection (Saunders *et al.*, 2009). The positivist tends to associate with a quantitative approach in which samples from a large population are used to

represent the wider populations. Structured methodology is generally applied in positivism (Gill and Johnson, 2010) along with statistical analysis (Saunders *et al.*, 2009).

On the other hand, the interpretivist philosophy is based on the understanding of different viewpoints of humans as social actors. Understanding is not based on the passive observation of an external reality, rather it is created by the interaction of the observer and the subject, from which a process of sense making or meaning is created. Samples and populations are not meaningful in this worldview. A qualitative approach is generally associated with the interpretivist in order to understand social actors at a specific time. Interpretivism is considered to be an appropriate perspective of management research (Maylor and Blackmon, 2005).

However, one might think that choosing only one paradigm is impractical in an actual situation. Therefore, pragmatism is an appropriate alternative and uses positivism and interpretivism in one study in order to gather the advantages of both philosophies.

According to Saunders *et al.* (2009), a research question is the most importance influence on ontology and epistemology. The pragmatic paradigm is the problem-oriented approach which assesses various inputs within the phenomenon in a real-world situation (Creswell and Clark, 2011). A mixed method research is associated with pragmatism in order to reflect both the objectivism and subjectivism points of view. A researcher integrates the quantitative and qualitative approaches to understand the phenomenon (Saunders *et al.*, 2009).

The pragmatic, therefore, is the research philosophy that is the most appropriate for this study to understand the real situation and propose the research design. Both quantitative and qualitative approaches can identify which Lean elements are applied in the award winning organisations as well as looking at how and why these elements are selected by these kinds of organisation. Additionally, the deductive and inductive approaches could be combined with the pragmatic approach. According to Greener (2008), a deductive approach moves from theory to data collection in order to test the theory. The deductive method is derived from the scientific research (Saunders *et al.*, 2009) and deductivism focuses on testing the hypotheses by operating from the general to the specific

phenomena (Adams *et al.*, 2007). Deductivism requires the operationalization process to examine the facts quantitatively (Saunders *et al.*, 2009); it therefore requires a structured approach to control data validation and an adequate size of sample to generate a conclusion (Saunders *et al.*, 2009).

In contrast, an inductive method aims to build a theory by focusing on the research contexts (Greener, 2008). It is the philosophy of social science (Maylor and Blackmon, 2005). The inductive approach derives from an observation of a real world before generating a conclusion. It is therefore driven by the specific phenomenon to create a general theory by applying empirical validation (Adams *et al.*, 2007). In other words, a theory has been developed as a result of data collection and analysis. In the inductive method, a researcher is a key part of a research process in order to gain an understanding of human actions in a particular phenomenon (Saunders *et al.*, 2009). Inductive research is mostly based on qualitative data and can operate with a small number of samples. In order to understand a complete phenomenon, mixed methods are applied in the data collection and analysis (Gill and Johnson, 2010).

When compared to the deductive approach, the inductive method is less concerned about generalisation and has a higher flexibility to allow a change in research structure (Saunders *et al.*, 2009). The deductive approach is based on quantitative data collection which aims to explain causal relationships among variables while the inductive approach focuses on gathering qualitative data which are used to understand the research context thoroughly (Saunders *et al.*, 2009). It can be seen that both the deductive and inductive approaches have their unique focuses and advantages. In fact, a researcher is able to apply both quantitative and qualitative data in one study (Creswell and Clark, 2011). Both methods can be applied in one research in order to complement each other (Adams *et al.*, 2007). This leads to an understanding of the nature of the problem and the potential causal relationships between the phenomena observed. Under the pragmatism philosophy, both deductive and inductive approaches are applied in order to combine the advantages of the two methods within this study. This paradigm is therefore the foundation for the research design, strategy and methods in the next section.

3.3 Research Purpose and Strategies

According to Saunders *et al.* (2009), the research purposes, which are mostly applied in research methods, are exploratory, descriptive and explanatory studies. Exploratory research is mostly applied in qualitative study (Creswell, 2003) to understand the phenomenon (Saunders *et al.*, 2009). An exploratory study is carried out to explore the literature, interview experts and conduct focus groups. A key advantage of this kind of research is its flexibility to change after finding new data. Descriptive research aims to give accurate information (Greener, 2008) about people, occasions or situations (Saunders *et al.*, 2009). It can be a part of either the exploratory or explanatory studies. The explanatory study places an emphasis on causal relationships between variables (Greener, 2008). Both quantitative and qualitative approaches can be applied in this research (Saunders *et al.*, 2009). The statistical analysis is conducted to examine the quantitative data while the qualitative analysis is applied to further explain the phenomenon.

Consequently, in this study, the exploratory, descriptive and explanatory researches were applied. The exploratory study was used in finding the related literature and interviewing managers in the award winning organisations in the empirical study. The descriptive research was applied in describing how Lean Thinking was implemented in the existing literature before drawing a critical evaluation. Both quantitative and qualitative data were collected and analysed in this study based on the explanatory research. This aimed to identify what Lean elements were implemented in the award winning organisations in Thailand and explain how and why these elements are essential in the Thai context. In addition, the explanatory research was also applied in the model refinement process in order to prove the validity of the developed model in both theoretical and practical application. In fact, all three research purposes were integrated in this study in order to not only gather and analyse the related data but to draw a complete conclusion on Lean Thinking implementation in Thailand as well.

In order to answer the research questions properly, the survey was selected as one of the research strategies for this study. According to Gill and Johnson (2010), a survey is a research strategy that is related to the deductive approach and can be used to collect a large amount of quantitative data of the same standard. The sample is then investigated to generalise a conclusion as being

representative of the population (Creswell, 2003). A survey is mostly used for exploratory and descriptive purposes (Saunders *et al.*, 2009). Key advantages of this research strategy are a controllable research process (Saunders *et al.*, 2009) as well as time and cost saving (Greener, 2008). In a survey strategy, a researcher can apply questionnaires, structured interviews and structured observations as the data collection methods (Adams *et al.*, 2007; Saunders *et al.*, 2009). According to Greener (2008), the semi-structured interview is considered to be a part of the questionnaire. Hence, both quantitative and qualitative data can be collected and analysed under the survey strategy.

In addition, another factor that needs to be considered is the period of time in which to conduct a research. In fact, a research can be done at either a specific time or a series of times (Saunders *et al.*, 2009). In this study, a cross-sectional research, which focuses on a study at a particular time, was applied. The cross-sectional study is associated with the survey strategy in which both quantitative and qualitative approaches can be applied (Saunders *et al.*, 2009).

Therefore, the survey is the most appropriate research strategy for this study. This is because one of the research questions of this study aims to examine the application of Lean Thinking in award winning organisations in Thailand. Based on the philosophy of Lean Thinking, data were gathered to establish if there were any consistent patterns between the theory and the real application in the awarded organisations. In other words, data collection and analysis were conducted in this study in order to test the claim by Womack and Jones (1996) on the universal applicability of Lean Thinking.

After that, the findings from the survey strategy were used to develop a conceptual academic model of Lean Thinking implementation in the Thai context. In order to refine the developed model, the survey strategy was also used to gather an opinion from professionals who are experts in quality management and/or Lean Thinking. This aimed to verify the validity of the developed model in both theoretical and practical application. As a result, a finalised model for Lean Thinking implementation as a new theoretical construct is developed for each industrial sector and a comparative view between the manufacturing and service sectors is produced. Based on these research purposes and strategies, the research design is formulated in the next section.

3.4 Research Design

According to Creswell and Clark (2011), pragmatism is highly appropriate with mixed-methods research as it allows a researcher to collect a variety of data types to answer a research question. In mixed-methods research, or triangulation, a researcher can use various approaches to validate the findings in one study (Creswell, 2003). According to Saunders *et al.* (2009), key advantages of the mixed-methods research are that various research methods can complement each other in an application. The qualitative data can be used to further explain a finding from the quantitative analysis. Additionally, the different research approaches focus on the unique research areas. Thus, a combined use of different research strategies may result in a complete understanding of both quantitative and qualitative issues.

Triangulation, or mixed methods, is the use of multiple sources of data collection in one study (Saunders *et al.*, 2009). According to Denzin (1978), there are four types of triangulation: data, investigator, theoretical and methodological approaches. However, the first two are not applicable to this study because the data triangulation uses various data sources on a comparable number of stakeholders in an analysis (Guion *et al.*, 2011) while this study is limited by a small number of participants in each group. In addition, only one researcher is responsible for this study therefore the investigator triangulation is not applied because it involves more than one researcher to gather and analyse the data (Denzin, 1978). Theoretical and methodological triangulations are, therefore, the most appropriate methods to be applied in this research.

In the methodological triangulation, a researcher gathers and combines the results from quantitative and qualitative approaches to the interpretation (Denzin, 1978). This could help the researcher to validate the initial findings. The differences between quantitative and qualitative approaches are generally explained by the data collection methods. The quantitative approach focuses on statistical data and analysis while the qualitative method aims to interpret the descriptive data. In addition, theoretical triangulation is applied in the refinement process (later in Stage 4) which uses various professionals in different positions (Guion *et al.*, 2011) to critique the developed model. Feedbacks from the experts are compared to establish the validity of the developed model.

In this study, both inductive and deductive approaches are applied. As shown in Figure 3-2, this research design is divided into four stages which are associated with the research objectives, as shown in Table 3-1.

Table 3-1: An association between the research objectives and stages of research design

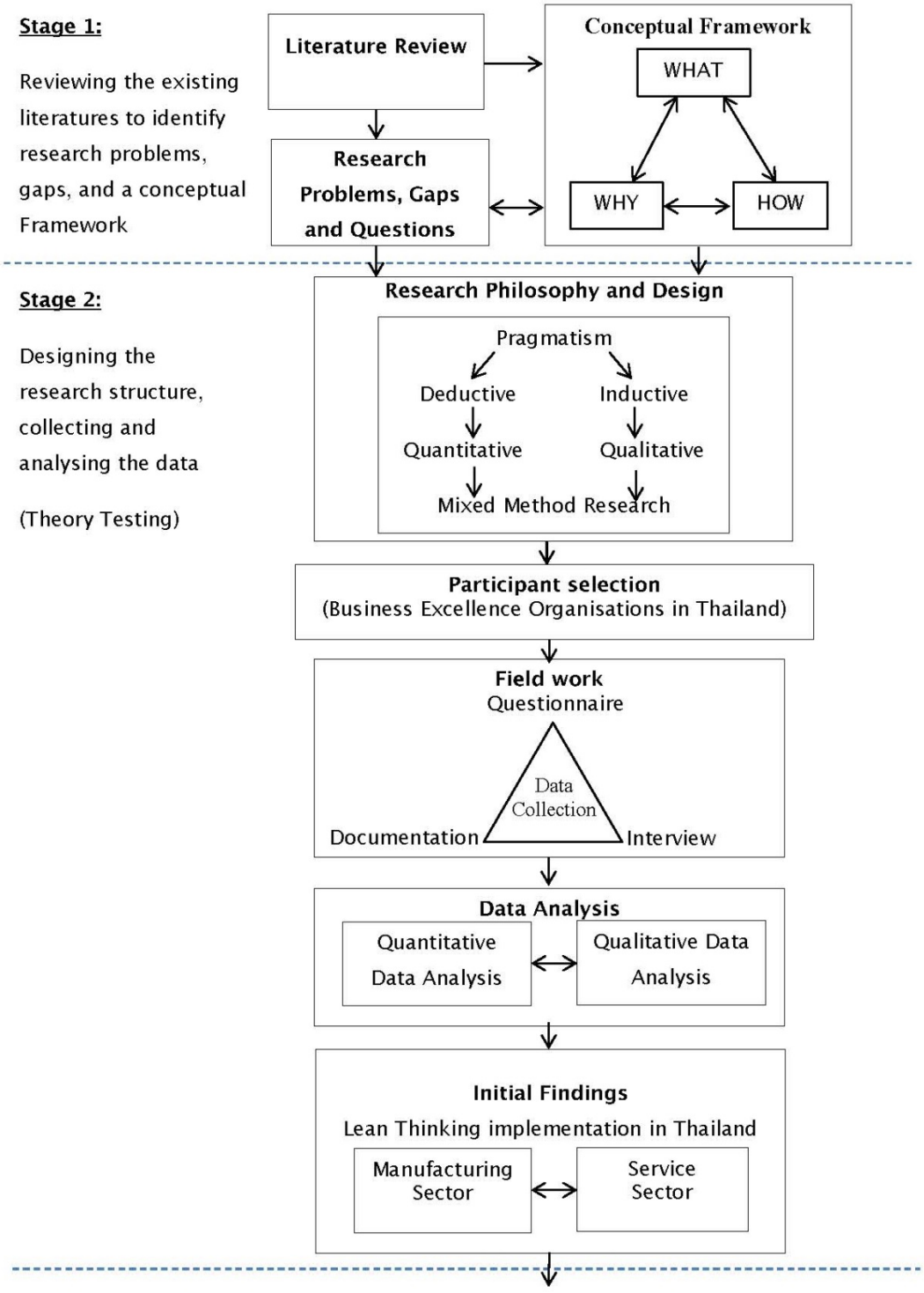
<table>
<tr><th>Research Objectives</th><th>Stages of Research Design</th></tr>
<tr><td rowspan="2">1. To determine and compare which aspects of the Lean toolbox are widely implemented in the Business Excellence (BE) organisations.</td><td>Stage 1:
Reviewing the existing literatures to identify research problems, gaps and a conceptual model.</td></tr>
<tr><td rowspan="3">Stage 2:
Designing the research structure, collecting and analysing the data (Theory Testing).</td></tr>
<tr><td>2. To identify key decision criteria used by the BE managers in selecting which aspects of the Lean toolbox to implement.</td></tr>
<tr><td>3. To explore how these managers support human resource roles and manage other important factors in their implementation of Lean Thinking.</td></tr>
<tr><td>4. To define critical Lean elements that support an achievement in quality improvement in these contexts.</td><td>Stage 3:
Developing the implementation model (Theory Building).</td></tr>
<tr><td>5. To refine, validate and develop the research model for Lean Thinking implementation.</td><td>Stage 4:
Validating and refining the implementation model
(Theory Testing).</td></tr>
</table>

In Stage 1, literature on TQM, BE and Lean Thinking implementation were critically evaluated to understand the current state of the academic debate. A literature review is a critical evaluation of the existing researches that are related to the research project (Gill and Johnson, 2010). This aims to not only determine the relationship of the previous studies to the project but also to identify strengths and weaknesses of the existing literature (Maylor and Blackmon, 2005). Hence, a thorough analysis of the literature results in a number of advantages (Maylor and Blackmon, 2005; Gill and Johnson, 2010; Robson, 2011) including:

- To identify gaps in the previous researches - a requirement in a further study.
- To describe and analyse the patterns and findings of the existing literature in order to propose the research questions.
- To develop a knowledge and understanding of the research topic.
- To formulate appropriate research methodologies and strategies in data collection and analysis.
- To prevent duplication in the study and any mistakes in conducting the research.

In this study, the TQM, quality awards, BE and Lean Thinking were identified as key terms in searching for previous research. Key sources of the reviewed literature are books and academic journal articles. They were searched for via Webcat and DelphiS which are in a computerised database at the library of the University of Southampton. In this study, the related literature was summarised and critiqued on its strengths and weaknesses. After that, these previous researches were compared and contrasted in order to identify the similarities and different points of view among them.

After reviewing and analysing the existing literature, research problems and gaps were identified prior to proposing a research question. This background allowed the creation of a conceptual framework to begin the process of data analysis and model refinement, development and validation. In other words, the conceptual framework was developed based on the literature review in order to test the theory – an approach associated with the deductive approach. Thus, a conceptual model on the appropriateness of Lean tools in a Thai context was created to examine the universal application of Lean Thinking.

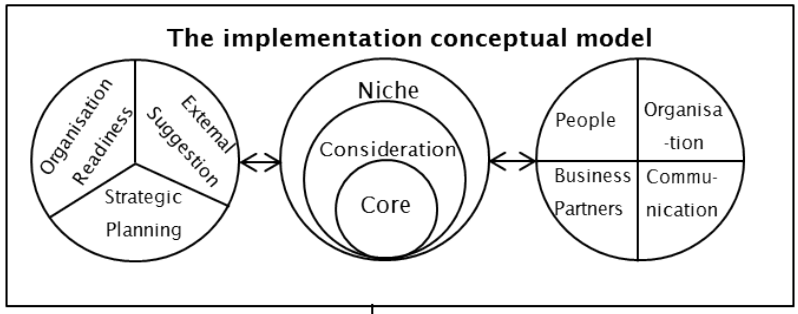

Stage 1:
Reviewing the existing literatures to identify research problems, gaps, and a conceptual Framework
Literature Review
Conceptual Framework
WHAT
WHY
HOW
Research Problems, Gaps and Questions
Stage 2:
Designing the research structure, collecting and analysing the data
(Theory Testing)
Research Philosophy and Design
Pragmatism
Deductive
Inductive
Quantitative
Qualitative
Mixed Method Research
Participant selection
(Business Excellence Organisations in Thailand)
Field work
Questionnaire
Data Collection
Documentation
Interview
Data Analysis
Quantitative Data Analysis
Qualitative Data Analysis
Initial Findings
Lean Thinking implementation in Thailand
Manufacturing Sector
Service Sector

(a)

Stage 3:

Developing the implementation model

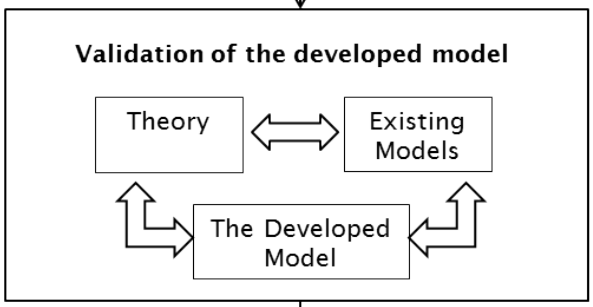
(Theory Building)

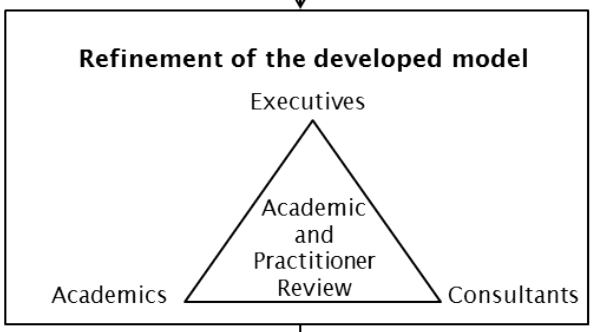


Stage 4:

Validating and refining the implementation model

(Theory Testing)





(b)

Figure 3-2: Research Design Structure
(a) The first part (Stages 1 and 2) (b) The second part (Stage 3 and 4)

In Stage 2, research philosophy and research design are explained. This identifies the research approach which includes the methods of both data collection and analysis. Pragmatism was applied in this study as explained in the above section. Both deductive and inductive approaches can be used under this research philosophy in order to not only test the theory but develop it as well. In addition, the mixed methods research which includes quantitative and qualitative methods was applied under the survey strategy.

The selection of the organisations to include in the study and the selection of potential respondents is also described. The targets of this study are managers who operate in the organisations that received a Thailand Quality Award (TQA) and/or Thailand Quality Class (TQC) during 2002-2012. This aims to understand how Lean Thinking was implemented alongside TQM in the BE organisations in Thailand. A methodological triangulation method was applied in the data collection in this stage. Three key kinds of data collection are by questionnaire, semi-structured interview and communication analysis. Both quantitative and qualitative data are used to effect a methodological triangulation in the data collection processes. Documentary analysis of company communications is the third approach used. The collected data were then analysed quantitatively and qualitatively.

The findings from the questionnaire, interview and documentary analysis are finally integrated into one dataset to describe the Lean Thinking implementation in the award winning organisations. A cross case data analysis examines if there are any differences to indicate if Lean Thinking has been implemented differently, depending on which sector the company comes from. This stage also provides a discussion of the quality management, motives, critical success factors and barriers to implementation. From these empirical findings can be drawn the conclusions to address the first three research objectives on Lean toolboxes, decision criteria and human resources in the Lean Thinking application. It can be said that data collection and analysis in this stage are based on the deductive approach that aims to test the theory. In this stage, the universality of the Lean Thinking application was examined. The empirical findings were later used to develop a more complete model of Lean Thinking implementation as part of Stage 3.

In Stage 3, a model of Lean Thinking implementation is developed as a new theoretical construct. The findings in the previous stage are evaluated and used in proposing the model. This relates with the inductive approach that places emphasis on the theory building. Additionally, the research design in this stage aims to address the third research objective in defining critical Lean elements that support an achievement in quality improvement. It was found that three Lean elements play significant roles in achieving quality improvement: Lean tools, decision criteria and supporting factors.

The developed model therefore identifies not only critical Lean elements but also the selection criteria which should be used when making a decision on an implementation.

In the Lean toolboxes, 30 Lean tools were categorised into three groups: Core, Consideration and Niche tools, based on the frequency of the implementation in the award winning organisations in Thailand, as explained in the findings chapter. While decision criteria that were used in deciding on the Lean Thinking application of the TQA and/or TQC organisation units were grouped into strategic planning, organisation readiness and external suggestion. In addition, the factors in either or both of the internal and external environments which can affect an application of Lean Thinking, are defined in the model. These factors are defined in this study as people, organisation, communication and business partner. The three critical Lean elements of tools, decision criteria and environment that support an achievement in quality improvement were placed in the model of this study. Importantly, a different model for each of the service and production sectors is introduced and explained.

Finally in Stage 4, two major tasks are accomplished. This aims to address the last objective of this study of refining, validating and developing the research model for Lean Thinking implementation. The research design in this stage is associated with the deductive approach that focuses on testing the theory. Firstly, the evaluation of the model (developed by the researcher utilising the data from Stage 3) is done through a comparative analysis of the existing frameworks and theory. A number of key frameworks or models of Lean Thinking; i.e. the five principles of Womack and Jones (1996) and the Toyota Way of Liker (2004) were compared and contrasted to the model of this research. In order to prove the validity of the developed model, the effectiveness of the

implementation of the award winning organisations in Thailand was also investigated.

This developed model is further refined by interaction with professionals in Lean Thinking and TQM. The theoretical triangulation is applied in the refinement process in which a number of experts in various positions play roles in evaluating the developed model. These validation professionals are scholars, consultants and executives. The academics are specialised in operations management, supply chain management, quality management and/or Lean Thinking and work in universities in Thailand. The remainder are managers and/or internal consultants who operate in the award organisations in Thailand. They are in both the manufacturing and service sectors. These practitioners are also the participants in the empirical study in Stage 2.

The online questionnaire which was presented with the developed model was applied to obtain the experts' opinion. All the gathered data are then used to refine the model and experts' feedback is compared and contrasted to establish the validation of the developed model. As a result, a finalised model for Lean Thinking implementation as a new theoretical construct is developed. This theoretical model is then ready for testing and further development in new research but constitutes the main deliverable and achievement of the research objectives and the filling of the research gap.

Finally, the overall research outcomes are discussed and the research project concluded. The contributions of the study to the development of academic discussion and to potential practical application are discussed. The limitations in the study are recognised and suggestions made to address them in any future work whose need has been realised in the process of concluding this research.

3.5 Chapter Conclusion

An understanding of research philosophy is important to be able to design effective research strategies, which are appropriate to a particular study. In this study, pragmatism is the most suitable to understand the real situation and propose the research design. This is because it can gather together the advantages of both positivism and interpretivism in one study. Additionally,

deductive and inductive approaches can be combined in a pragmatic approach (Creswell and Clark, 2011). A mixed method research is therefore associated with pragmatism in order to reflect both the objectivism and subjectivism points of view. In fact, key research purposes of this study are to explore, describe and explain the implementation of Lean Thinking in the award winning organisations in Thailand and these methodological choices are therefore most appropriate.

In this study, theoretical and methodological triangulations were applied. Both quantitative and qualitative data were collected through questionnaires, semi-structured interviews and documentation in this study, within the survey strategy. The qualitative data can be used to further explain a finding from the quantitative analysis. In the data collection, an organisation which had achieved the Thailand Quality Award (TQA) and/or the Thailand Quality Class (TQC) was selected as the target of the study. Learning from best practice organisations is one of the effective approaches to improve performance (Stuart *et al.*, 2002). The processes in this study are divided into four stages: establishing the conceptual model, designing the research structure, developing an implementation model of Lean Thinking, and finally refining and validating the developed model.

Chapter 4: Data Collection and Analysis

This chapter aims to report on how the empirical data of Lean Thinking implementation in the selected manufacturing and service organisation units were collected. As described in the previous chapter, the triangulation of data collection was used in this study. Questionnaire, semi-structured interview and documentation were the three key sources of data collection in the empirical study while theoretical triangulation was applied in the model refinement process. Along with data on what Lean tools were used, data about the quality management, motives, critical success factors and barriers in the implementation process were also gathered.

4.1 Data Collection

Using mixed methods, a researcher can apply all available data collection tools in order to combine and use the best features of each of the research data collection and analysis tools. The key advantage of the qualitative data collection is that it assists a researcher to understand and interpret the related contexts as understood by the respondents and interpreted by the researcher (Creswell and Clark, 2011). On the other hand, the major strength of the quantitative data collection is that it can gather a large number of samples in the same standard way and in theory this process can be replicated by another researcher with other respondents (Bryman and Bell, 2007). This is not achievable in the same way using qualitative methods.

In the data collection procedure under a mixed method research, both quantitative and qualitative data collection methods needed to be designed thoroughly. It is important to plan the sampling procedures in the earliest stage (Creswell and Clark, 2011). Purposeful and non-probabilistic samplings were selected as the qualitative and quantitative samplings in this study, respectively. According to Creswell and Clark (2011), purposeful samples are selected deliberately because of their experience regarding a particular concept while non-probabilistic sampling is chosen due to the availability of the samples. The organisations that achieved the Thailand Quality Award (TQA) during the years 2002-2012 therefore were selected as the target of this study and as the

purposeful samples due to their capabilities in quality management. In addition, all 38 TQA recipients during the years 2002-2012 were contacted to request their participation as the non-probabilistic sampling in this study. In effect a complete census of all winners was attempted but in the outcome a representative, non-probabilistic sample was obtained.

4.1.1 Data Collection Methods

After evaluating all possible data collection methods, multiple sources of data, both quantitative and qualitative data, were triangulated and supported the data analysis. As explained in the previous chapter, both primary and secondary data were applied in this study. The primary data were gathered not only from questionnaires but also semi-structured interviews while the secondary data were taken from documentation. These included: company annual reports, newsletters, company documents, business magazines and quality award publications; organisation websites were also used as sources of secondary data.

Thus, the three key sources of collected data were questionnaires, semi-structured interviews and documentation. Under multiple sources of data collection, the researcher was able to seize and combine advantages of each approach. The *questionnaire* was applied to gather quantitative data by using closed-ended questions which were based on a predetermined order of questions (Creswell and Clark, 2011). It is appropriate to use a standard question to investigate organisational practices in different phenomena (Saunders *et al.*, 2009). This study therefore applied the online questionnaire as the self-administered questionnaire which was to be completed by the respondents (Saunders *et al.*, 2009). This is because the targets of this study are executives in organisations that achieved the Thailand Quality Award (TQA) during the years 2002-2012. Although there is a natural limitation on distance, they have the ability to access the Internet and be contacted via e-mail effectively. In this case, it is more likely that the response rate from the right person will be high (Saunders *et al.*, 2009). Therefore, the online questionnaire was applied to gather quantitative data from the award winning organisations in Thailand.

Saunders *et al.* (2009) also suggested that questionnaires can be used more efficiently if combined with other data collection methods. *The semi-structured*

interview as the qualitative data collection method therefore was applied in this study to converge with the questionnaire. The semi-structured interview is a series of open questions which provide a question guide while also allowing an interviewee to describe a situation to extend an answer (Greener, 2008). This kind of interview can be used to answer the why-question in order to explain what has been found from the use of the questionnaire (Saunders *et al.*, 2009). Findings from both questionnaires and semi-structured interviews were combined to identify and clarify Lean Thinking implementation in Thailand.

Documentation, as the source of secondary data, is also used in this study. Both qualitative and quantitative data were gathered from the documentation. The documentation can be used in both descriptive and explanatory research (Saunders *et al.*, 2009). The written materials were used in this study in order to support the primary data which were gathered from the questionnaires and semi-structured interviews. These secondary data include company annual reports, newsletters, company documents, business magazines, quality award publications and organisation websites.

In the first stage, the website of the Office of Thailand Quality Award (www.tqa.or.th) was accessed in order to collect information on the award winning organisations. After that, further information for each TQA recipient was collected through their websites. Company newsletters, documents and business magazines were received during the interviews while quality award publications were requested from the Office of Thailand Quality Award. These materials might point out the quality management journey of the award winning organisations which can be used to support the findings from the primary sources. Additionally, company annual reports which were used in the financial analysis were gathered from the Department of Business Development, the Ministry of Commerce in Thailand to identify their organisational performance after the implementation of Lean Thinking.

As an exploratory piece of work, gaining insight from a few key respondents allows the framing of the questions and the form of data gathering to emerge. Using mixed methods, a survey assists a researcher to understand a broad view of Lean Thinking implementation which leads to an investigation in more depth through an interview (Creswell, 2003). Within this study, both qualitative and

quantitative data therefore are triangulated in the data collection in order to address the research objectives as shown in Table 4-1.

Table 4-1: Research objectives and sources of data

Research objectives	Source of data
To determine and compare which aspects of the Lean toolbox are widely implemented in the Business Excellence (BE) organisations.	Survey
To identify key decision criteria used by the BE managers in selecting which aspects of the Lean toolbox to implement.	Interview
To explore how these managers support human resource roles and manage other important factors in their implementation of Lean Thinking.	Interview
To define critical Lean elements that support an achievement in quality improvement in these contexts.	Survey and interview
To refine, validate and develop the research model for Lean Thinking implementation.	Survey, documentation and allied to literature findings

4.1.2 Data Collection Procedure

According to Stuart *et al.* (2002), learning from a well-known organisation which has a good performance is worthwhile. The targets for this study are organisations that achieved the TQA during the years 2002-2012. Learning from these best practice organisations is one of the choices for companies wishing to improve their organisational performance. It is important to note that a number of TQA receivers are departments or business units. Therefore, in this study the term 'organisation unit' is used to refer to each award recipient.

4.1.2.1 Data Collection Phase 1 (Empirical Study)

In the beginning stage, the researcher visited the website of TQA (www.tqa.or.th) in order to search for lists of the award recipients and contact details. The total numbers of potential companies to be included were 38 organisations (TQA, 2013b). All organisations which achieved the TQA during 2002-2012 were contacted to request their participation in this study. The time schedule for the data collection phase 1 is shown in Table 4-2.

Table 4-2: Time table for the data collection processes (Phase 1: Empirical Study)

Tasks	2012							
	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov
Contact TQA recipients								
Receive an acceptance								
Send a questionnaire								
Follow-up the questionnaire								
Receive survey response								
Setting of interview timetable								
Conduct the interviews								
Collect related documentation								

Firstly, the researcher made a telephone call to the quality manager of each organisation to ask for their participation. Twenty-five TQA achievers were interested in participating in this study; however, the remainder refused to join this research at this stage. Key reasons given for not participating was that at that time (2012) they had changed to apply other quality management approaches, for example quality assurance for specific business, rather than the continued use of TQA assessment criteria. Although the researcher attempted to persuade them to share their experiences in quality improvement by explaining the benefits of the participation, they insisted they would not participate. The willingness to participate in the study is the most important to make any real progress. In addition, 25 of the 38 TQA achievers is a good

number and represents the majority of the award winning organisations. Therefore, the researcher continued to the next stage with 25 TQA recipients.

For the 25 organisation units which were interested in the study, a formal letter was sent mostly to top management to inform them about the researcher, the research process and the confidentiality policy. It also asked the target organisations to participate in the study. (A copy of the letter is shown in Appendix A). The researcher aimed to elicit responses from not only top/senior management but also middle managers who are in either production or quality management. Key reasons for selecting these people as the target of this study are their experience in quality improvement in proposing a policy on quality development, implementing quality management approaches or supporting an application of quality approaches. It was to be expected that these people were able to identify what were important quality aspects and explain why those elements were selected in their organisation units.

After the TQA recipients received the letter, a number of them took approximately a month to make a decision. However, some organisation units spent up to two months in decision making. During this time, a telephone call was used to follow-up the contact. From a total of 25 award winning organisations which were contacted via the formal letter, 22 of them agreed to participate. Therefore, the participants in this study are approximately 57% of total TQA recipients. In fact, the researcher aimed to obtain an acceptance of at least 50% of TQA recipients. Thus, the sample size number exceeded expectations and represents the majority of the award winning organisations.

After an agreement to participate in the study, the researcher and key contact person made an arrangement for the application and return of the questionnaire and setting of the interview timetable. The questionnaire was created using the iSurvey (www.isurvey.soton.ac.uk/4963) as the online survey, as shown in Appendix B.

Questions which were used in questionnaire were designed thoroughly based on the literature review. There are two sections of the questionnaire in which the first part aims to gather general information of the award winning organisations. The second section of the questionnaire was proposed to collect data about quality management in the TQA organisations. As shown in Table 4-3, questions that were used to collect information about quality management in the

questionnaire were derived from several sections of the literature review in Chapter 2.

Table 4-3: A link between questions in the questionnaire and literature review in this study

Questions in the questionnaire	Sections in the Literature Review
The application of Lean tools	Section 2.7: Lean Thinking implementation 2.7.1: Lean Thinking in manufacturing 2.7.2: Lean Thinking in service 2.7.3: Lean Thinking implementation in Thailand
The application of quality activities	
Reasons for applying Lean tools and quality activities	Section 2.7.7.2: Framework on selection criteria in decision making on QM implementation
Goals in the application of Lean Thinking	Section 2.7.4: Goals and benefits of Lean Thinking implementation
Improvement after the application	
Key Success Factors in the application	Section 2.7.5: Key Success Factors (KSFs) in Lean Thinking implementation
Barriers in the application	Section: 2.7.6 Barriers and solutions in Lean Thinking implementation

According to Saunders *et al.* (2009), the online questionnaire can be used to assist a researcher to gather data from a target which might be difficult to access and the data are then automatically stored electronically. In the pre-survey period, the researcher was in the United Kingdom while the target organisations were in Thailand. The online questionnaire, therefore, was the most appropriate medium for collecting data from the targets. In addition, the online survey would

prevent the researcher from missing any returned questionnaires lost in the overseas mailing post. It also assisted the researcher in following-up the number of survey respondents electronically.

The online questionnaire in this phase is comprised of both open-ended and closed-ended questions. The first type of questionnaire can be used to assist a researcher to interpret data effectively (Saunders *et al*., 2009). The open-ended questions are appropriate to gather a detailed response in order to understand the phenomenon clearly. On the other hand, responses from the closed questions can be used in a comparative analysis due to their predetermination (Saunders *et al*., 2009). In this study, list, category, ranking and rating questions were applied as the closed-ended questions in the online questionnaire in order to combine advantages of these types of questions.

List questions allow a respondent to consider all potential alternatives before a selection. In contrast, a respondent can choose only one appropriate answer in the category questions (Greener, 2008). These two kinds of the closed questions were used to collect the organisational information of the respondents. Furthermore, Ranking questions were asked respondents to place Lean tools and activities in an important order. Five-Likert scale was used in the rating questions. The frequency scale (from always to never application) was applied in the questions about the frequency of the implementation of Lean tools and activities in the award winning organisations. Additionally, the agreement scale (from strongly agree to strongly disagree) was used to ask the respondents' opinion on not only reasons and goals in and improvements from an application but also important factors that might support and/or obstruct an achievement in quality development.

The hyperlink to the questionnaire was initially sent via an e-mail to the key contact person and was then allocated to the person responsible for quality improvement in that organisation. According to Saunders *et al.* (2009), a researcher should do the first follow-up one week after emailing a questionnaire to a target. However, in this study the first follow-up was done after three weeks without any response due to a consideration of Thai culture. After that, the second and third follow-ups were done six and nine weeks respectively after the first sending of the questionnaire via both e-mail and a telephone call. Indeed, the majority of the organisation units responded to the questionnaire after they

received the first follow-up. Totally, it took 22 weeks to receive 20 responses on the survey.

Table 4-4: A link between questions in the interview and literature review in this study

Questions in the interview	Literature Review
Background of quality management	Section 2.7.3: Lean Thinking implementation in Thailand
The application of quality tools and activities	Section 2.7: Lean Thinking implementation 2.7.1: Lean Thinking in manufacturing 2.7.2: Lean Thinking in service 2.7.3: Lean Thinking implementation in Thailand
Reasons for applying quality tools and activities	Section 2.7.7.2: Framework on selection criteria in decision making on QM implementation
Improvement after the application	Section 2.7.4: Goals and benefits of Lean Thinking implementation
Human resource management	Section 2.6: Lean Thinking
Key Success Factors in the application	Section 2.7.5: Key Success Factors (KSFs) in Lean Thinking implementation
Barriers in the application	Section: 2.7.6 Barriers and solutions in Lean Thinking implementation

A list of the interview questions, as shown in Appendix C, was sent to the contact person prior to the interview. Questions in the interview were designed carefully in order to not only gather the information on quality management and Lean

Thinking implementation in the award winning organisations in Thailand but also validate the results of the survey questionnaire. Similar to questions in the questionnaire, the interview questions were proposed based on literature review in Chapter 2 as shown in Table 4-4.

The interview was planned as a semi-structured interview in which interview questions are designed and sent to the participants before a meeting. If an interviewee raised any interesting issues, additional questions were asked for further details. The researcher requested the same person to both respond to the questionnaire and participate in an interview. This is because the researcher aimed to confirm and validate the survey results by using the interview. If the questionnaire and the interview were responded to by the same person, it was more likely that he or she would provide a highly consistent response. However, a willingness to take part in the research is the most important to make progress in the study. Although the responses in both methods from the same person were requested, some organisation units provided different people for the survey and interview. However, one can work on the assumption that any implementation from the same organisation has to have a degree of alignment across its managers. Despite receiving the responses from different people, the answers should therefore be almost the same as being given by the same person.

Both the questionnaire and the semi-structured interview guide had a carefully-designed format in order to achieve reliability and validity across the multiple case studies. All participating organisations received the same sets of questionnaire and interview questions. The questionnaire contained both English and Thai languages to ensure that the respondents had a clear understanding of the questions. The questionnaire was pilot tested for comprehensiveness and clarity by experts who are both scholars and practitioners in quality management. The pilot questionnaire which was created using the iSurvey (www.isurvey.soton.ac.uk) as the online survey contained both English and Thai languages. Its hyperlink was sent via an e-mail to ten academics and ten managers who are in either production or quality management. The majority of them provided feedback on the consistency between English and Thai languages, flow and relatedness of the questions as well as any identified problems in responding to the questionnaire. All feedbacks were used to improve the questionnaire before sending it to the target organisation.

4.1.2.2 Data Collection Phase 2 (Model Refinement)

After all designed data were collected, they were analysed quantitatively and qualitatively. Both quantitative and qualitative findings were merged into one dataset to debate the universality of Lean Thinking applications in Thailand. After that, a model on Lean Thinking implementation was developed in order to understand how Lean Thinking has been implemented alongside Total Quality Management. In order to refine the developed model, a review from both academics and practitioners who are experts in quality management and/or Lean Thinking was designed for this study. As explained in the previous chapter, theoretical triangulation is applied in the refinement process which uses various professionals in different positions (Guion *et al.*, 2011) to critique the developed model. The feedbacks from the experts are compared to establish the validation of the developed model.

In the refinement process, both open-ended and closed-ended questions were designed thoroughly to collect useful evaluation from experts. As the close-ended questions, listing questions were used to ask the experts' opinions on Lean elements in the developed model. In addition, rating questions were used to weight the degree of importance of each Lean element in the developed model. On the other hand, the open questions were also used in the online questionnaire in order to collect the detailed data. In other words, the reviewers can clearly explain their evaluation on the model of this study through an answer of the open-ended questions. Thus, this kind of question was applied to deeply understand reasons for an evaluation of the experts in order to interpret data effectively.

Due to the industrial uniqueness, the refined questions for practitioners in the manufacturing and service organisation units were put differently in order to match the particular application in each industry. Hence, three sets of questions were proposed, i.e. for academics, practitioners in the manufacturing business and practitioners in the service sector. These sets of questionnaires were designed by using the iSurvey (www.isurvey.soton.ac.uk) as the online survey. In this phase, the targets are experts who work in Thailand. The online questionnaire, therefore, was the most appropriate medium for collecting data from the targets. This is because the online questionnaire can be used to gather

data from a target which might be difficult to access and those data are then automatically stored electronically (Saunders *et al.*, 2009).

In this data collection phase, the pilot questionnaire was also applied. It was created by using the iSurvey (www.isurvey.soton.ac.uk) and contained both English and Thai languages. Its hyperlink was sent via e-mail to ten academics and ten managers in quality management for them to review the questionnaires. All feedbacks, which included consistency between English and Thai languages, flow and relatedness of the questions as well as any identified problems in responding to the questionnaire, were used to further develop the questionnaire before sending it out to the targets.

Table 4-5: Time table for the data collection processes (Phase 2: Model Refinement)

Refinement Processes	**2014**							
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Contact professionals to review the model								
Send the developed model to review								
Follow-up the review of the developed model								
Receive feedback from the professionals								
Analyse data from the refinement questions								
Refine the developed model								

The time schedule for the data collection phase 2 is shown in Table 4-5. After the refinement questions were redesigned completely, 22 TQA executives who participated in responding to the questionnaire and/or semi-structured interview were contacted again via e-mail and telephone call to request their participation in refining the developed model. Thirteen of them are in the service sector, the remainder in the manufacturing business. They are both managers and internal consultants in the award winning organisations in Thailand who have roles as practitioners in quality improvement. The advantages of using the same practitioner in both the initial data collection and refinement processes are not only to validate the applicability of the proposed model but also to prove the accuracy of the empirical findings used in the model development. In other words, this aims to in order to build credibility of the developed model.

In parallel, the researcher visited the websites of several universities in Thailand in order to search for contact details of academics who are experts in operations management, supply chain management, quality management and/or Lean Thinking. In order to request their participation in the refinement processes, ten academics from either industrial engineering or management science were contacted via e-mail and telephone call. The advantages of using scholars in refining the proposed model are that they can provide useful ideas from a comparison between the proposed model and the existing literature and/or the possible application in Thailand. Additionally, the use of theoretical triangulation, which requests an evaluation from different professionals to critique the developed model, results in gaining several perspectives which are based on both conceptual and implemental contexts. These could provide worthwhile ideas that would be used to refine the developed model effectively.

After the above experts agreed to participate in this study, the hyperlink of the online questionnaire was sent via an e-mail to the targets. In the model refinement process, the particular sets of questionnaire for the academics and practitioners were developed. As shown in Appendix D, the questionnaire for the academics was created using the iSurvey as the online survey (www.isurvey.soton.ac.uk/11709). In addition, due to the uniqueness of the industrial sector, the refinement questions for practitioners in the manufacturing and the service organisation units were designed differently by using the iSurvey. The questionnaire for the manufacturing business (www.isurvey.soton.ac.uk/11957) is shown in Appendix E while that for the service sector (www.isurvey.soton.ac.uk/11967) is shown in Appendix F.

Questions in the questionnaire in the model refinement process were also designed prudently in order to gather opinions of professionals about the developed model. Indeed, the model of this study was developed to not only fill gaps in the literature but also answer research problems in an academic debate. Thus, questions in the questionnaire in this stage were mainly based on the literature review section 2.7.7.1 Framework on Lean Thinking implementation and section 2.8.2 Identifying Gaps in Chapter 2. Particularly, the comprehensiveness of the Lean elements, an ease to understand and a possibility in the implementation were used as significant criteria in evaluating the developed model in the refinement process.

In this study, the first follow-up was done two weeks after sending a questionnaire to a target, in deference to the Thai culture, although Saunders *et al.* (2009) suggested doing this one week after an e-mail. After that, the second and third follow-ups were done four and six weeks respectively after the first sending of the questionnaire via both e-mail and telephone call. Indeed, the majority of the participants responded to the questionnaire after they received the first follow-up. In total, it took seven weeks to receive 25 responses to the online questionnaire. The collected data in this stage were used to refine and develop further the proposed model in order to provide a complete focus on Lean Thinking implementation.

4.2 The participants of this study

The targets of this study are executives who have experience in quality improvement in the quality award winning organisations in Thailand. All Thailand Quality Award (TQA) recipients during 2002-2012 were contacted through e-mail and/or telephone to ask for the participation in this study. Approximately 57% of the total recipient population agreed to participate in this study. Their willingness to take part in the research is most important in order to make progress in the study. In fact, the researcher aimed to obtain an acceptance from least 50% of the TQA recipients. Thus, the number in the sample size reaches expectations and is a good number as it is the majority of the award winning organisations.

Table 4-6: General information on the participants

Note: * TQA: Thailand Quality Award, TQC: Thailand Quality Class, TLA: Thailand Lean Award

NO.	Study Participants	Response		Quality Award*			Industry		Category			Nationality	
		Survey	Interview	TQA	TQC	TLA	Production	Service	Government Organisation	State Enterprise	Private Organisation	100% Thai Owner	Joint Venture
1	AA	✓	✓	✓	-	-	✓				✓		✓ (Thai-India)
2	BB	✓	✓	✓	✓	-		✓			✓	✓	
3	CC	✓	✓	✓	✓	-		✓			✓	✓	
4	DD	✓	✓	✓	✓	-	✓				✓	✓	
5	EE	✓	✓	-	✓	-	✓				✓	✓	
6	FF	✓	✓	-	✓	-	✓				✓	✓	
7	GG	✓	✓	-	✓	-	✓				✓	✓	
8	HH	✓	-	-	✓	-		✓	✓			✓	
9	II	✓	✓	-	✓	-		✓			✓	✓	
10	JJ	✓	✓	-	✓	-		✓			✓	✓	
11	KK	✓	✓	-	✓	-		✓			✓	✓	
12	LL	✓	✓	-	✓	-		✓			✓	✓	
13	MM	✓	✓	-	✓	-	✓				✓	✓	
14	NN	✓	✓	-	✓	-	✓				✓		✓ (Thai-Japan)
15	OO	✓	✓	-	✓	-		✓	✓			✓	
16	PP	✓	✓	-	✓	-	✓				✓	✓	
17	QQ	✓	✓	-	✓	-		✓		✓		✓	
18	RR	-	✓	-	✓	-		✓			✓	✓	
19	SS	-	✓	-	✓	-		✓			✓	✓	
20	TT	-	✓	-	✓	✓		✓			✓	✓	
21	UU	✓	✓	-	✓	✓	✓				✓	✓	
22	VV	✓	✓	-	✓	✓		✓	✓			✓	
Total		19	21	4	21	3	9	13	3	1	18	20	2
Total							22		22			22	

In order to keep the participants' identity anonymous for reasons of confidentiality, double capital letters, from AA to VV, are assigned to each organisation unit. In addition, it is important to note that a number of TQA recipients are departments or business units. Therefore, in this study the term 'organisation unit' is used to refer to each award recipient. As shown in Table 4-6, 19 and 21 of the award winning organisations participated in the survey and interview, respectively.

Four organisation units have won the TQA; however, three of them had received the Thailand Quality Class (TQC) award before the TQA. A total of 21 business units that participated in the study have received the TQC. Nine participants are in the production sector while the remainder are in service industry. The participants in the production sector are in paper, chemicals and plastics, cement, fibre and product and food industries. The 13 organisation units in the service sector operate in education, telecommunications, energy, payment services, hospitals, maintenance and retailing industries. The majority of the participants are private organisations that were founded by 100% Thai owners.

As shown in Table 4-7, it can be seen that only organisation AA received a TQA at the first attempt. While, three other TQA winners which are DD, CC and BB won the TQC at the second, third and fourth attempts, respectively. These three organisation units applied for the award in subsequent years until they achieved the TQA. In fact, 18 study participants won the TQC without reaching the TQA. The majority of the TQC winners applied for the award in the following year except for one organisation which applied for and achieved the TQC six years after its first achievement.

In fact, there are three organisations that received both the TQC and Thailand Lean Award (TLA). Two of them achieved the TQC once, while one organisation unit qualified for the TQC twice. VV has reached the TLA at the silver level whereas TT has been granted this award twice at the bronze level for two different departments in the organisation. Interestingly, UU has won TLA three times at bronze, silver and golden levels in 2010, 2011 and 2012, respectively.

Table 4-7: Participants' year of achieving awards

NO.	Study Participants	Year										
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1	AA	TQA	-	-	-	-	-	-	-	-	-	-
2	BB	-	-	-	-	-	TQC	TQC	TQC	TQA	-	-
3	CC	-	-	TQC	TQC	TQA	-	-	-	-	-	-
4	DD	TQC	TQA	-	-	-	-	-	-	-	-	-
5	EE	-	-	-	-	-	-	-	TQC	TQC	TQC	-
6	FF	-	-	-	TQC	-	-	-	-	-	-	-
7	GG	-	-	TQC	-	-	-	-	-	-	-	-
8	HH	TQC	TQC	-	-	-	-	-	-	-	-	-
9	II	-	-	-	-	TQC	-	-	-	-	-	TQC
10	JJ	-	-	-	-	-	-	-	-	-	TQC	TQC
11	KK	-	-	-	-	-	-	-	-	-	TQC	TQC
12	LL	-	-	-	-	-	-	-	-	TQC	-	-
13	MM	TQC	TQC	-	-	-	-	-	-	-	-	-
14	NN	-	TQC	-	-	-	-	-	-	-	-	-
15	OO	-	-	-	-	-	-	TQC	-	-	-	-
16	PP	TQC	TQC	-	-	-	-	-	-	-	-	-
17	QQ	-	-	-	-	-	-	-	-	-	TQC	-
18	RR	-	-	-	-	-	-	-	-	TQC	-	-
19	SS	-	-	-	-	-	-	-	-	TQC	TQC	TQC
20	TT	-	-	TQC	-	TQC	-	-	-	-	TLA Bronze	TLA Bronze
21	UU	-	-	-	TQC	-	-	-	-	TLA Bronze	TLA Silver	TLA Golden
22	VV	-	-	-	-	-	TQC	-	-	TLA Silver	-	-

Note: * TQA: Thailand Quality Award, TQC: Thailand Quality Class, TLA: Thailand Lean Award

It can be seen that these study participants have qualified in quality management. The majority of them began their quality improvement journey more than ten years ago with a number of quality certifications. This can be proved by their achievement in quality award winning. In addition, the participants are well-known organisations which are considered to be high performance organisations in Thailand. They, therefore, are worthwhile to be investigated in this study in order to understand how Lean Thinking was implemented along with Total Quality Management as part of the quality development journey in the award winning organisations in Thailand.

4.2.1 The participants in Data Collection Phase 1 (Empirical Study)

As shown in Table 4-8, the respondents who participated in the survey and/or interview for this study can be categorised into three groups:

- Group 1: Top management and senior management
- Group 2: Middle managers which include departmental managers and quality management (QM) managers
- Group 3: Internal consultants of the headquarter company.

Table 4-8: Respondents to questionnaire and interview in data collection - phase 1

Data Collection Methods	Industry	Position in the Organisation Units			Total Respondents
		Top Management	Middle Management	Internal Consultants	
Questionnaire	Manufacturing	4	3	2	**9**
	Service	4	6	1	**11**
Total		8	9	3	**20**
Interview	Manufacturing	4	3	2	**9**
	Service	6	5	1	**12**
Total		**10**	**8**	**3**	**21**

As explained above, the researcher aimed to elicit responses from top/senior management and middle managers who are in either production or quality management. Indeed, the person who responded to the questionnaire and took part in the interview was assigned by the organisation unit itself. Some award winning recipients provided senior managers who are responsible for quality improvement programmes. They have supported not only its organisation but also other business units in the same company group. Therefore, it is difficult to assign them into group one (top management) or group two (QM manager). Group 3, therefore, is designed for QM managers who play roles as internal consultants for a number of business units in the same company group.

However, respondents to the questionnaire and the interview were mostly top and middle managers.

4.2.2 The participants in Data Collection Phase 2 (Model Refinement)

In the model refinement process, participants who played roles in reviewing the developed model were not only practitioners but also academics who are experts in operations management, supply chain management, quality management and/or Lean Thinking. In this phase, the researcher requested managers who participated in the first phase in the empirical study to evaluate the model. However, only 16 of those practitioners participated in this model refinement process. The researcher expected to receive responses from at least 50% of total participants in the first phase of data collection. In fact, the participants who are practitioners in the model refinement process are approximately 72% of total participants in the empirical study. The numbers for the sample size, greatly exceeded expectations and represent the majority of participants in the first phase of data collection. In other words, the participants in the refinement process were the majority of respondents from the empirical study.

Table 4-9: Practitioners who participated in data collection - phase 2

Industry	Position in the Organisation Units			Total Respondents
	Top Management	Middle Management	Internal Consultants	
Manufacturing	3	3	2	**8**
Service	3	4	1	**8**
Total	6	7	3	**16**

As shown in Table 4-9, eight respondents are in the manufacturing businesses while the same numbers are in the service organisation units. The practitioners who participated in reviewing the developed model can be categorised into three groups which are the same as those in the phase 1 of the data collection. They are top management, middle management and internal consultants. As

explained in the previous section, the internal consultants are senior managers who support quality improvement in both their company and other business units within the same company group. Hence, the majority of the respondents in this phase are top and middle managers. An evaluation from the practitioners in different positions provided a comprehensive view that could be applied in the model refinement effectively.

Table 4-10: Academics who participated in data collection phase 2

Area of Expertise	Years of Expertise			Total Respondents
	1-5	6-10	More than 10	
Operations, Supply Chain and Quality Management	2	3	1	**6**
Other Management Areas	3	0	0	**3**
Total	5	3	1	**9**

Furthermore, the participants in the model refinement process included academics who work in several universities in Thailand. They are experts in operations management, supply chain management, quality management and/or Lean Thinking. The researcher requested ten scholars to evaluate the developed model. However, nine of them provided comments on the model evaluation, as shown in Table 4-10. The researcher again aimed at the participation of at least 50% of the total number. In fact, the scholars who participated in the model refinement process are 90% of those academics who were contacted. This number exceeded expectations and the academics came from several well-known universities in Thailand. It can be assumed therefore that these respondents are a good representation of scholars to evaluate this developed model.

The nine academics who provided an evaluation of the developed model can be categorised into two groups. The first category is the scholars who are entirely expert in operations management, supply chain management and/or quality management. While, the other group of academics are experts who are interested in not only the areas of expertise of the first group but also other

areas of management, such as marketing and financial management. The majority of the scholars who participated in the model refinement process are pure experts in operations management, supply chain management and/or quality management. In fact, the scholars in both homogeneous and various expertise could reflect the model assessment in not only the accuracy in Lean Thinking application but also in other related important issues. Lean Thinking, indeed, is a systematic thinking that requires the implementation of a whole organisation (Bicheno, 2008). Therefore, a variety of consideration criteria is worthwhile in efficiently improving the developed model of this study.

4.3 Data Analysis

4.3.1 Data Analysis Phase 1 (Empirical Study)

Due to the small number of participants, it was not possible to perform a detailed statistical analysis based on the quantitative research. This is because the quantitative approach requires a sufficient size of samples in a study in order to generate a conclusion (Saunders *et al.*, 2009). Nine of the 22 participants are in the production sectors (paper, chemicals and plastics, cement, fibre, and product and food industries). The remainder of the participants are in the service sectors (education, telecommunications, energy, payment services, hospitals, maintenance and retailing industries). It can be seen that the participants operate in a wide range of industries. In other words, because there are very small numbers of participants in each business group this could lead to difficulties if the study were only going to perform a quantitative analysis. Therefore, the qualitative method is applied in parallel in this study and overcomes this limitation as well as having had its own justification in the methodology as explained in Chapter 3.

In this study, both quantitative and qualitative data were collected through questionnaires and semi-structure interviews, respectively. The researcher aimed to explore what constitutes Lean elements from the survey and to explain why and how these elements are implemented in Thailand from the interview responses. Once the data was collected, data analysis was the next task. In fact, there are several analysis methods of mixed data collection, e.g. data

transformation, typology development, extreme case analysis and data consolidation (Creswell and Clark, 2011). In this study, the data consolidation which merges both quantitative and qualitative data into one data set is applied. According to Creswell and Clark (2011), data analysis of mixed methods design is comprised of data reduction and data display. Both processes were applied throughout the analysis to ensure that the analysis would reach convincing results.

4.3.1.1 An analysis of the primary data

In the quantitative data analysis, a detailed statistics was not an appropriate choice to be done in this study due to a limitation on the small number of participants. However, the descriptive statistics can be used in the exploratory research in order to give both description and comparison of the numeric variables (Saunders *et al*., 2009). Therefore, the SPSS statistics, version 20, has been used to generate the descriptive statistics. This was done in order to not only summarise the frequencies of the application of Lean elements but the levels of agreement of the participants in the Lean Thinking implementation as well. Additionally, the descriptive statistics was applied to compare and contrast the implementation of Lean Thinking between the manufacturing and service sector.

After the respondents completed the questionnaires, all variables were encoded as either numerical or categorical in order to enter data into the analysis software effectively. In addition, for all missing data in the questionnaire it was assumed that the respondents had not done the activities and/or had neutral opinions on the issues. Therefore, they were coded as ‘never’ and/or ‘neutral’, respectively. The data sets were entered and checked for the errors in a Microsoft Excel spreadsheet before being uploaded to the SPSS. The data were then analysed and categorised into critical groups. The process of the quantitative analysis is shown as Figure 4-1.

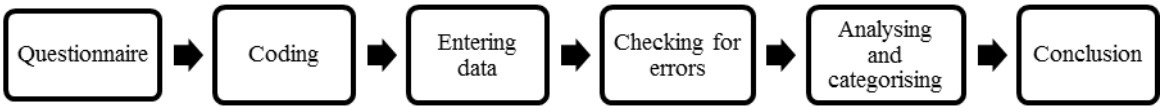


Figure 4-1: The process of quantitative data analysis

In the qualitative data analysis, a number of mediums have been used in order to analyse data from interview transcriptions and field notes. As shown in Figure 4-2, the researcher collected all the field notes and interview records after the semi-structured interviews had been completed. Transcription of the interview records was done as soon as possible in order to ensure that the transcription was accurate. In order to build credibility, the transcripts were sent to the interviewees so they could check for any errors. In parallel, the researcher had checked the transcripts against the recordings. As most interviews were conducted in the Thai language the researcher therefore needed to translate the transcripts into English. The transcription and translation were done on a Microsoft Word document before being uploaded to NVivo version 10. NVivo is a computer aided, qualitative data analysis software which can be used to organise, encode and create the relationships among variables (Greener, 2008). The transcripts were then analysed and categorised into critical groups.

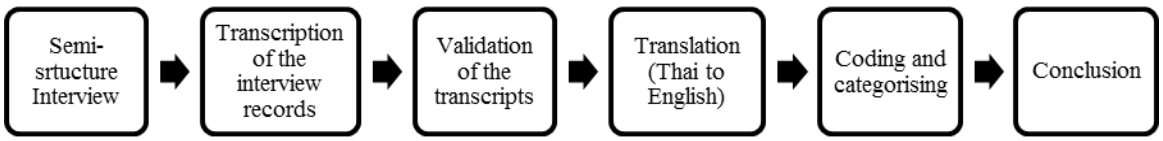


Figure 4-2: The process of qualitative data analysis

After the researcher completed the data analysis, the findings from the qualitative data were used to explain the reasons for Lean Thinking implementation in the Business Excellence organisations which were explored by the quantitative data. Furthermore, the results from both quantitative and

qualitative data analysis were used in developing a framework for Lean Thinking implementation in Thailand.

4.3.1.2 An analysis of the secondary data

In order to identify any improvement after the Lean Thinking implementation, annual reports of the case study organisations were analysed. In this study, a five-year period which spanned two years before and two years after winning the first award was used in the financial analysis. However, a number of targets did not provide their financial statements due to being a business unit or a government department. Therefore, the financial statement of an overall organisation was used in the analysis if available. In fact, there is still an unclear relationship between TQM and/or Lean Thinking implementation and financial performance in the existing literature, particularly in Thailand.

This study, therefore, investigated the financial outcome of the target organisation. Nonetheless, it was difficult to distinguish which parts of the financial improvement came from the implementation (Bergquist *et al.*, 2005) of Lean Thinking. Financial analysis only is not enough to completely identify the improvement from the implementation of Lean Thinking. Therefore, this study investigates not only financial performance but also other indicators which include customers, internal processes and learning organisation in order to provide a comprehensive view on an improvement from the implementation.

In addition, further information of each TQA recipient was collected and analysed through their websites, newsletters, documents and business in parallel with quality award publications from the Office of Thailand Quality Award. These materials might point to the quality management journey of the award winning organisations which can then be used to support the findings from the primary sources.

4.3.2 Data Analysis Phase 2 (Model Validation and Refinement)

After developing a conceptual model of Lean Thinking implementation, it was essential to validate and refine the model in order to prove its accuracy and

effectiveness in application. In order to do that, a comparative analysis with the existing literature was conducted to verify the validation of the developed model. After that, data from the online questionnaires that were collected from experts in quality management were analysed to refine the developed model of this study.

4.3.2.1 Data Analysis Phase 2.1 (Model Validation)

In the model validation, a comparative analysis was done in order to compare and contrast the Lean elements of the developed model with those of the existing literature. The data analysis in this stage was therefore based on the secondary data. After completing the model development, both theoretical and practical frameworks of Lean Thinking implementation were identified to use in the analysis. The theoretical frameworks were searched from key books on Lean Thinking. These included 'Lean Thinking' by Womack and Jones (1996), The 'Toyota Way' by Liker (2004) and 'Staying Lean: thriving, not just surviving' by Hines *et al.* (2011). The authors of these books are well-known as key experts in Lean Thinking. Therefore, it is worthwhile comparing the developed model with the Lean Thinking frameworks suggested by these professionals.

In addition, a comparative analysis in the model validation emphasised not only the theoretical models but also the practical frameworks. The second of these was found in the published academics journals on Lean Thinking implementation. These articles were searched via Webcat and DelphiS which are in a computerised database at the library of the University of Southampton. A number of frameworks that were found in the journal articles were used in a comparative analysis. After obtaining the required data, each Lean element in the developed model was thoroughly compared with those in the existing frameworks to identify similarities and differences among them. In addition, a comparison was made to identify the essential aspects of Lean Thinking in a real application.

In order to prove the validity of the developed model, an evaluation of the implementation effectiveness in the award winning organisation in Thailand was done in parallel with a comparative analysis. In this section, the organisational performance of the award recipients was investigated in the four perspectives of

the balanced scorecard (Kaplan and Norton, 1996): financial, customer, internal business process and learning-and-growth dimensions. This assessment aimed to identify the improvements from Lean Thinking implementation. If the award winning organisations achieved their organisational development from Lean Thinking applications, it could be concluded that the developed model that was created from their implementation would result in an improvement as well. In fact, an analysis in this section used data from the empirical findings chapter.

4.3.2.2 Data Analysis Phase 2.2 (Model Refinement)

In the model refinement process, there were both open-ended and closed-ended questions to gather as much as possible evaluation measures to improve the proposed model. Therefore, these two types of refinement questions were analysed differently by the particular methods as shown in Figure 4-3. Although there are three sets of questionnaire for academics and practitioners in different sectors, these questionnaires similarly contained both open-ended and closed-ended questions. After gathering responses from experts, all data were separated into two groups: quantitative and qualitative. The responses from the closed-ended questions were considered to be quantitative data while those from the open-ended questions were regarded as qualitative data.

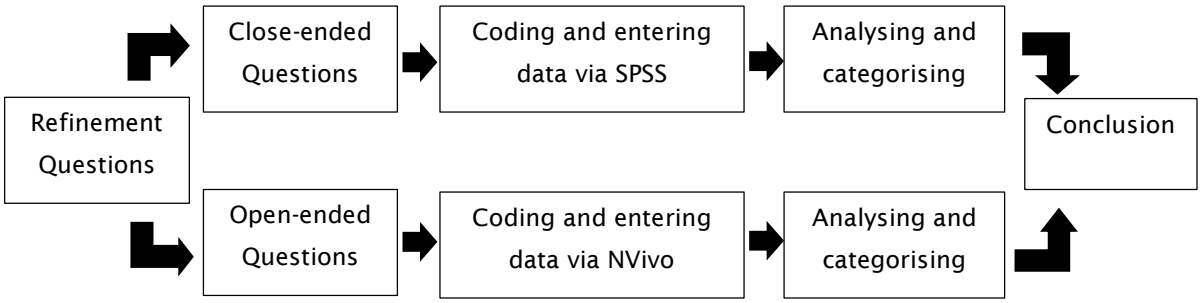


Figure 4-3: The process of data analysis in the model refinement

In fact, data analysis processes in this phase were similar to those in the empirical study. The quantitative data were analysed using SPSS statistics version 20 while the open-ended questions which were qualitative data were analysed using NVivo version 10. In the quantitative analysis, the descriptive statistics was

applied in order to summarise the number of agreement and disagreement from the reviewers on the developed model. In addition, this kind of statistics can be used to measure the central tendency of the sample (Greener, 2008; Saunders *et al*., 2009). Therefore, the average scores from the evaluation of the developed model were calculated in a form of the descriptive statistics. All variables were encoded after receiving responses from the participants in order to analyse data effectively by using the software. Before being uploaded to the SPSS programme, these quantitative data sets were entered and checked for errors in the Microsoft Excel spreadsheet. All missing data in the questionnaire were tracked back to requesting the respondents to complete the evaluation via e-mail and a telephone call. The data, then, have been analysed and categorised into critical groups.

In parallel, the qualitative data from the open-ended questions were translated in the Microsoft Word document before being uploaded to NVivo. This was because most participants responded to the questionnaire in the Thai language. The researcher, therefore, needed to translate the responses into English. Feedback from the model evaluation was analysed and categorised into critical groups. After completing the data analysis, both quantitative and qualitative data were merged into one data set in order to apply it in improving the developed model.

4.4 Chapter Conclusion

In this study, a mixed method research, both quantitative and qualitative data collection methods were designed and applied thoroughly in order to combine and use the best features of each data collection and analysis tool. In fact, there were two phases of data collection. In the empirical study as the first phase, online questionnaire, semi-structured interview and documentation were three key sources of data collection. Participants in this stage were managers who were in the award winning organisations in Thailand. They were top management, middle management and internal consultants in not only manufacturing but also service organisation units. The majority of them began their quality improvement journey more than ten years earlier with a number of quality certifications. After receiving responses from participants, both primary

and secondary data analysis was applied in this stage alongside the SPSS statistics version 20 and the NVivo version 10. The findings from the quantitative and qualitative data analysis were used to develop a conceptual model in Lean Thinking implementation.

In phase two of the data collection and analysis, the model validation and refinement were planned in order to prove and improve the validity of the developed model. In the model validation, a comparative analysis between the model of this study and that of the existing literatures was done to identify similarities and differences among them. Additionally, an evaluation of the implementation effectiveness in the award winning organisations was done in order to prove the validity of the developed model. Four perspectives of the balanced scorecard were applied as a base for the performance assessment. In fact, a comparative analysis and an evaluation of the implementation effectiveness were planned to verify the validity of the developed model in both theoretical and practical application.

In the model refinement, the online questionnaire was applied to gather feedback from an assessment of the developed model. There were three sets of questionnaires which were designed specifically for scholars, practitioners in the manufacturing business, and practitioners in the service sector. However, these questionnaires similarly contained both closed-ended and open-ended questions that were analysed quantitatively and qualitatively using the same software as in the previous phase. The participants in this phase were, therefore, not only managers who participated in the empirical study but also academics who were experts in operations management, supply chain management, quality management and/or Lean Thinking. After receiving responses from the experts, all data were analysed and used to refine the developed model in order to ensure that the developed model was valid and had applicability in a real situation.

Chapter 5: Research Findings

This chapter explores how Lean Thinking is implemented in the award winning organisations in Thailand in order to respond to the first three research questions and objectives which were presented in Chapter 1. The background of quality management and Lean toolbox were investigated in order to determine and compare which aspects of the Lean toolbox are widely implemented in the Business Excellence (BE). In addition, motives in the implementation, improvement and challenges in Lean Thinking application are described and explained to identify key decision criteria in selecting which aspects of the Lean toolbox to implement.

Furthermore, roles of human resources and how the case organisations supported them along with other resources in Lean Thinking implementation are clarified in this empirical study to address significant elements in Lean Thinking implementation. All of these were done in order to contribute to research aims about an academic debate on a claim of Womack *et al.* (1990) on the universality of Lean Thinking implementation. The initial findings will also be used in a comparative analysis to the existing literatures.

5.1 Background of quality management

From the empirical study, it was found that more than 75% of participants began their quality management journey by implementing ISO 9001 certification in order to create standard of work. This finding is similar to the study of Krasachol *et al.* (1998) and Punnakitikashem *et al.* (2010). The ISO certification assists an organisation to build a solid standard before the development to higher quality level. The majority of case study organisations, therefore, used the ISO certification before Total Quality Management (TQM) application. Hence, the ISO standard is considered as a good start for TQM implementation (Krasachol *et al.*, 1998) and a motivating factor for business process improvement (Bendell, 2005).

However, having only the ISO certification is not enough to improve the organisational performance. Other quality management approaches are needed

to develop the participants' performances. Three key approaches that were considered by the organisation units are Total Quality Management (TQM), Total Productive Maintenance (TPM) and Lean thinking. TQM was often selected as the second approach in quality management after the ISO standard due to consistent factors between them in the aspects of customer, leadership, employees and suppliers through process management. According to Krasachol *et al.* (1998), the Deming idea of TQM was the most popular in Thailand. One quarter of organisation units therefore applied for and achieved Deming Prize in Japan in order to benchmark their TQM performance to the original quality management standard. When making a decision on which quality approach should be applied in the organisation units, both internal and external forces are involved. However, an internal environment is more emphasised than any other. As shown in Figure 5-1, the case study organisations aimed to improve their organisational performance as the key reason in the implementation of quality management.

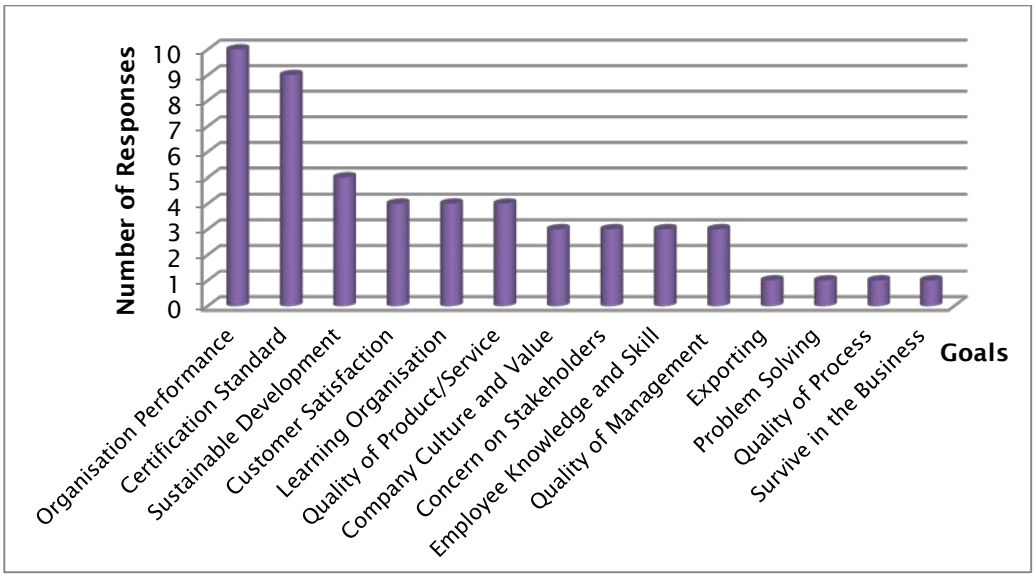


Figure 5-1: Goals of the implementation of quality management approaches

After the implementation of TQM, the case organisation units decided to apply for Thailand Quality Award (TQA). Two vital reasons for the award application were to receive feedback from an assessment and to benchmark their operation to an international standard. In addition, an application for TQA is used to evaluate the position of TQM implementation in the organisations. Although an achievement in the national quality awards (NQAs) is considered as a success in the TQM implementation (Ghobadian and Woo, 1996), a number of organisation

units that achieved Thailand Quality Class (TQC) as the second prize continued to improve their performances to reach the first prize, Thailand Quality Award. They claimed that the quality award achievement was not the highest goal of their organisation units. Indeed, all participants plan to do continuous improvement after they received TQA. One of the manager choices is Lean Thinking implementation.

5.2 Lean Thinking implementation in Thailand

After Womack and Jones introduced the universal application of Lean Thinking in 1996 (Womack and Jones, 1996), a number of businesses (which included organisations in Thailand) were interested in implementing this thinking to continually improve their performance. The majority of organisation units explained that only achieving a TQM implementation was not enough to reach sustainable development. They are, therefore, looking for other approaches that assist them to develop an overall organisation. According to Bozdogan (2010), Lean Thinking focuses on process improvement similar to TQM however this thinking further plans to develop an organisational system. Lean Thinking was, therefore, applied in the award winning organisations because it has been considered as one of the important quality approaches that leads to better quality of organisational performance.

As shown in Figure 5-2, approximately 45% of participants claimed that they have not applied Lean Thinking. However, half of them are considering the possibility in implementing this approach as shown in Figure 5-3. The remainder were concerned about perceived inappropriateness to their businesses. Particularly in the service industry, they claim that since Lean Thinking began in the manufacturing sector, it is difficult therefore to apply Lean Thinking in their businesses.

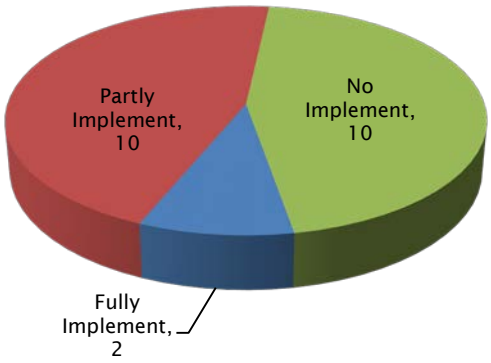


Figure 5-2: The implementation of Lean Thinking

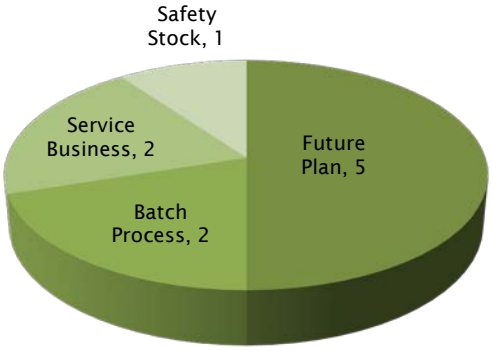


Figure 5-3: Reason for not implementing Lean Thinking

In contrast, more than half of the participants have implemented Lean Thinking in their units. Only two of them have fully implemented Lean Thinking and achieved Thailand Lean Award. Key reason which motived these Business Excellence (BE) organisation units to implement this thinking is the elimination of wastes or non-value-added (NVA) activities followed by the requirement of their customers. According to Schonberger (1982), wastes are considered as serious problems. The participants were also concerned that wastes in their procedures would result in both ineffective operations and unnecessary expenses. Lean Thinking therefore could be used to assist their units to not only reduce excess activities but also create value to customers by using the capabilities of their human resources in effective ways instead of solving repeating problems and doing non-valued-added activities.

The organisation units which applied Lean Thinking identified that several departments participated with a different level of importance in their implementation process. Interestingly, Manufacturing/Service and Quality Management play important roles in participating in Lean Thinking implementation process. A number of them, in both the production and service sectors, explained that Lean Thinking implementation was initiated and supported from the department of Quality Management. After that, this thinking has been applied initially and mainly in the operational department.

Although ten participants claimed that they have not applied Lean Thinking in their units, they have actually implemented a number of Lean tools. The majority of participants clarified that they have used different names instead of Lean Thinking. Thus, it might be assumed that Lean tools have been used under different quality management approaches. However, the organisation units have also applied different tools at different levels. Therefore, thirty Lean tools are categorised into three groups based on the frequency of their implementation. These three categories are defined here as Core, Consideration and Niche. Lean tools in the Core group are used by most organisation units. The Consideration group includes some tools for specific important uses and ought to be considered however in this study they were used less often than those in the Core. The Niche group are very specialised in their application and they were used by few organisation units in the study.

Table 5-1: The calculation for allocating Lean tools into the specific categories in this study

Degree of the application	**Overall units (20 responses)**	**Manufacturing units (9 responses)**	**Service units (11 responses)**
Always (5.0 score)	100	45	55
Usually (4.0 score)	80	36	44
Sometimes (3.0 score)	60	27	33
Seldom (2.0 score)	40	18	22
Never (1.0 score)	20	9	11

As explained above, thirty Lean tools were categorised into three groups based on the frequency of the application. The participants in this study applied these Lean tools at different levels from 'always' to 'never' implemented. The precise points were assigned to the specific degree of the application as shown in Table 5-1. According to Saunders *et al.* (2009), the Likert rating scale is generally applied in the rating questions in order to gather an opinion of the respondents.

Types of rating can be categorised as the agreement, amount, frequency and likelihood (Saunders *et al.*, 2009). In order to categorise Lean tools effectively, five-Likert scale is applied in this study based on the frequency of the tool application. The always implementation was therefore assigned at 5.0 score followed by usually, sometimes, seldom and never application at 4.0, 3.0, 2.0 and 1.0 scores, respectively.

In the overall units, these degrees of application were multiplied by 20 which was the total number of the survey respondents. Similarly, in the calculation for the unique industrial sector the application degrees were multiplied by 9 and 11 which were the total number of the survey respondents in the manufacturing and the service sectors, respectively. This methodology was applied in this study because different Lean tools were applied at different levels. Hence, it is not sensible to categorise these tools by considering only one or two degrees of application. In fact, a scale score which is a sum of the rating questions' scores is used to present a result of the evaluation (Saunders *et al.*, 2009). Therefore, the degrees of application were multiplied by total number of the overall respondents (20), manufacturing units (9) and service units (11) in order to create a frame of the application points in a particular category of Lean tools, as shown in Table 5-1.

Table 5-2: The application point of each category of Lean tools

Categories of Lean tools	**Overall units**	**Manufacturing units**	**Service units**
Core	61-100	28-45	34-55
Consideration	41-60	19-27	23-33
Niche	0-40	0-18	0-22

Consequently, the same method was applied in the implementation of each tool. The different degrees of application of a specific tool were combined into a scale score. Thus, each Lean tool has a precise point from the application of the award

winning organisations. From the calculation, the researcher was able to categorise thirty Lean tools into three groups which were based on the frequency of the implementation as shown in Table 5-2. We assigned Lean tools whose application points fell between "always" and "usually" implemented as the Core while those with "sometimes" application as the Consideration. The Niche group was assigned to Lean tools whose application points ranged from "never" to "seldom" implemented.

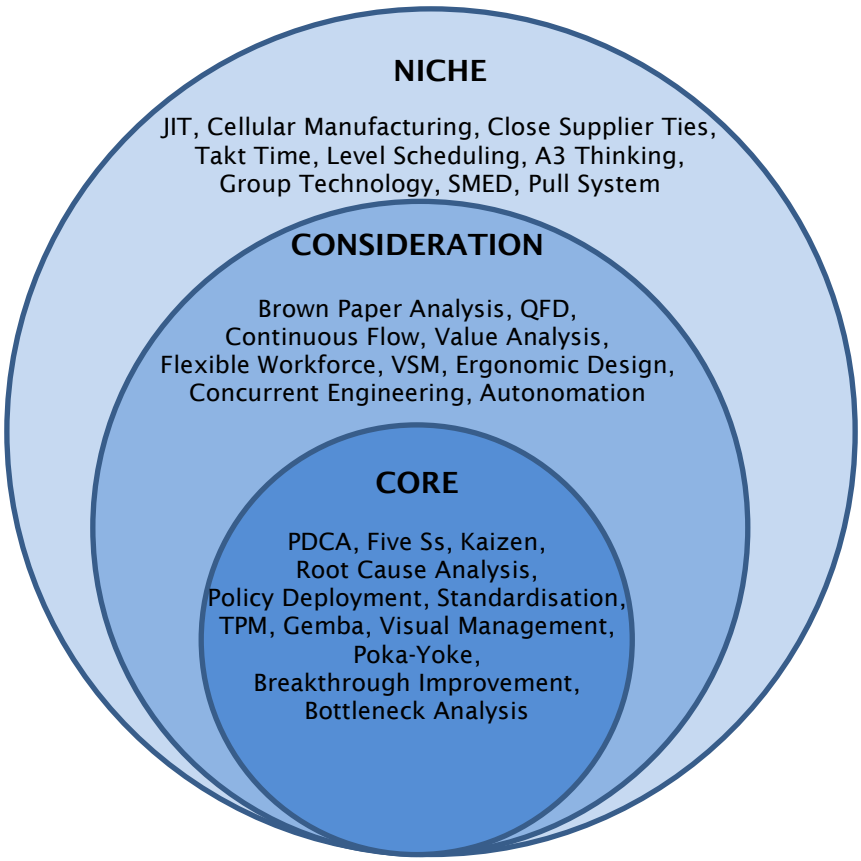


Figure 5-4: Lean tools implementation in overall organisation units

As shown in Figure 5-4, Plan, Do, Check Act (PDCA) was implemented by the highest number of participants in the core group followed by Five Ss and Kaizen (Continuous Improvement). This is similar to the study of Pradabwong *et al.* (2012), where PDCA was generally applied in their studied companies. The participants in this study claimed that PDCA has been used as a basis in all activities. If an employee wants to do something, he or she is required to follow the PDCA circle in order to ensure that all actions are thought through and

checked carefully. Five Ss was applied in the early stage of quality management due to its ease of application to improve the quality of the working environment while Kaizen (Continuous Improvement) has been done through an improvement project. Indeed, continuous improvement is a key part of the success in the Japanese business approach (Brown, 1994). The majority of study participants supported their employees to launch an improvement project at least once a year. Key motive for those projects is to develop employee knowledge and skill which might finally lead to the learning organisation.

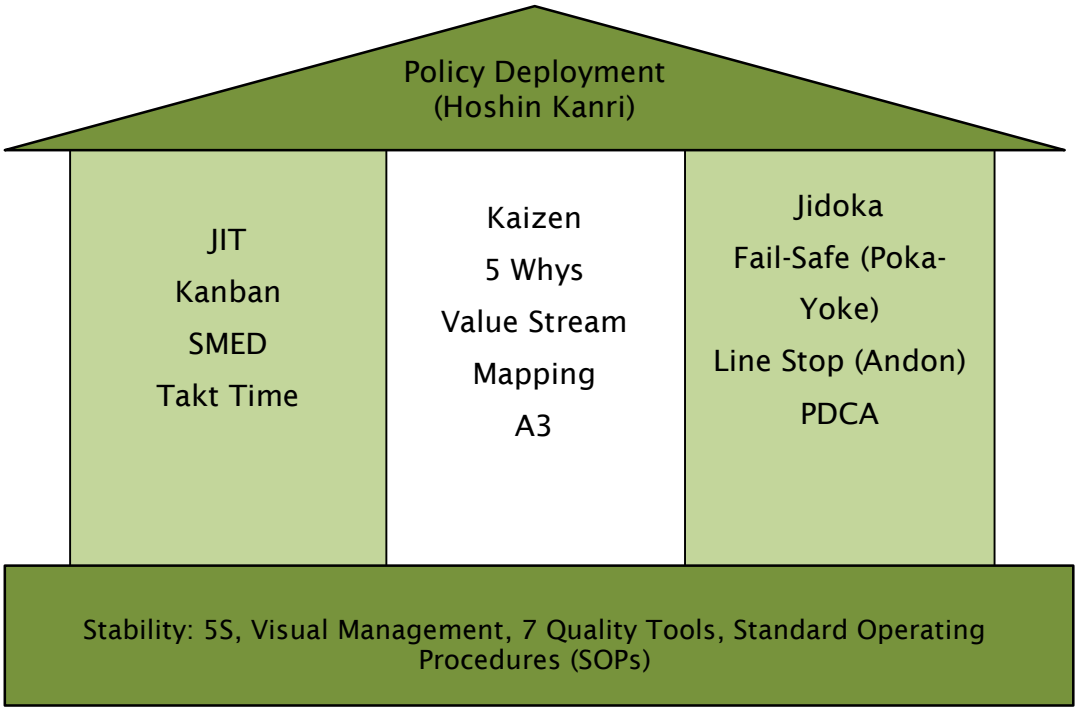


Figure 5-5: House of Lean (Source: Bicheno and Holweg (2009) p.32)

According to Bicheno and Holweg (2009), House of Lean comprises of three major parts which are base, pillars and roof as shown in Figure 5-5. All aspects are considered as essential elements in Lean Thinking. It can be noticed that seven Lean tools which are considered as the Core implementation in this current study are also parts of the House of Lean. These tools include PDCA, Five Ss, Kaizen, Hoshin Kanri (Policy Deployment), Standardisation, Andon (Visual Management) and Poka-Yoke (Error Proofing). This might identify a similarity between the literature and the practices in Thailand. However, there is also a difference in the implementation. Although Value Stream Mapping (VSM) and

Jidoka (Autonomation) are two elements in the pillar of House of Lean, they are categorised as the Consideration tools in this study because they are only applied in some organisations.

Additionally, Just-in-time (JIT), Takt Time, Hejunka (Level Scheduling), A3 Thinking, Single Minute Exchange of Die (SMED) and Kanban (Pull System), which are categorised as key tools in the House of Lean, have been rarely implemented by the organisation units in this study. These tools are, therefore, categorised as suitable for Niche implementation. The study participants claimed that it is not feasible to implement Just-in-time (JIT) because of the need to source material in bulk from other countries and therefore it is not possible to do this in the small batches needed for JIT. It can be said that the universal application of Lean Thinking might be questioned by this argument. This is because not all Lean tools are implemented widely in the organisation units Thailand. In fact, in this study, Lean tools are only implemented if they are consistent with the organisational circumstances.

Also investigated was whether these Lean tools are implemented differently between production and service sectors. It can be noted that organisation units in different industries have weighted Lean tools differently. Lean tool implementation in the production sector is shown in Figure 5-6 while that in the service industry is shown in Figure 5-7.

It can be noticed that PDCA is likely to be still weighted as the most common tool in both production and service sectors. However, the numbers of Core tools in the manufacturing sectors are twice those in the service sector. It can be noticed that in the Core category the first eight Lean tools in the manufacturing sector are the same as all Lean tools in the service sector although these Lean tools are sequenced differently. Therefore, it might be said that the first eight Lean tools are likely to be essential to all businesses that plan to improve their organisational performance through Lean Thinking. The logic of these results suggests that in order to achieve in a Lean Thinking application, an organisation (in whatever business sector) should implement these eight Lean tools in an early stage.

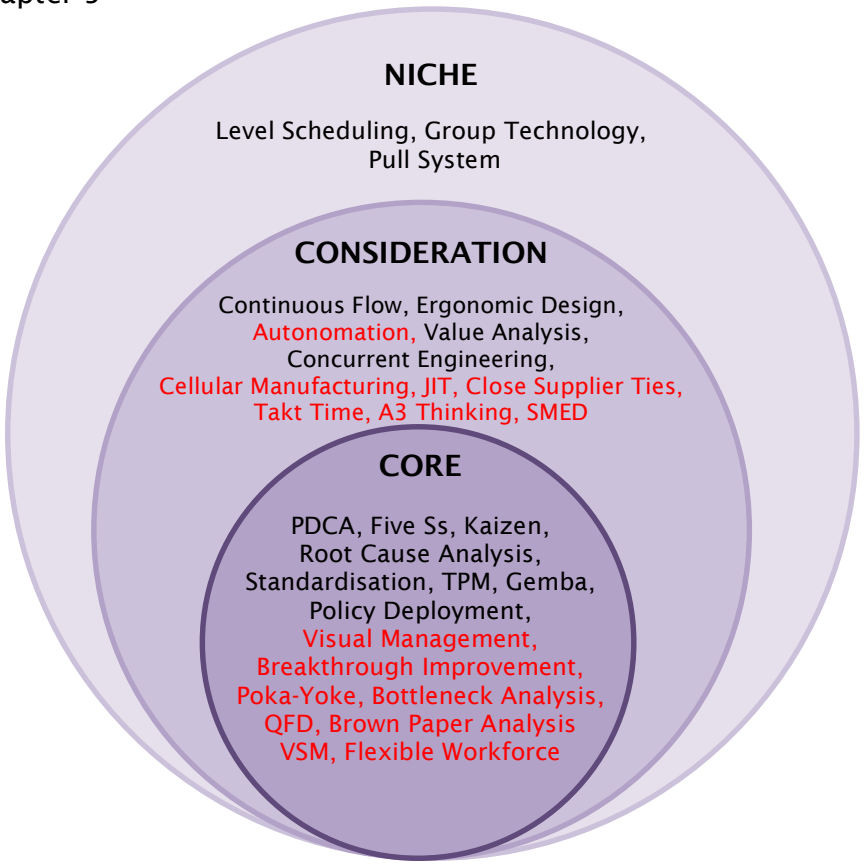


Figure 5-6: The implementation of Lean tools in the manufacturing organisation units

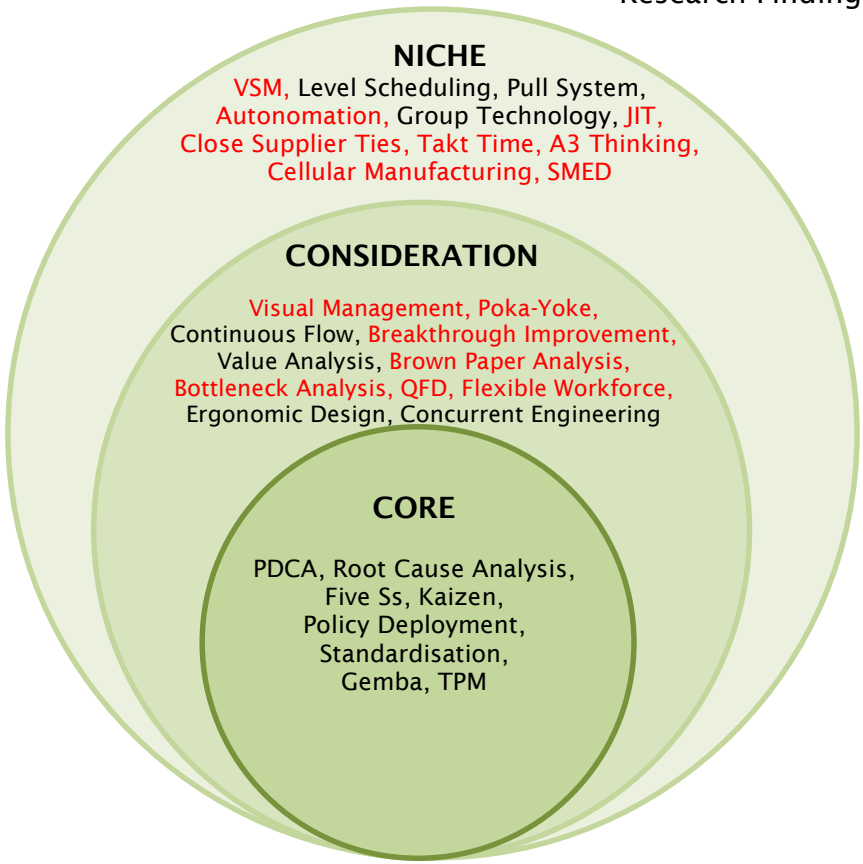


Figure 5-7: The implementation of Lean tools in the service organisation units

(Note: Where the tools appear in different parts of the diagram in the two sectors they are shown in red)

According to Bicheno (2008), few Lean tools were developed in the beginning stage of Toyota Production System (TPS). The majority of them were in the top-management level which was in line with Hoshin Kanri or Policy Deployment. Under this tool, top management plays a role in proposing an organisational direction which guides all employees to perform in an appropriate way. That is why Policy Deployment is concerned as an essential tool in the Core group. Additionally, top managers in the majority of participant organisations are required to go and see (Gemba) at the operational level in order to understand an actual situation before setting a right policy. Particularly in the service sector, Gemba can be done in the service areas or the customer places. Thus, this Core tool can be used to not only increase employee morale in operating quality improvement programmes but also customer satisfaction about the customer care policy.

In the Consideration group, both manufacturing and service sectors tended to weight the same number of Lean tools, eleven tools. Continuous Flow, Ergonomic Design, Value Analysis and Concurrent Engineering are categorised as the Consideration tools in both industries. According to Bicheno (2008), it is important to design an appropriate working environment in order to support an employee to produce the right quality of work. This might be a reason why participants in both production and service tend to have similar concerns on the Ergonomic Design. In addition, both production and service organisations have to be concerned about customer's value (Womack and Jones, 1996). A cross-functional team, which comprises of a number of specialised employees who design product or service under Concurrent Engineering to cover all customers' expectations, is likely to be required in both industries. Seven of eleven Lean tools in the Consideration group of the service sector are categorised as in the Core in the manufacturing organisation units.

In the third group, Niche, eleven tools are concerned as a specialised application in the service sector. Three Lean tools which are likely to be weighted similarly in both sectors as being in the Niche implementation are Level Scheduling, Group Technology and Pull System. It can be noticed that Pull System is one of five key principles of Lean Thinking (Womack and Jones, 1996). However, in this study it is regarded as a Niche tool which was likely to be rarely applied in the award winning organisations in Thailand. In addition, a number of participants

who are in the manufacturing sector claimed that it is difficult to level the production scheduling due to a variable demand from their customers. According to Bicheno (2008), under conditions of variable customer demand, the application of Kanban (Pull System) is waste. This might be a reason why Kanban (Pull System) and Level Scheduling are categorised in the Niche group in this study.

Furthermore, one Lean tool which tended to be weighted very differently between the manufacturing and service sectors is the Value Stream Mapping (VSM). It is categorised as Core tool in the manufacturing sector while it is regarded as a Niche application in the service. Although VSM is one of five critical principles of Lean Thinking, it was thought about by the award winning organisations in manufacturing and service businesses in a different way. The production units tended to consider the VSM as the Core tool that assisted them to understand and improve a whole process accurately. In contrast, the service organisation units are likely to consider the VSM as a specialised application which was rarely implemented in their units. This might reflect a question about the universal application of Lean Thinking or indeed a lack of understanding by some of the managers.

In general, the participants aimed to increase their organisational performance after the implementation of Lean Thinking. When making a decision on which Lean tools should be implemented, they usually consider an alignment with their organisation's objectives and strategies. They claimed that it is important to set clear organisational objectives. After that, managers, particularly the Quality Management manager, play significant roles in finding which Lean tools should be applied in order to assist the organisation units to achieve their goals. As shown in Figure 5-8, both production and service sectors were likely to be equally concerned about these two criteria, to increase the organisational performance and to align with objectives and strategies of the organisations, in making a decision on the implementation. However, the participants had a low level of concern about the links to supplier/customer programmes as important criteria influencing a decision about Lean Thinking application processes to be implemented.

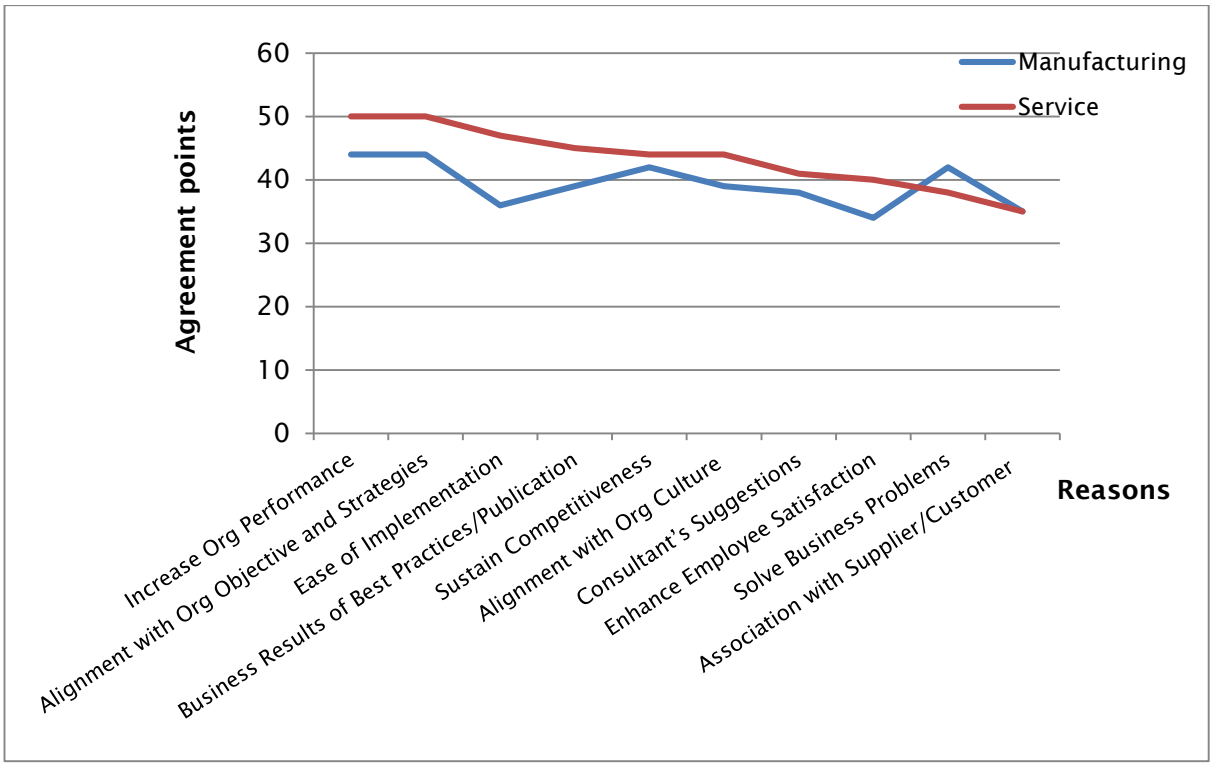


Figure 5-8: Reasons for Lean tool implementation

5.3 Key success factors in Lean Thinking implementation

In order to reach an achievement in the implementation of Lean Thinking, the participants suggested a number of critical success factors as shown in Figure 5-9. Importantly, both manufacturing and service organisation units were likely to consider leadership and management support as the most important aspect in the application followed by the employee involvement. All participants claimed that it was impossible to achieve quality improvement without a support from top management. In fact, quality development programmes require an initiative from senior management to not only propose the related policies but also provide sufficient support resources. In addition, the management is required to create trust between managers and employees under the open door policy. This finding is similar to the studies of Simons and Taylor (2007), Allway and Corbett (2002) and King and Venturini (2005) on the importance of management support.

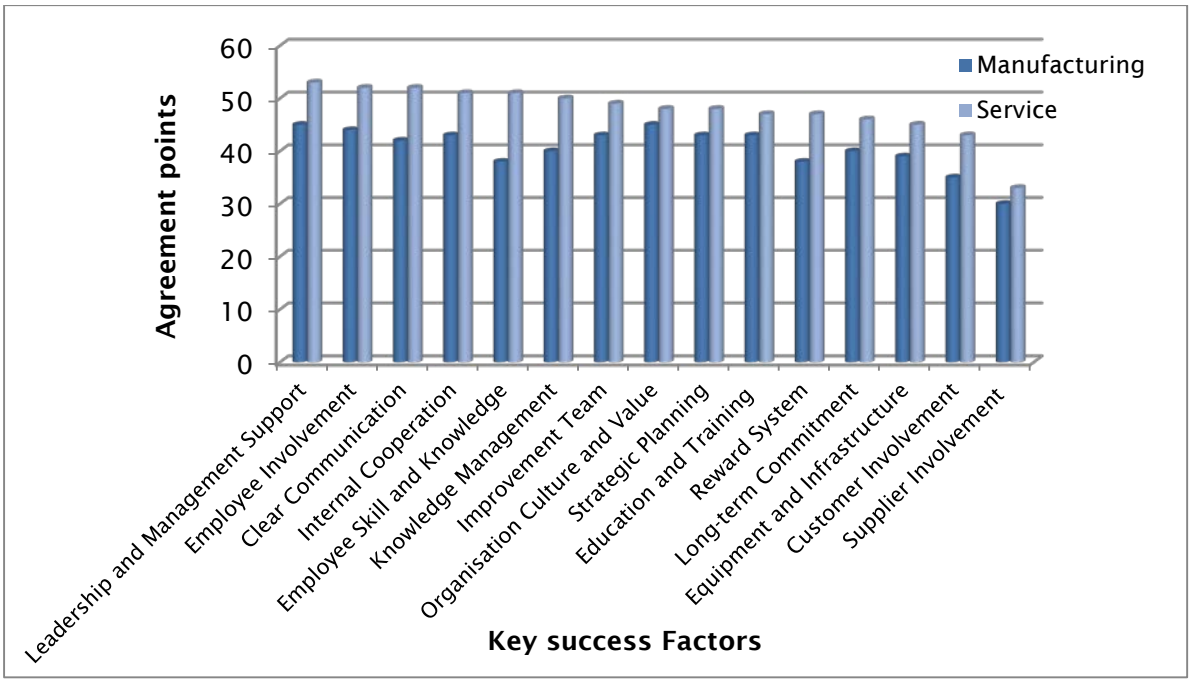


Figure 5-9: Key success factors in Lean Thinking implementation

The participants further explained in the interviews that quality development cannot be reached without a whole organisation involvement. According to Thawesaengskulthai (2010) and Crute *et al.* (2003), commitment of top management and positive attitude of employees were critical success factors in Lean Thinking application. It is therefore important to encourage employees to have positive attitude and apply quality improvement into their responsibilities. Thus, quality should be embedded in the process rather than seen as additional work. If not, an employee will offer resistance to the improvement programmes.

The manufacturing units were likely to considered organisation culture and value as the most important success factors in Lean Thinking implementation. However the service units tended to weight these aspects as being only in the middle rank.

The Toyota Company built a strong culture by investing in developing people and creating deep relationships based on trust (Liker and Hoseus, 2010). The manufacturing organisation units, therefore, were likely to create a Lean culture which embedded the lean tools in all normal processes rather than being seen as additional to the employees' responsibilities. They believed that this culture

would motivate an employee to be eager to apply Lean Thinking in the same direction successfully.

Supplier involvement was likely to be considered as the least important factor in Lean Thinking application in both sectors. It, therefore, can be argued that the implementation of Lean Thinking was based mostly within the individual organisation units rather than spanning across organisations and into their supply chains.

5.4 Barriers and solutions in Lean Thinking implementation

Despite having experiences in quality development for more than ten years, the participants were still faced with a number of barriers in the implementation of Lean Thinking as shown in Figure 5-10.

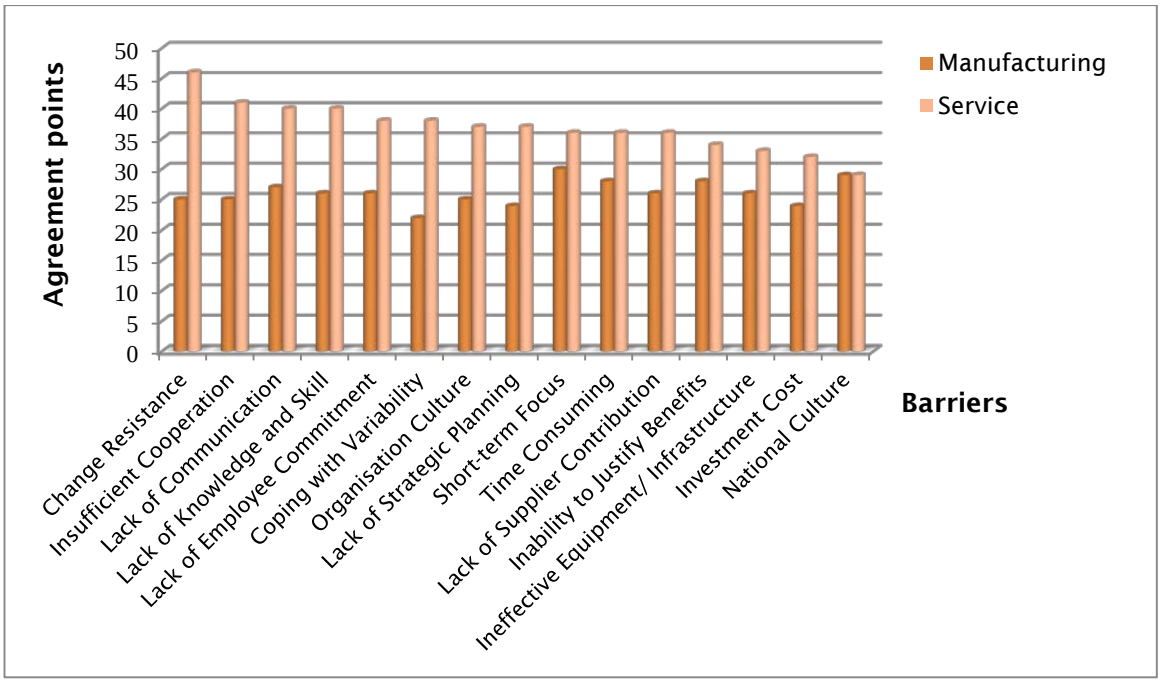


Figure 5-10: Barriers in the implementation of Lean Thinking

The service organisation units were likely to be significantly concerned about resistance to change as having the most impact. This is similar to the study of

Thawesaengskulthai (2010) and Pradabwong *et al.* (2012). This is because employees are afraid that a change might lead to the loss of their jobs. From the interviews, the participants explained that people who work in the office, particularly at a management level, resisted the change more than those who were the operational employees. Another explanation is that an employee can have a negative attitude to the quality improvement programmes. When the management announces the development policy, employees might believe that they have to be responsible for more work effort but with no new rewards or incentives. They, therefore, either do not apply the Lean tools and activities in their responsibilities or create only simple improvement projects. This can lead to a failure in the improvement programmes.

On the other hand, the manufacturing organisation units tended to weight resistance to change in the middle rank. As explained above, the manufacturing units tended to concentrate on organisation culture and value as the most important success factor. They attempted to create a culture of change management in order to prepare their people to be able to manage in flexible circumstances.

However, the manufacturing organisation units were likely to demonstrate a short-term focus which completely contrasts with the theory of Lean Thinking (Womack and Jones, 1996). This might result from a misunderstanding about the process. After the implementation, both managers and employees expected to see a significant improvement, particular in cost reduction. However, Lean Thinking is a system that emphasises the potential to deliver an increase in customers' value rather than simply the reduction of cost (Bicheno, 2008). When they could not identify cost reduction from the implementation of Lean Thinking, the managers tended to stop the application and look for new tools or techniques. This therefore resulted in inconsistency and ultimately an unsuccessful implementation.

In order to solve this problem of a short-term focus, a number of the award winning organisations were likely to propose a pilot team to thoroughly study the feasibility of the implementation of a particular tool or technique before the actual application. According to Liker and Hoseus (2010), it is important to evaluate any specific differences in environment between the specific organisation and the Toyota Company in order to adapt and restructure the

company to become more flexible in adopting Lean Thinking. The feasibility study therefore assists an organisation unit to prepare for the implementation and to understand the actual context of the application.

Manufacturing units tended to evaluate the national culture as second in importance in the ranking of all barriers while the service units were likely to weight it as the least important factor. Although Womack and Jones (1996) claimed the universality of Lean Thinking, Cooney (2002) and other Lean opponents believe that it has limitations based on business conditions, industry structures, and social and political institutions. The manufacturing units in Thailand were also concerned about the cultural issues. They therefore used the feasible study as explained above in order to understand Lean Thinking and adapt their organisation structures in readiness for the implementation.

Clear communication strategies to try and overcome barriers in the implementation of Lean Thinking were similar to the study of Kim *et al.* (2006). In parallel, education and training programmes (similar to the study of Pradabwong *et al.* (2012)) were also used to reduce existing barriers, particularly any misunderstanding by employees. It is important to inform and educate employees on the importance of the quality improvement particularly on the benefits for employees as well as those for the organisation. Importantly, a communication should be used to adjust an employee attitude that quality improvement is not additional work and to assist employees to understand how to improve their work successfully through Lean Thinking implementation.

5.5 Human resource in Lean Thinking implementation

According to Liker and Hoseus (2010), in Toyota culture human resource (HR) is considered as competitive element which could not be duplicated. However, the existing literatures show less concern about people aspects which indeed can be of significant importance to success of a Lean Thinking implementation (Bicheno, 2008). Hence, human resource development and Lean system development need to be worked on together along with a creating a high level of trust. In order to do that, an emphasis on human resource needs to be added in not only organisation policy, but also company culture.

The award winning organisations in Thailand tended to consider a number of factors that relate to human resource management (HRM). The participants claimed that it is important to begin quality improvement from top management initiatives. In addition, top managers have to provide sufficient resources in the implementation which includes time and budget. Without the management support, Lean Thinking implementation could not be achieved. Top management needs to commit, involve, support and act as a role model in being a Lean practitioner. An act of senior management on Lean Thinking application can persuade employees to recognise the importance of quality improvement. Indeed, Thai employees tend to follow what a leader has done due to their compromising culture. In other words, Thai people generally avoid any interpersonal conflict in order to keep a good relationship. Even though employees do not agree with the management to apply new quality management tools or techniques, they do not open a direct confrontation. In contrast, most Thai employees are more likely to follow the management policy in implementing new quality management approaches to improve the processes for which they are responsible.

As shown in Figure 5-11, the manufacturing and service organisation units tended to weight top management support and commitment as the most important in the ranking of human resource management factors in Lean Thinking application. Both sectors tended to weight all HRM aspects as being of similar ranks. After top management initiated and proposed a policy on quality improvement, the participants explained that they attempted to create Lean culture in their organisation units. However, the manufacturing units were likely to consider organisation culture and value as one of the most important aspects in the HRM. The service organisation units, on the other hand, tended to consider these elements as being in the middle rank as explained above.

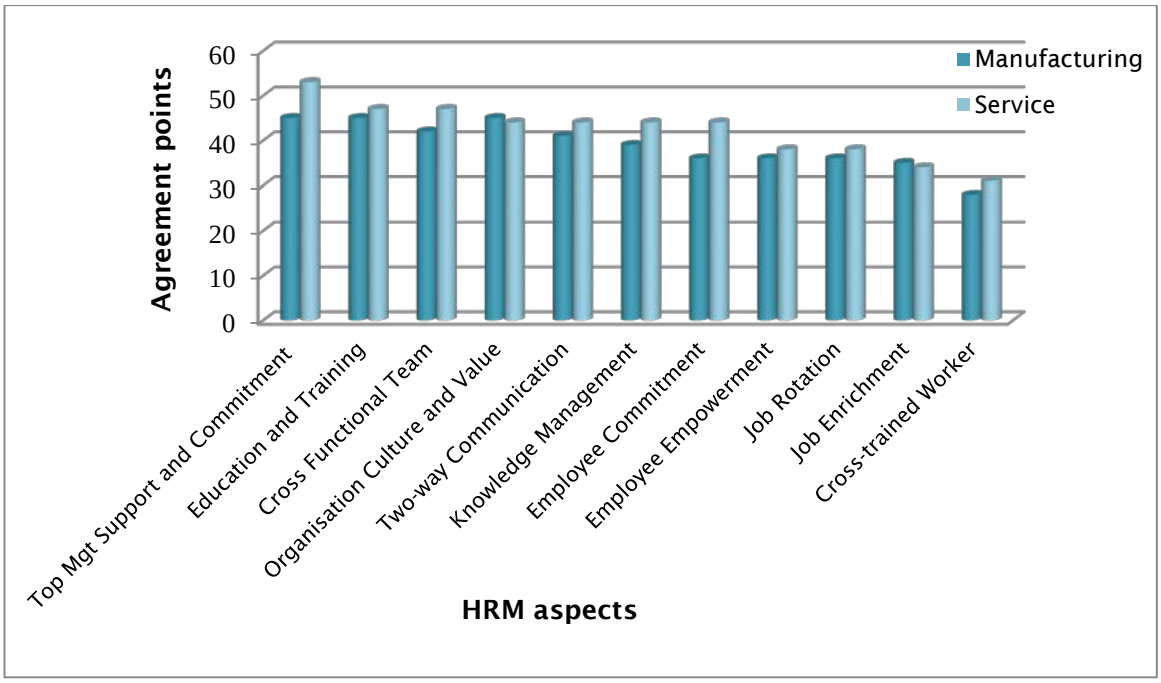


Figure 5-11: Human Resource Management (HRM) aspects in Lean Thinking implementation

According to Liker (2004), a consistent company culture should be created and shared within an organisation. In order to create organisation culture and value successfully, it is important to ensure that new tools or techniques which will be implemented in organisation units have to be aligned with and integrated into the existing system. This guides a whole organisation to operate in the same direction and that leads to an environment of consistent behaviours. Again, a leader is likely to play an important role in creating a quality culture in the award winning organisations in Thailand. However, quality culture cannot be created by only the management level. Thus, employee's attitude on quality improvement programmes is one of the significant factors in developing organisation culture on quality.

5.5.1 Motivation in Lean Thinking implementation

However, it does not mean that if a leader concentrates on quality improvement, all employees will follow the management policy. A number of participants explained that there are three types of employees. The first one is an employee who buys-in and is willing to do quality improvement while the second group participates in the programme because others have done quality improvement. The last category does not want to apply and resists any implementations which then create a barrier in Lean Thinking application, as discussed above. Different motivation factors, therefore, are applied for different groups of employees. In fact, the aspects that are used to encourage an employee can be categorised into two groups that are positive and negative forces. However, the participants strongly emphasised that a positive factor is more powerful than the other. The only two negative force factors that are used in the participating units are KPI evaluation as well as discipline and regulation as shown in Figure 5-12.

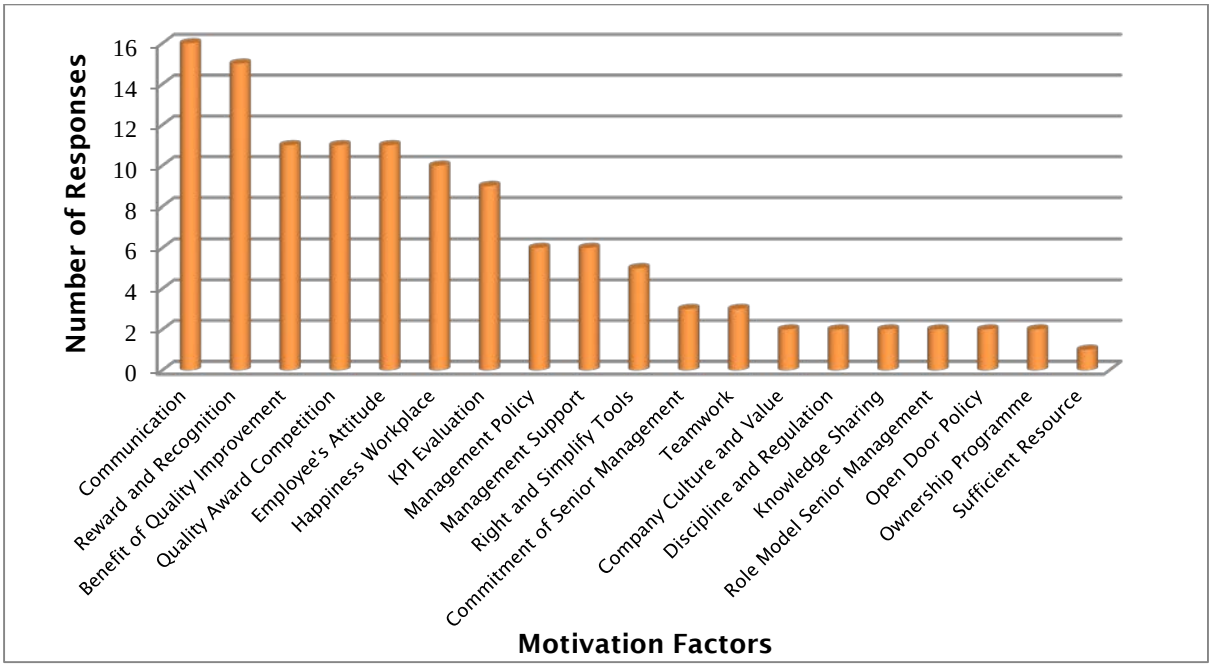


Figure 5-12: Motivation factors that were used in encouraging employees to apply Lean Thinking

In order to encourage employees to apply Lean Thinking positively, it is important to communicate to an employee the success story of best practice organisations and the achievement of the improvement programmes in other

organisations. Particularly, the benefits of how Lean Thinking assists employees to perform their work effectively and safely rather than any advantages to the management or the organisation should be the main focus. A clear communication indeed can be used to not only solve a problem on change resistance from a negative attitude but also motivate employees to achieve better performance. According to Bicheno (2008), a miscommunication causes a number of wastes. Therefore, an effective communication process is needed in Lean Thinking implementation.

As shown in Figure 5-12, reward and recognition are recognised as another significant motivation factor. Money, praising, certification, bonus, salary and/or promotion are likely to be used as rewards for an employee who has good performance in the award winning organisations in Thailand. It is important to provide a reward that is based on employees' needs. If an organisation gives unwanted reward, an employee will not be challenged to do quality improvement programme. However, a small number of participants recommended that money should be used in the beginning stage. After that, an organisation should provide other rewards instead of money. This is because money might destroy employees' willingness in quality improvement. If an organisation has too much emphasis on the money incentive, employees would only be interested in how to receive more money rather than how to improve an organisation as a whole. This results from an ignorance of the systemic impact which is at the heart of Lean Thinking (Bicheno, 2008) that finally leads to a failure in the quality improvement.

5.5.2 Education and training in Lean Thinking implementation

In order to inform an employee of the importance of system awareness, the majority of participants provide a number of education and training programmes for their human resources at both management and operational levels. Key motive in an education programme is to develop employee skill and knowledge. In addition, training programmes assist employees to understand what Lean Thinking is and why it is important to their organisation (Crute *et al*., 2003). The majority of participants claimed that they considered their people as the valued asset similar to the Toyota concept. The participants explained that they could

not reach organisational excellence without high quality of people. In order to create quality human resources, both public and in-house trainings were used.

In the beginning stage, the participants supported their employees to participate in the public training that was organised by an external institution. After that, they encouraged their employees to share new knowledge with other colleagues. This aimed to not only create a sharing environment in the organisation units but also support employees to practice as an internal expert. In parallel, in-house training was also organised by either external or internal expert. However, an external expert was used when the organisation units planned to apply new and/or difficult improvement approaches.

Furthermore, the majority of the participants created company databases in which were collected articles, reports and other documents from education and training programmes. This database allowed all employees to access and learn from the catalogues in order to not only improve employees' skill and knowledge but also prevent repeating of problems that used to happen in the organisation units. According to Bicheno (2008), repeating problems is one kind of waste. Repeatedly solving the same issue does not add any value to customers. Therefore, the database assists employees' to learn from other's experiences which might reduce non-value-added activities and create a learning organisation.

However, only one seventh of participants supported their people to do self-learning and learn from their daily responsibility. They claim that learning can be done not only in a classroom but also at a workstation. However, the most important thing is that an employee has to apply new knowledge to improve the performance of their responsibilities. If not, education and training programmes are useless. Therefore, the participants have proposed having an internal quality competition at least once a year to encourage their employees to apply new knowledge to create new improvement projects.

Additionally, a number of participants supported their employees to learn from other best practice organisations by visiting other companies and participating in the quality award competition at the national level. According to Stuart *et al.* (2002), learning from a well-known organisation which has a good performance, is worthwhile. In parallel, they encouraged their people to share knowledge to other companies. They claimed that this will result in not only the awareness on

the importance of quality improvement but also the increased capability of internal trainers. The key considerations in the management of education and training were based on career path and competency analysis in order to increase employees' skill and knowledge. This finally leads to an improvement in employee and organisational performances.

Furthermore, the participants claimed that one of the significant aspects that led to an achievement in Lean Thinking application was working in a cross-functional team. In the 14 principles of the Toyota way, cross-functional team is one of the effective methods in developing quality and productivity (Liker, 2004). However, working in teams is not easy. The participants therefore provided the training on how to work in a team. After that, both production and service organisation units supported employees to build a team in which a member comes from different departments. This resulted in not only sharing skill and knowledge among employees but also breaking a 'silo' view in the organisation units. Indeed, Toyota Production System (TPS) which originated Lean Thinking concentrates on a total systems view (Liker, 2004). It is therefore important to consider an organisation as a whole rather than focus on any one specific department. Working in cross-functional teams might assist employees to understand other departmental standpoints and integrate ideas to develop all parts of the organisational units.

5.5.3 Communication in Lean Thinking implementation

In order to manage human resource well through Lean Thinking, the participants also considered two-way communication as one of the most effective approaches. As explained above, communication plays an important role in not only encouraging employees in Lean Thinking application but also creating organisational culture and values. The award winning organisations in both manufacturing and service sectors tended to provide related information to employees as well as they received feedback from their people. An employee is indeed recognised as an internal customer who plays an important role in quality improvement in the award winning organisations similar to the suggestion of Brown (1994). A meeting and chain of command were generally used as the formal channels in their units. Top management in a number of organisation

units go and see (Gemba) as well as communicate directly to the operational employees regularly in order to motivate workforces and receive feedback from them as the two-way communication. On the other hand, letter, hotline, e-mail and employee survey were used to allow employees to deliver their feedback, opinion, suggestion or complaint to the management.

The participants were concerned to communicate not only to employees as the internal stakeholders but also customers, communities and suppliers as the external stakeholders. Customers' value is the highest goal that an organisation needs to identify (Womack and Jones, 1996) in order to run its business successfully. A communication to and from potential customers is one of the effective methods to understand value from the customer perspective. Customer survey, call centre and sales person were used as key communication channels. The majority of participants had done a customer survey once a year in order to find out customer requirements, satisfaction, reliability performance, quality of product/service and market demand. The results of the survey were used in benchmarking with competitors or comparing with industrial averages. Benchmarking with competitors' product is used to ensure that quality programmes are in the right approach to serve customers' expectation (Brown, 1997). However, Bicheno (2008) suggested that zero waste was the benchmarking indicator rather than the performance of business competitors. This might reflect that these award winning organisations tend to be Lean beginners instead of mature operators.

Due to the importance of customers' voices, the participants proposed that customer service departments process feedback from customers. In a serious case, the customer service has to process the information within 24 hours while the general information has to be done within three days. Waiting for service is considered as one of the wastes from a customers' perspective (Bicheno, 2008). Quick response therefore is vital to support the provision of value to customers. Indeed, it is important to identify any hidden requirement in parallel with direct customer satisfaction from the voices of customers. Thus, this information can be used to launch new product/service as the order winner which leads an organisation to success in the competitive business environment.

The participants further explained that they communicated to suppliers as well. However, only a very small number of them allowed their suppliers to visit their

plants, organised a meeting with the suppliers and/or evaluated and provided feedback to their suppliers once a year. These participants claimed that they aimed to receive the update information from their suppliers in order to solve a problem and improve the organisational performance in parallel with creating a good relationship with the suppliers to achieve win-win situations. Thus, it is obvious that only a few numbers of participants were significantly concerned about the role of suppliers. It might be possible that the award winning organisations in Thailand had a low concern about the importance of the supplier relationship.

Another external stakeholder that received a communication from the award winning organisations is the community. This is because they believed that people in a community might be their customers in the future. A number of participants allowed the community to visit their plants to provide an understanding and a trusting environment between organisation units and the societies in which they were located. A survey was also used to receive feedback from the community which might be used to improve performance particularly in environmental development. In addition, a Corporate Social Responsibility (CSR) project was likely to be done at least once a year in the majority of the award winning organisations in order to improve the community welfare and quality of people who might be contributing to the quality of product/service in the future.

5.6 Expectation from Lean Thinking implementation

Before the award winning organisations decided to apply a number of Lean tools, the production units were likely to aim to improve their quality of product/service while the service units tended to plan to do continuous improvement as their highest goals. As shown in Figure 5-13, the manufacturing tended to weight having a learning organisation as the least important goal. According to Liker and Hoseus (2010), learning organisation is one of the achievement criteria after the implementation of Lean Thinking. This might reflect a difference between the existing literatures and the practices in Thailand. On the other hand, the service organisation units were unlikely to consider a learning organisation as the least important goal. They had a low concern about

customer/supplier relationship as well as flexibility. Similar to the study of Pradabwong *et al.* (2012), organisations in Thailand tended to have very low concern about supplier relationship due to a lack of trust between the organisations and their suppliers.

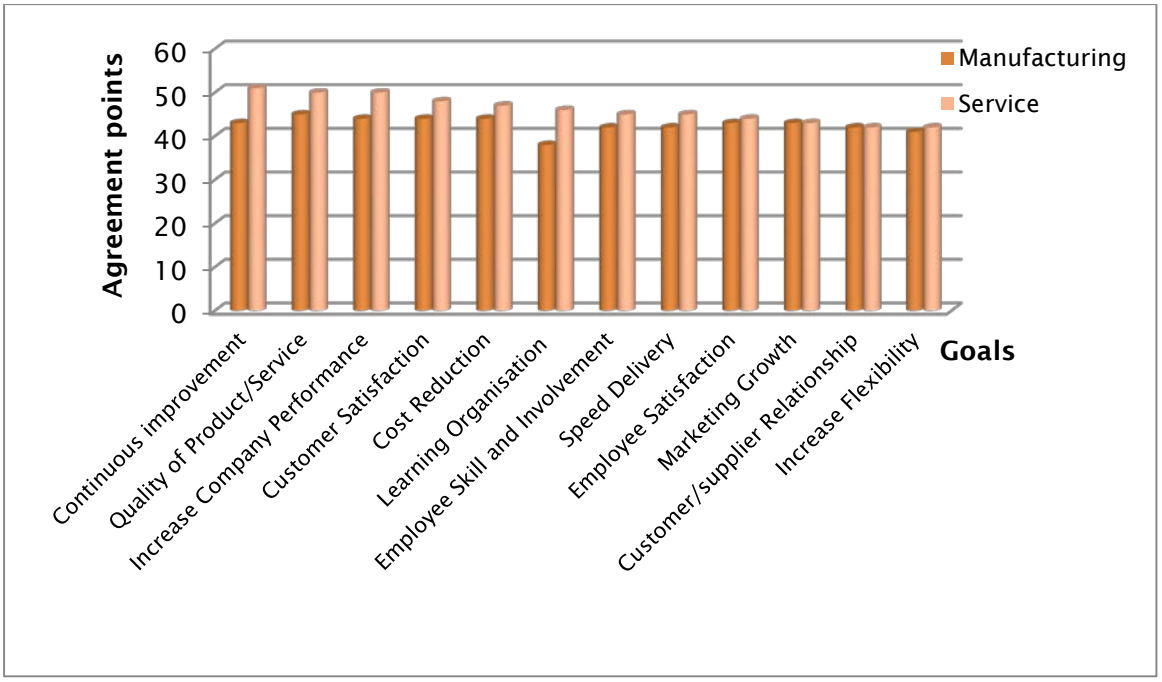


Figure 5-13: Goals in Lean Thinking implementation

5.7 Improvement from Lean Thinking implementation

After Lean Thinking implementation, the majority of the participants claimed a number of significant improvements. The researcher, therefore, categorised them into four perspectives which are on the balanced scorecard of Kaplan and Norton (1996). This is because the existing literatures on Lean Thinking implementation are generally focused on only one or two indicators which are mostly internal processes and/or customer satisfaction. By using the balanced scorecard, the improvement on four dimensions which are financial, customer, internal business processes and learning-and-growth are investigated. This provides a comprehensive view of the improvement from Lean Thinking implementation.

Firstly, from a financial perspective, both production and service organisation units were likely to experience an increase of revenue and a reduction in

inventory holding cost, activity cost and service cost. Although in the conventional view an inventory cannot be held in the service industry (Chopra and Lariviere, 2005), it is indeed relevant to a number of service businesses (Bicheno, 2008). According to Bicheno (2008), in the service sectors there are not only physical inventory but also information. Both of these inventories are needed to be kept sufficiently in order to meet variability of customer demand. However, excessive inventory is considered as one of the wastes which cause storage costs and delay (Liker, 2004). In this study, the participants in both manufacturing and service organisation units had to control the level of their physical and information inventory in order to meet their customers' requirement. The service organisation units also kept an adequate inventory level which was used to support their service processes.

Additionally, the researcher further investigated other financial performance from the annual reports of the participants. Of the total 22 participants, three of them are government institutes which do not provide the financial statements. In addition, four units are in the same companies. In this case, the annual reports of the headquarter organisation were used in the calculation. Therefore, financial statements of sixteen organisations are used in the analysis.

However, there are only a few literatures on Lean Thinking implementation that analysed the companies' financial performance. This study therefore, adapted the approaches of financial analysis from the literatures on TQM implementation which focused on a comparison of the financial performance before and after the award achievement over a six-to-ten-year period (Wisner and Eakins, 1994; Hendricks and Singhal, 1997; Ramasesh, 1998; Iaquinto, 1999; Hendricks and Singhal, 2001; Hansson and Eriksson, 2002; Jacob *et al.*, 2004; Boulter *et al.*, 2013; Zhang and Xia, 2013).

Although the participants applied Lean Thinking in different periods of time, the researcher assumed that Lean Thinking was implemented as part of various approaches that assisted the participants to achieve Thailand Quality Award as suggested by NIST (2013b). Therefore, we proposed an assumption that Lean Thinking was implemented in the year of receiving the first award.

As shown in Figure 5-14, this study investigated the financial performance of sixteen organisations in a five-year period. Although one might suggest that a

financial analysis over only a five-year period might not reflect the real performance of the organisations, this study was limited by the available information. This study selected the award winning organisations during 2002-2012 as the population target of the research. The oldest financial reports which were provided by the Department of Business Development, the Ministry of Commerce, in Thailand were in 2000. Therefore, we could analyse the financial performance of the participants that achieved TQA in 2002 for two years before receiving the award. In addition, the latest TQA organisation units achieved their first award in 2011. Therefore, the researcher could analyse the financial performance of the participants that achieved TQA in 2011 for two years after receiving the award. Thus, five-year period of financial analysis is the most appropriate in this study.

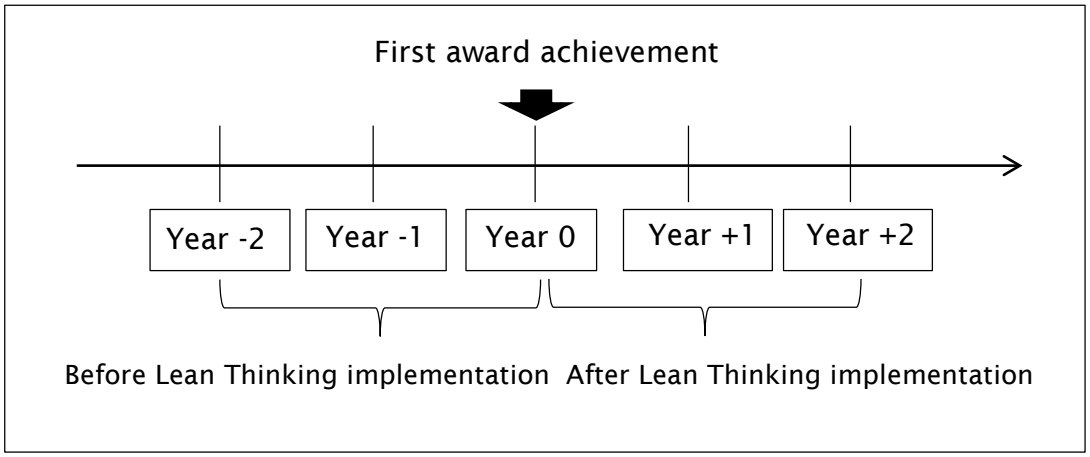


Figure 5-14: Time period in financial analysis

As shown in Figure 5-15, it can be noticed that the most significant improvement is inventory turnover (which is calculated from cost of goods sold divided by value of inventory). The participants experienced that after Lean Thinking implementation they could increase the inventory turnover to approximately 45 times a year. According to Schonberger (2009), inventory turnover can be used to identify the existence of Lean Thinking due to its evident measurement. Thus with more inventory turnover, the participants achieved leaner performance through the effectiveness of inventory management from the Lean Thinking implementation.

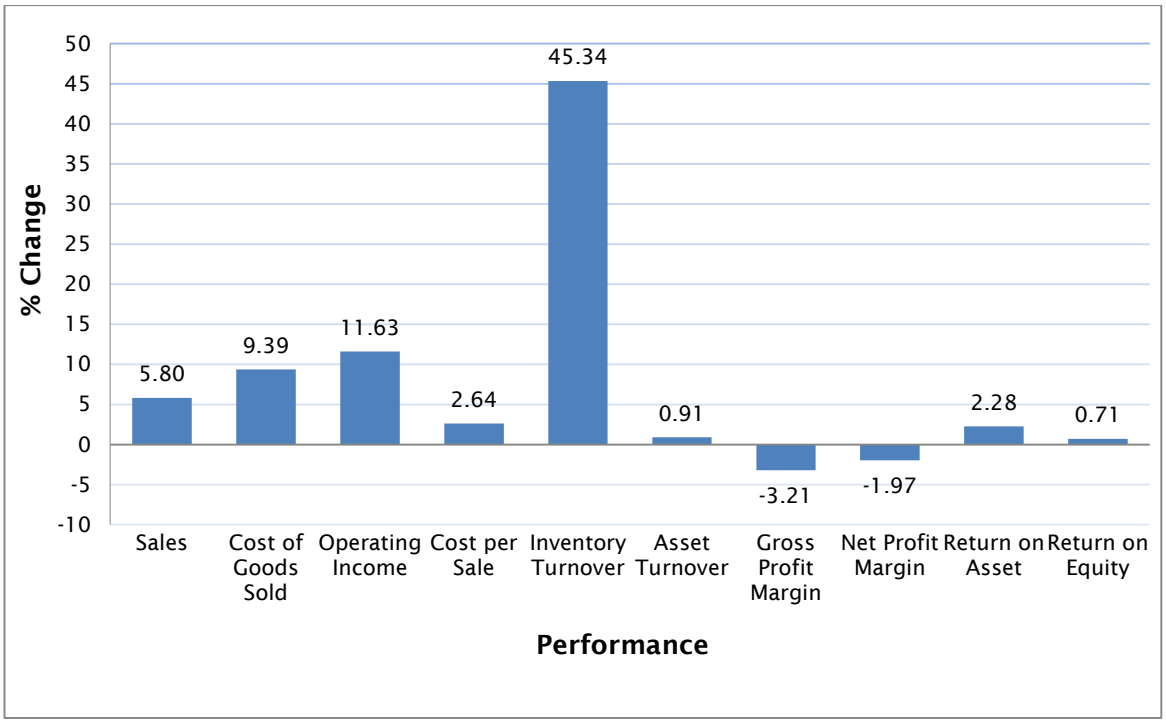


Figure 5-15: Financial performance of the participants in five-year period

The second improvement is the operating income (sales minus cost of goods sold) which measures the profitability before other expenses. The participants have better operating income after Lean Thinking implementation at 11.63%. This refers that revenues of the award winning organisations tended to cover cost of production. When considering how the participants managed their costs, it is noticeable that cost of goods sold was increased at 9.39% after Lean Thinking implementation. However, cost of goods sold does not entirely reflect an outcome from Lean Thinking implementation. It is indeed affected by a number of factors which might be influenced by an external environment that is recognised as an uncontrollable aspect. According to Bicheno (2008), Lean Thinking is a system that emphasises the potential to deliver an increase in customers' value rather than simply the reduction of cost. The researcher therefore further investigated other financial outcomes of the award winning organisations.

The participants have less profits which are evident in both gross profit margin (gross profit divide by sales) and net profit margin (net profit divide by sales) after they applied Lean Thinking implementation. Profit margin indeed measures

the percent of profit that could be generated from each dollar of sales during a given period of time (Elliott and Elliott, 2011). Gross profit margin is a measurement of profitability after cost of goods sold while net profit margin is that after all costs and expenses. It can be noticed that the award winning organisations are likely to have less profits in both measurement indicators. This is related to the above finding on the increase of cost of goods sold which have an impact on the decrease of gross profit margin.

In addition, net profit margin which considers all costs and expenses in a calculation has been declined after the implementation. This is evidence that although the participants had higher sales after the implementation, they experienced not only the increase of cost of goods sold but also the decrease of profit margins. However, financial performances on sales, costs and expenses as well as profits are not only affected by the implementation of Lean Thinking. It is possible that these financial performances were affected by other factors which might have included an uncontrollable external environment. In this study, we found both positive and negative financial performances from the financial analysis.

It can be noticed that there are mixed results in financial performance similar to the study of Wisner and Eakins (1994) on financial performance of TQM organisations. Indeed, financial outcome might be impacted by a number of factors which include uncontrollable external environments. It was therefore difficult to distinguish which parts of the financial improvement came from quality management implementation (Bergquist *et al.*, 2005). However, improvements in the financial criteria can be used to inform the management to recognise the importance of quality improvement (Jaaron and Backhouse, 2011). Hence, an evaluation on only financial performance is not sufficient to identify a whole picture of the improvement from Lean Thinking implementation. The researcher therefore decided to apply the balanced scorecard to measure the performance of participants after the implementation of Lean Thinking.

In the second perspective of the balanced scorecard, customers play important roles in defining values. Customers' value is the first priority that an organisation needs to be concerned with in order to provide right products in the right time (Womack and Jones, 1996). As shown in Figure 5-16, the participants in both manufacturing and service sectors experienced improvements in better

customer relationship, satisfaction and complaint. The participants believed that the better performance from a customer's perspective was a result from an attempt of the award winning organisations in improving a communication between them and their customers as explained above. With a better communication, customers were informed about important information that related to product/service. This created a trust and better relationship between the participants and customers. In addition, Lean Thinking implementation resulted in better customer experiences due to better quality of product/service and on-time delivery (which resulted from better operation that will be discussed later). Customers therefore have higher satisfaction with fewer complaints.

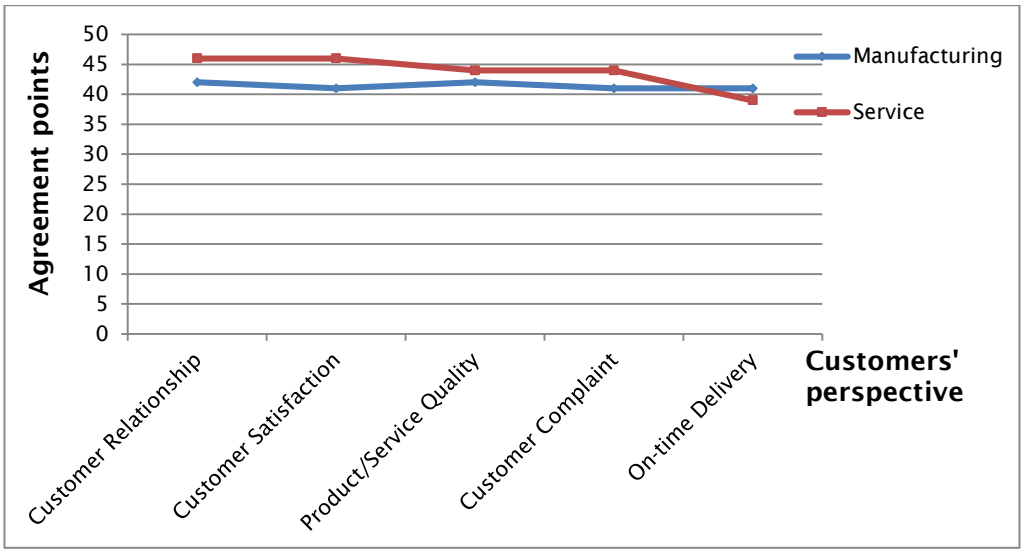


Figure 5-16: Improvement in customers' perspective

In the third perspective of balanced scorecard, the participants experienced a number of improvements in their internal processes as shown in Figure 5-17. Both production and service organisation units found that they tend to significantly increase their productivity as the highest rank from Lean Thinking implementation. In parallel, the participants claimed that they could improve the safety of their working environment after the application. This was evident in the reduction of accident rates which resulted from the appropriate application of Lean tools as well as the education and training for employees. The participants explained that a well-designed Lean Thinking application led not only to increased effectiveness of the system but also better protection from injury for their employees. It can be noticed that the service organisation units weighted

most factors in the internal processes higher than the production except the last four factors. This might be because the unique characters of the service sector on these four aspects.

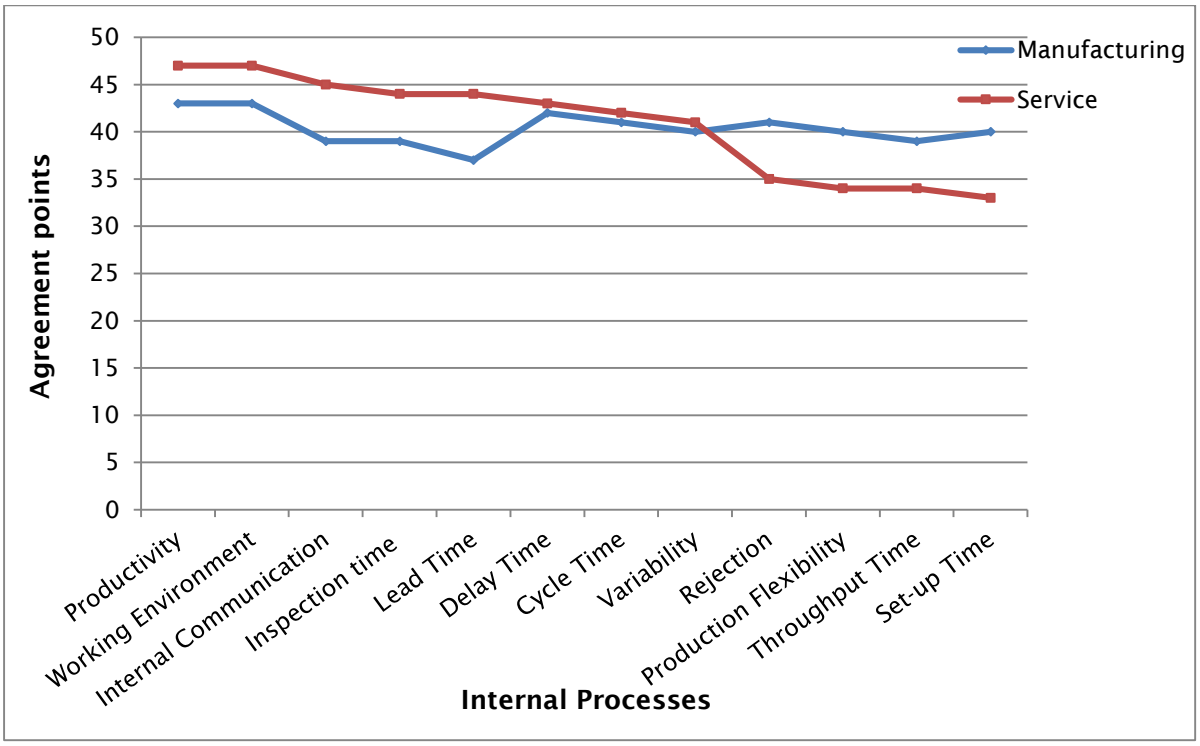


Figure 5-17: Improvement in the internal processes

The participants further explained that they also found the reduction on seven wastes or non-value-added (NVA) activities after the implementation of Lean Thinking, as shown in Figure 5-18. As the highest rank, the service organisation units found that Lean Thinking implementation was possible led to the decrease of inappropriate processing while the production units were likely to weight the reduction of defects/reworks. Additionally, organisation units in both sectors tended to report that unnecessary movement was less well developed improvements compared to those for other wastes. This might be because both sectors implemented ergonomic design (in the Consideration group) only sometimes therefore unnecessary movement still existed in their units when compared to other wastes.

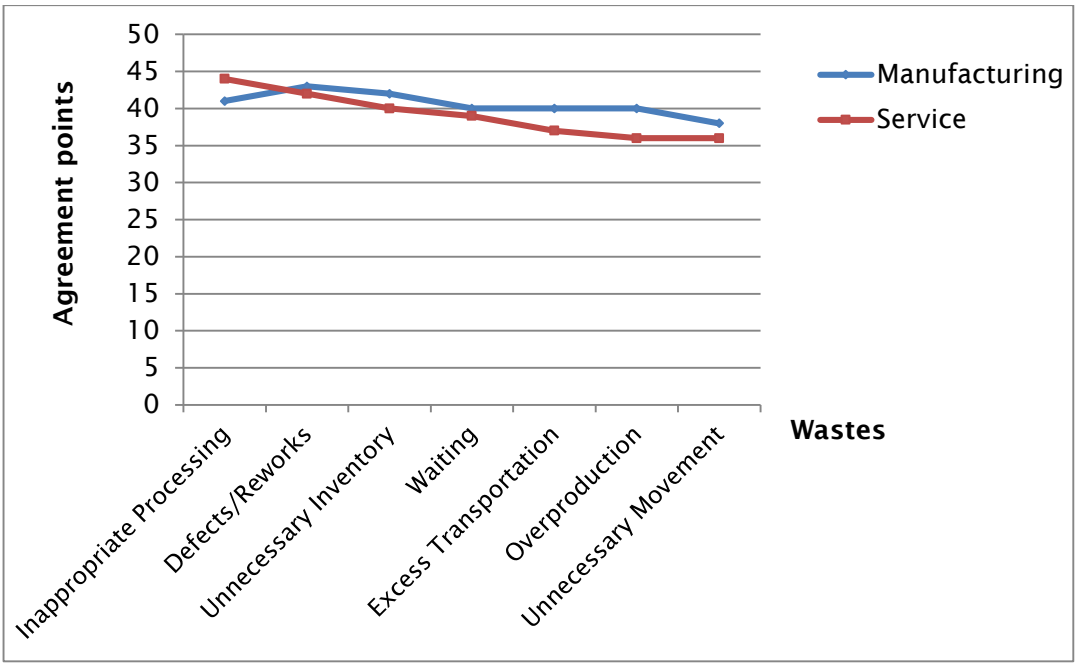


Figure 5-18: Seven wastes after Lean Thinking implementation

In the last perspective of balanced scorecard, learning and growth is one of the highest goals of Lean Thinking implementation (Liker and Hoseus, 2010). The service organisation units believed that the highest improvement was in the employee skill and contribution as shown in Figure 5-19. The participants explained that they considered their employees as the most precious asset that led their organisation units to not only survive in the business but also achieve longer term sustainability. Under Lean Thinking, they therefore invested in education and training as explained above in order to create a learning culture that would finally result in a higher quality of people who would play a vital role in improving organisational performance.

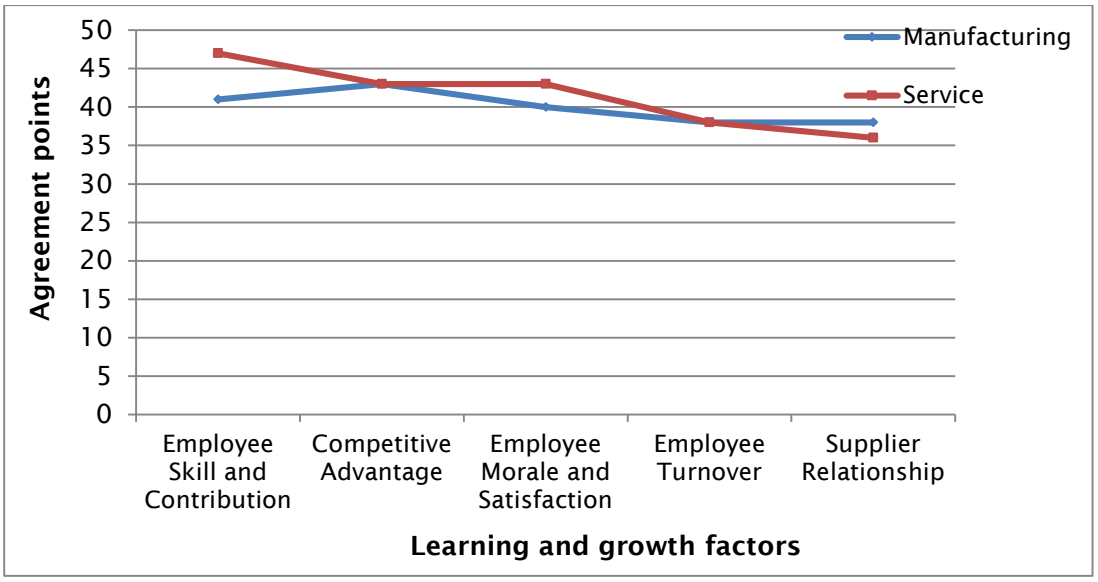


Figure 5-19: Improvement in Learning and Growth

Both production and service were likely to weight competitive advantage at the same scores after the implementation of Lean Thinking. When implementing the quality improvement programmes, the award winning organisations tended to evaluate the impact on their systems. They explained that wherever Lean Thinking was implemented in their organisation, units should be able to improve their performance as a whole rather than only that one specific area. If an application of one technique has at the same time positive and negative impacts on different processes, the participants decided to not implement that technique due to a worry about the overall system.

The participants further explained that awareness of systems thinking and the importance of human resource assisted them to improve not only their internal processes but also all related aspects which included employees and suppliers. It was found that after Lean thinking implementation employee turnover was decreased in both manufacturing and service organisation units. This is because employees work in safer workplaces within a trust environment among colleagues which resulted in better physical and psychological aspects.

In addition, the participants claimed that the application of Lean Thinking led to the development of supplier relationship. This is because the suppliers play important roles in providing quality material which finally transformed into product and/or service. A number of participants shared quality improvement

programmes with their suppliers. This led to win-win situation that both award winning organisations and suppliers could join knowledge and skills to develop a whole supply chain. However, when compared to other aspects the participants had little focus on supplier relationship as explained above. Thus, it would be better if organisations in Thailand were more concerned about supplier development. This might lead to an improvement of the whole system of Thai economics.

Although different businesses found a different level of improvement on these four perspectives of the balanced scorecard, we found that the evaluation from the four perspectives of the balanced scorecard were complementary to each other. Hence, Lean Thinking was likely to assist the award winning organisations to develop their internal processes which led to better experiences of customers. When customers were satisfied with the product/service, they tended to continue to buy product/service from the organisation. Revenue and profit then were increased from the continuous purchase while costs were relatively reduced through having better internal processes. An organisation therefore had sufficient budget to develop their employees and processes. Thus, a cycle of improvement is going on.

5.8 Chapter Conclusion

The award winning organisations in Thailand were likely to begin their quality management journey by the implementation of the ISO certification in order to create a working standard. After that, they decided to apply total quality management (TQM) to improve quality of their organisational performance. The application to Thailand Quality Award (TQA) was used to benchmark their TQM capability against the international criteria and receive feedback from the assessment process to do inform their continuous improvement programmes. Lean Thinking was implemented to further develop their organisational performance. However, the participants in manufacturing and service sectors implemented Lean tools differently due to their unique circumstances. The researcher therefore categorised them into three groups which are Core, Consideration and Niche based on the frequency of their use in the different implementations. This reflects both similarity to and difference from the existing

literature on Lean Thinking. It might be said that the Thai BE organisations tended to have a unique pattern in selecting an application of Lean tools. In other words, not all Lean tools were likely to be implemented differently in the particular businesses. Thus, a claim of Womack *et al.* (1990) on the universal application of Lean Thinking might be questioned.

It was also found that the Thai BE organisations considered both internal and external factors in making a decision on a selection of Lean tool application. However, key decision criteria are mainly focused on an increase of the organisational performance and an alignment with their organisation's objectives and strategies. It might therefore be said that these two aspects are key justifications for the choices made in the implementation of Lean Thinking.

Under Lean Thinking implementation, the award winning organisations in Thailand were likely to concern about their human resources as precious assets. Importantly, a leader plays a significant role in initiating and supporting quality improvement programmes in their organisation units. Due to being precious assets, human resources were supported to improve their capabilities through education and training. In addition, appropriate motivation and clear communication were important to encourage employees to apply Lean Thinking into their responsibilities. Without an involvement of a whole organisation, Lean Thinking could not be achieved. In addition, a number of BE organisations in Thailand were likely to place emphasis on the other internal and external factors, i.e. involvement of customer and suppliers in quality improvement programmes. Thus, the Thai BE organisations were likely to not only manage human resource thoroughly but also balance other significant aspects that might affect an implementation of Lean Thinking.

After the implementation, the participants had experience on a number of improvements. This study applied four perspectives of the balanced scorecard as the evaluation criteria. In the financial perspective, there are mixed results in which it is difficult to distinguish which parts of the performance come from Lean Thinking implementation. (This is consistent with the studies of Wisner and Eakins (1994) who also report mixed financial result in their studies.) Therefore, the three remaining dimensions are used to support the financial analysis. We found that there are improvements on the dimensions of customer, internal

processes as well as learning and growth perspectives in both manufacturing and service organisation units.

Chapter 6: Developing a Model of Lean Thinking

This chapter develops a conceptual academic model to explain how Lean Thinking has been implemented alongside Total Quality Management (TQM). The model of this study identifies critical Lean elements that support an achievement in quality improvement which associated with the fourth research question and objective. The model of this study was indeed developed from findings which were generated from the triangulation of data collection and analysis explained in the previous chapter. The developed model provides not only Lean elements and sequences in the application but also the decision criteria and supporting factors for the implementation of Lean Thinking.

6.1 Significant elements of Lean Thinking

The empirical findings in the previous chapter have identified three important elements in the implementation of Lean Thinking. In order to achieve an improvement in organisational performance, not only should Lean tools be considered but also decision criteria and other supporting factors. These findings are related to the literature suggestions. Lean Thinking is a system (Bicheno, 2008) that focuses on both tool implementation and the soft side of management (Schonberger, 2007; Liker and Hoseus, 2010). Tools and technology should be installed in supporting people to continuously improve their work (Liker and Morgan, 2006). However, it is also important to propose decision criteria which are used to consider the organisational situations and expectations (Bendell, 2005; Thawesaengskulthai and Tannock, 2008). In addition, several critical factors impact on the success of Lean Thinking implementation (Allway and Corbett, 2002; Cuatrecasas, 2002; King and Venturini, 2005; Simons and Taylor, 2007; De Souza, 2009; Piercy and Rich, 2009; Thawesaengskulthai, 2010).

Therefore, Lean tools, decision criteria and supporting factors are considered to be significant elements that lead to an achievement in quality development through Lean Thinking implementation.

6.1.1 Lean Tools

According to Bicheno (2008), Lean thinking is not a set of Lean tools, it is a system that requires the implementation of the appropriate tools in order to create competitiveness. From the literature review, a number of organisations have been interested in Lean thinking application. However, they found difficulties in how to select a proper tool and reject an inappropriate one. Therefore, while Lean tools do not form the whole of Lean Thinking, they are recognised as an essential part which assists Lean implementers to reach their goals in improving organisational performance.

In the previous chapter, it was found that a number of participants who claimed that they had not applied Lean Thinking in their organisation units had implemented several Lean tools. These participants explained that they have used different names instead of Lean Thinking. Hence, it might be assumed that Lean tools have been used under different quality management approaches. The award winning organisations in Thailand have indeed implemented different Lean tools at different levels. Thirty Lean tools were therefore categorised into three groups which are defined in this study as Core, Consideration and Niche, based on the frequency of their implementation.

Lean tools in the Core group are likely to be used by most organisations. The Consideration group includes some tools for specific and important uses, and ought to be considered; however, in the study they were used less often than those in the Core group. The Niche group tools are very context specific in their application and were used by few organisation units in the study.

Furthermore, it was also found that the participants who operated in different industries tend to weight Lean tools differently. As shown in Table 6-1, it can be seen that the number of Core tools in the manufacturing sector are twice those in the service sector. In the Core category the first eight Lean tools in the manufacturing sector are the same as all the Lean tools in the service sector although these Lean tools are sequenced differently. Therefore, it might be said that these eight Lean tools are likely to be essential to an organisation in whatever business sector and they should be applied in an early stage in order to achieve Lean Thinking implementation.

Table 6-1: A comparison of Lean tools between the manufacturing and the service sectors

Category of Lean tools	Manufacturing sector	Service Sector
CORE: Usually implemented in most organisations.	PDCA, Five Ss, Kaizen, Root Cause Analysis, Standardisation, TPM, Gemba, Policy Deployment, Visual Management, Breakthrough Improvement, Poka-Yoke, Bottleneck Analysis, QFD, Brown Paper Analysis, VSM, Flexible Workforce	PDCA, Root Cause Analysis, Five Ss, Kaizen, Policy Deployment, Standardisation, Gemba, TPM
CONSIDERATION: Important usage to be considered.	Continuous Flow, Ergonomic Design, Autonomation, Value Analysis, Concurrent Engineering, Cellular Manufacturing, JIT, Close Supplier Ties, Takt Time, A3 Thinking, SMED	Visual Management, Poka-Yoke, Continuous Flow, Breakthrough Improvement, Value Analysis, Brown Paper Analysis, Bottleneck Analysis, QFD, Flexible Workforce, Ergonomic Design, Concurrent Engineering
NICHE: Particular use in particular circumstance.	Level Scheduling, Group Technology, Pull System	VSM, Level Scheduling, Pull System, Autonomation, Group Technology, JIT, Close Supplier Ties, Takt Time, A3 Thinking, Cellular Manufacturing, SMED
Note: Where the tools appear in different parts of the table in the two sectors they are shown in red.		

In the Consideration group, both manufacturing and service sectors were likely to weight the same number of Lean tools, i.e. 11. Both industries considered Continuous Flow, Ergonomic Design, Value Analysis and Concurrent Engineering as the Consideration tools. Seven of the 11 Lean tools in the Consideration group of the service sector are categorised as Core in the manufacturing organisation units. Hence, it can be said that although the Consideration tools are important, they were likely to be implemented more or less often in the different sectors.

In the third group, Niche, 11 tools are considered to be a specialised application in the service sector. Three Lean tools which are weighted similarly in both sectors as being in the Niche implementation are Level Scheduling, Group Technology and Pull System. Hence, the Niche group includes very specialised tools in Lean Thinking implementation. In addition, one Lean tool was found to be weighted very differently between the manufacturing and service sectors and that is Value Stream Mapping (VSM). It is categorised as a Core tool in the manufacturing sector while it is regarded as a Niche application in the service sector. The logic of these results suggests that unique Lean tools are applied differently in specific industries. An alternative view is that the overall processes in services are simpler than in manufacturing and therefore the value streams are more obvious in services without needing the details of the VSM.

As shown in Table 6-1, 30 Lean tools were likely to be implemented differently between the manufacturing and service organisation units. Therefore, these three categories of Lean tools might be used to confirm the first proposition that Thai BE managers from different organisational groupings prioritise different choices of Lean tools in the implementation of Lean Thinking.

According to Bicheno (2008), Lean tools, if used appropriately, will give good results. However, it is questioned in this study which criteria play significant roles in influencing the decision making of the award winning organisations.

6.1.2 Decision Criteria

An organisation could achieve continuous improvement if it considers the right factors when making a decision on what project should be chosen (Kornfeld and Kara, 2013). In fact, both rational and emotional factors should be considered when making a decision on the application of quality management (Thawesaengskulthai, 2010). In order to achieve Lean Thinking implementation, an organisation should consider its current situation, environment, organisational goals and peoples' perceptions. From the literature review, there were a number of organisations that failed in the implementation of quality improvement programmes due to inappropriate considerations. Hence, it is important to identify key aspects which should be considered in decision making

for Lean Thinking implementation in order to achieve organisational improvement effectively.

From the empirical findings, the award winning organisations tended to consider a number of factors when making a decision on which Lean tools should be implemented in their organisation units. In general, the participants aimed to increase their organisational performance after implementation and considered an alignment with their organisation's objectives and strategies. Both manufacturing and service sectors were likely to rank these two factors, the increase of the organisational performance and the alignment with the organisation's objectives, equally as the most important in the ranking of decision criteria, as explained in the previous chapter.

However, the award winning organisations in Thailand did not only consider these two aspects, they were likely to also concern about other important factors which might affect the implementation of Lean Thinking. These decision criteria were therefore categorised into three groups which are defined in this study as Organisation Readiness, Strategic Planning and External Suggestion, as shown in Table 6-2.

In fact, these three decision criteria were ranked by the award winning organisations differently. In general, both manufacturing and service organisation units were likely to consider Strategic Planning as the most important factor which was used in decision making followed by Organisation Readiness and External Suggestion. The majority of the participants explained that it was important to set clear organisation objectives in the beginning stage. After that, a manager should find Lean tools which could be applied in order to assist his or her organisation to achieve their key goals. This finding is similar to the suggestion of Bendell (2005) that key decision criteria should be the primary needs of an organisation.

Table 6-2: Decision criteria which were used in the consideration of Lean Thinking implementation

Decision Criteria	Definition and sub-criteria
Strategic Planning	Decision making is based on policies, objectives, plans and other requirements of an organisation. • Organisation Objectives and Strategies • Management Policy • Business Requirement • Solve Business Problem • Sustain Competitiveness
Organisation Readiness	Consideration of the appropriateness of existing resources and cultures of an organisation. • Organisation Culture • Ease of Implementation • Supplier/Customer Programmes • Appropriateness for the Organisation
External Suggestion	Implementation is influenced by an external expert's suggestion and/or learning from best practice organisations. • Consultant's Suggestion • Business Results of Best Practices • Feedback from Assessment • Law and Regulations • Technology Development

Organisation Readiness is a consideration of existing resources as well as organisational cultures, which includes the capabilities of the human resources within the organisation. After the award winning organisations considered their requirements, they generally investigated the availability of their resources. If these resources, particularly human resources, are not in readiness, the participants will provide education and training programmes in order to increase essential knowledge and skills of their people. However, the participants claimed that in the beginning stage, the key decision criterion was ease of implementation.

When making a decision on Lean Thinking implementation, the participants in this study considered not only internal factors but also external aspects. The third decision criterion, the External Suggestion, is a consideration of the influence of the external environment, which includes consultant's suggestions, learning from best practice organisations and feedback from the assessment. The majority of the participants claimed that learning from experts was one of the most effective approaches to planning their continuous improvement; however, it was still important to investigate their needs and readiness after obtaining the external suggestions.

Therefore, it might be said that although these three decision criteria were likely to be weighted differently by the award winning organisations, the Strategic Planning, the Organisation Readiness and the External Suggestion were used as complementary factors in making a decision on Lean Thinking implementation.

Although these decision criteria are named differently from those in the second proposition, it can be confirmed the second proposition that current situations (Organisation Readiness), future requirements (Strategic Planning), and external factors (External Suggestion) are key decision criteria used by different Thai BE managers in making a decision on the implementation of Lean Thinking.

6.1.3 **Supporting Factors**

In order to achieve Lean Thinking implementation, it is important to recognise a system as a whole rather than focus on any single specific department (Crute *et al.*, 2003; Jekiel, 2010). From the literature review, a selection of a powerful tool using reasonable decision criteria is not enough to ensure the smooth flow of the implementation. A number of researchers suggested key tasks that should be performed as part of an application, similarly to the empirical findings of this study. However, different companies are faced with different environments (Hines *et al.*, 2004). In order to reach a successful implementation, a manager has to restructure the organisation to become more flexible in adopting new ideas (Achanga *et al.*, 2006).

In this study, the award winning organisations suggested a number of key success factors which were used to achieve Lean Thinking implementation. Both

manufacturing and service organisation units were likely to consider leadership and management support as the most important aspects in the application. Quality development programmes require an initiative from senior management to not only propose the related policies but also provide sufficient support resources. It can be seen, therefore, that management policies and sufficient resources were two critical criteria (Strategic Planning and Organisation Readiness) used in the decision making for the implementation of Lean Thinking, as explained in the section above.

The participants further explained that there were other critical success factors which included employee involvement, clear communication and internal cooperation, as discussed in the previous chapter. The researcher therefore defined these aspects as the Supporting Factors which assisted the award winning organisations to achieve implementation. From the empirical findings, these supporting factors were categorised into four groups which are defined in this study as People, Organisation, Communication and Business Partner, as shown in Table 6-3.

Table 6-3: Supporting factors in Lean Thinking implementation

People	Organisation	Communication	Business Partner
1. Leader - Commitment of Senior Management - Lean Leadership - Buy-in - Role Model - Involvement - Management Support **2. Employee** - Employee Attitude - Commitment and Involvement - Employee Skill and Knowledge - Employee Empowerment **3. Improvement Team** - Cross Functional Team - Functional Team **4. Consultant** - Internal Expert - External Expert	**1. Strategic Management** - Management Policy - Strategic Planning - Organisation Objectives - Organisation Culture and Value - Alignment and Integration - Trust Environment - Open Door Policy **2. Operations Management** - Safety and Environmental Management - Risk Management - Project Management - Change Management - Waste Management - System of Product/service Management - Market Service Logistics **3. Human Resource Management (HRM)** - Discipline and Regulation - Employee Motivation - Education and Training - Knowledge Management - Job Rotation - Job Enrichment - Cross-Trained Worker - Reward and Recognition - Happiness Workplace **4. Resource Management** - Fact and Data - Budget - Equipment - Time - Infrastructure	**1. Two-way and Transparency** **2. Voice of Employee** **3. Voice of Customer** **4. Voice of Community** **5. Voice of Supplier**	**1. Customer** - Customer Focus - Customer Relations Management - Customer Involvement **2. Supplier** - Supplier Evaluation - Supplier Development - Supplier Involvement

The first critical factor is People which include leaders, employees, improvement teams and consultants. The participants weighted People as the most important aspect in supporting the application of Lean Thinking. As explained above, a quality improvement programme can be applied in an organisation only if it is initiated and supported by top management. However, quality development cannot be reached without a whole organisation's involvement. Thus, after the management commits to the application of Lean Thinking it requires its employees to apply quality improvement programmes into their individual or team responsibilities. They may operate under a support of internal and/or external consultants in order to ensure that their application is appropriate.

Although People are regarded as the most important in the ranking of key success factors, they can also be a cause of barriers in the implementation of Lean Thinking. This is because if an employee has a negative attitude towards quality improvement, he or she will offer resistance to the new programme. Human resources was also recognised as a competitive resource (Liker and Hoseus, 2010) and should be empowered as the process owner to drive quality improvement (Crute *et al.*, 2003; Jekiel, 2010). Therefore, an organisation requires the effectiveness of its human resource management (HRM) in order to motivate and draw out its people's capabilities in order to drive quality improvement.

In this study, HRM was identified as part of the second supporting factor which was defined as the Organisation. The Organisation issues are concerning the roles and impacts of not only HRM but also strategic management, operations management and resource management. These areas of management support the smooth flow of Lean Thinking implementation. In parallel, Lean Thinking as the modern manufacturing strategy contributes as one of the essential parts in formulating the business strategy into an effective direction (Brown, 1998c). The strategic management involves formulating and implementing goals, policies and strategies in order to shape the overall direction of the organisation. In other words, an organisation is required to integrate, align and fit all initiatives within its operation (Crute *et al.*, 2003; Mohammad *et al.*, 2011). In order to reach better organisational performance, quality has to be concerned as a strategic point (Brown, 1997). Additionally, top management has to create an organisational culture that supports quality improvement (Crute *et al.*, 2003;

Jekiel, 2010). Therefore, without alignment in an organisation and appropriate quality culture, Lean Thinking implementation cannot be achieved.

Operations management focuses on designing, producing and controlling processes in order to meet customers' requirements. In fact, the operations capacities and the strategic management need to be linked and complement each other (Brown, 1998a; 1998b). Without a consideration on the connection between organisational strategy and project management, quality improvement cannot be achieved (Kornfeld and Kara, 2013). Therefore, operations management has to be considered in parallel with strategic management in order to reach a success in quality development through Lean Thinking implementation. In addition, resource management emphasises the efficient utilisation of organisational resources which include data, infrastructure, equipment, budget, time and so on. Ineffectiveness in managing processes and resources is considered as waste in Lean Thinking. Lean Thinking is indeed covered from operational to strategic management (Bozdogan, 2010). Therefore, it can be said that these areas of management and Lean Thinking are complementary and support each other to reach quality development in an organisation.

The third supporting factor, Communication, is used to send important information to inform both internal and external stakeholders. From the existing literature, a number of researchers suggested that communication is one of the key success factors that assisted Human Resources to understand the management policies (Cuatrecasas, 2002; Crute *et al.*, 2003; Kim *et al.*, 2006; Brown *et al.*, 2007; Jekiel, 2010; Thawesaengskulthai, 2010; Pradabwong *et al.*, 2012). However, these literatures mainly focus on internal communication. In this study, it was found that both internal and external communications play important roles in supporting Lean Thinking implementation.

The award winning organisations in both sectors were likely to weight communication as one of the significant aspects which can either support or obstruct the achievement of Lean Thinking application. In order to manage human resources well through Lean Thinking, two-way and transparent communication was considered to be one of the most effective approaches. Therefore, related information was provided to employees to encourage the application while organisation units received feedback from their people. Under

a clear communication system, human resources understand the reasons why Lean Thinking implementation is needed. Additionally, they will offer feedback in terms of suggestions which can be used to further improve organisational performance.

The participants were concerned to communicate not only with employees as the internal stakeholders but also with customers, communities and suppliers as the external stakeholders. Customers' value is the highest goal that an organisation needs to identify (Womack and Jones, 1996) in order to run its business successfully. Communication to and from potential customers is one of the most effective methods to understand customers' value. The award winning organisations explained that they tend to also communicate with suppliers to receive updated information from them in order to solve any problems and improve organisational performance in parallel with creating a good relationship with the suppliers to achieve win-win situations.

Another external stakeholder that received communication from the award winning organisations is the community in order to improve community welfare and the quality of people who might be contributing to the quality of product/service in the future. Therefore, it can be seen that two-way communication is one of the powerful aspects that can be used to inform and receive important information. It offers not only a better understanding between organisation units and their stakeholders but also a feedback that can be used for continuous improvement through Lean Thinking implementation. Thus, communication with both internal and external stakeholders is essential to cover all related issues. It can therefore be determined that both internal and external stakeholders play vital roles in supporting the implementation of Lean Thinking. The first three supporting factors are mainly focused on internal organisation while the last aspect emphasises the role of the external organisation, defined in this study as the Business Partner.

A business partner includes customers and suppliers who play roles in supporting Lean Thinking implementation. Although the participants weighted the involvement of these business partners as the least important factor when compared to other aspects, ineffectiveness in managing these partners could result in barriers to the application. This is evident in both the existing literature and the empirical findings of this study. In fact, customer value is one of the key

principles of Lean Thinking (Womack and Jones, 1996). A focus on customers can assist an organisation in understanding their customers' requirements. A number of participants in this study learn from their customers through customers' involvement and customer relations management, as explained in the previous chapter. They could, therefore, receive essential information that can be used in quality improvement.

Another business partner is suppliers who also support a smooth flow of processes by providing sufficient quality materials. However, the award winning organisations were likely to have little concern about the roles of suppliers in their quality development programmes. This was evident from supplier involvement being considered as the least important factor in Lean Thinking application in both sectors, as explained in the previous chapter. In addition, only a few participants proposed supplier development and evaluation programmes regularly. However, a good relationship between organisations and suppliers was suggested (Brown and Cousins, 2004; Brown *et al.*, 2007; Pradabwong *et al.*, 2012) in order to share essential information that could be used to improve performances of both organisations. Hence, suppliers need to be wisely managed and closely developed in order to create long-term relationship (Brown and Cousins, 2004). Additionally, an entire supply chain from suppliers to customer needs to be considered in order to achieve in the implementation of Lean Thinking (Brown, 1998c). This study therefore suggests that an organisation should span its quality improvement across organisations into its supply chain in order to entirely support Lean Thinking implementation.

In order to be successful in managing its business partners, an organisation requires effective communication. This supporting factor is therefore related to the previous aspect, Communication. It can be said that all four supporting factors are linked and complement each other. Lean Thinking is a system that needs to be considered as a whole instead of a specific area (Crute *et al.*, 2003; Bicheno, 2008). Thus, these four supporting factors should also be planned, aligned and operated in the same direction in order to support the implementation of Lean Thinking successfully.

It might be said that these four supporting factors, People, Organisation, Communication and Business Partner, are related to three aspects which are organisational management, intercompany management and human resource

management in the third proposition. Therefore, it can be confirmed the third proposition that these supporting factors need to be thoroughly managed in order to achieve quality improvement in selected Thai BE organisations.

Supporting factors are indeed the existing resources and situations of the organisation which are used as decision criteria in taking a decision on Lean Thinking implementation. It can be said that supporting factors and decision criteria are linked to each other. These two Lean elements then support the application of Lean tools to align and fit with an organisation's environments. Therefore, three significant elements which are Lean tools, decision criteria and supporting factors are essential aspects in Lean Thinking implementation and are linked to each other. If an organisation considers these three vital elements when implementing Lean Thinking, the researcher believes that the organisation is more likely to achieve quality development. These three elements then will be used to create a conceptual model of Lean Thinking implementation in the next section.

6.2 Developing a model of Lean Thinking implementation

As discussed in the previous section, in order to achieve quality improvement through Lean Thinking implementation, it is essential to consider three significant elements, which are Lean tools, decision criteria and supporting factors. Although the implementation of Lean tools is not equal to a Lean system, it can be used to reach a desired result of quality development. However, an application of Lean tools needs to be considered carefully based on organisational environment. It was found that the appropriateness of the organisation conditions and the alignment with the organisation strategies are vital decision criteria while human resources is a key supporting factor that drives quality programmes.

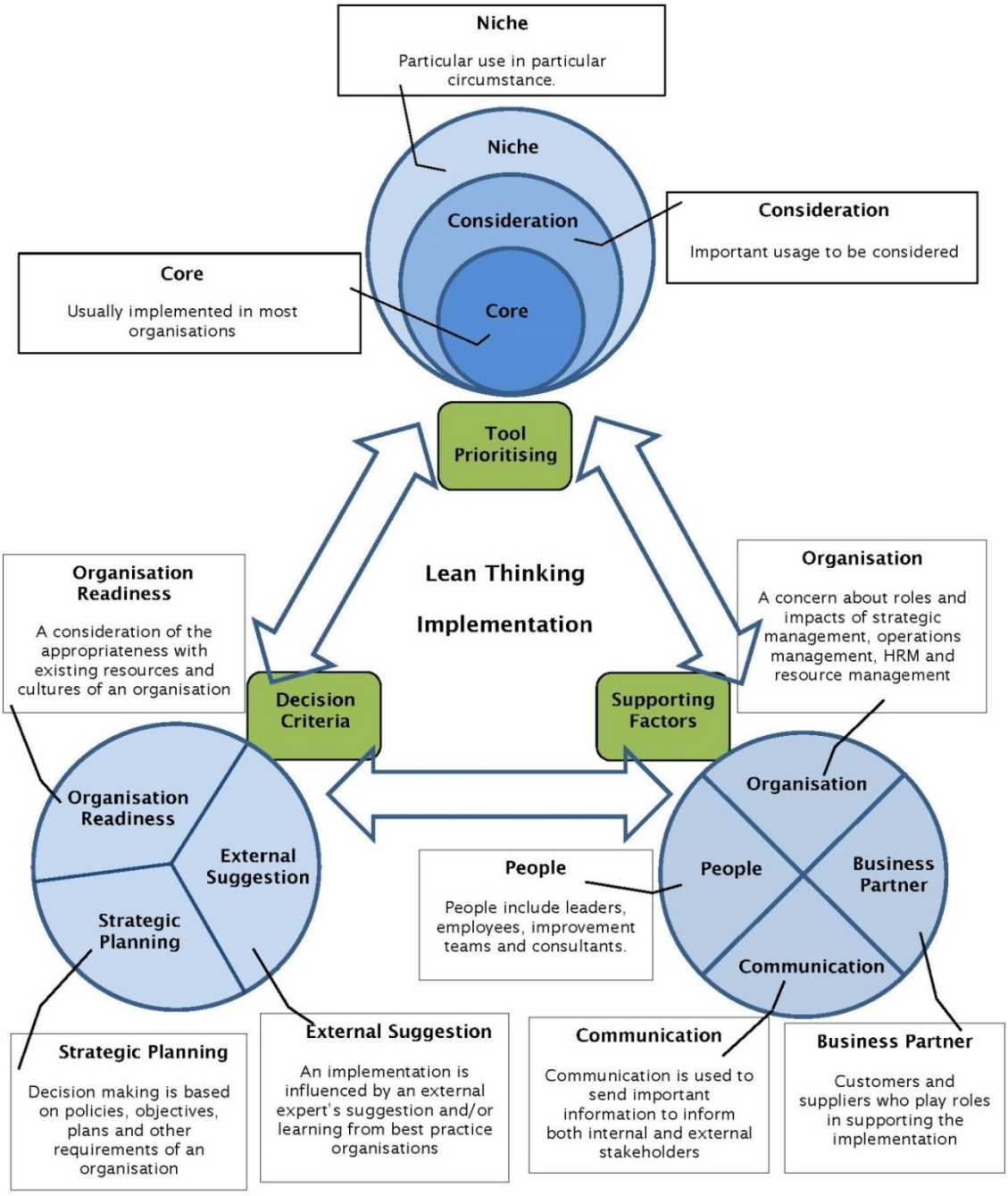


Figure 6-1: Lean Thinking Elements and Interaction Model

Tool prioritising, decision criteria and supporting factors were used in developing a conceptual model of Lean Thinking implementation. As shown in Figure 6-1, decision criteria and supporting factors are considered as the bases of Lean tool application. Before a manager decides to implement tools, it is important to consider the organisational requirements and situations in order to drive an entire organisation in the same direction towards a desired goal. Therefore, Lean tools, decision criteria and supporting factors have an impact on and complement each other. In order to reach success in Lean Thinking application, these three significant Lean elements should be considered in parallel.

In the developed model, decision criteria identify reasons that need to be considered before the implementation, supporting factors point out how to do quality improvement successfully and tool prioritising determines what tools should be selected in different sequences. Thus, the model of this study confirms the fourth proposition that selected Thai BE managers consider reasons why it is important to implement Lean Thinking, how to implement to achieve quality development and what tools should be implemented in an organisation in order to be successful in the implementation of Lean Thinking.

From the empirical findings in the previous chapter, the award winning organisations were likely to apply different tools at different levels using different quality management approaches. Organisation units in manufacturing and service sectors tend to implement Lean tools differently. However, we found that decision criteria and supporting factors in both sectors are relatively similar. The participants (in whichever business sector) weighted strategic planning and people as the most important in the ranking of decision criteria and supporting factors, respectively. Thus, a key difference between the manufacturing and service sectors is the application of Lean tools. The conceptual model of Lean Thinking implementation in the manufacturing units was created, as shown in Figure 6-2 while that in the service sector is shown in Figure 6-3.

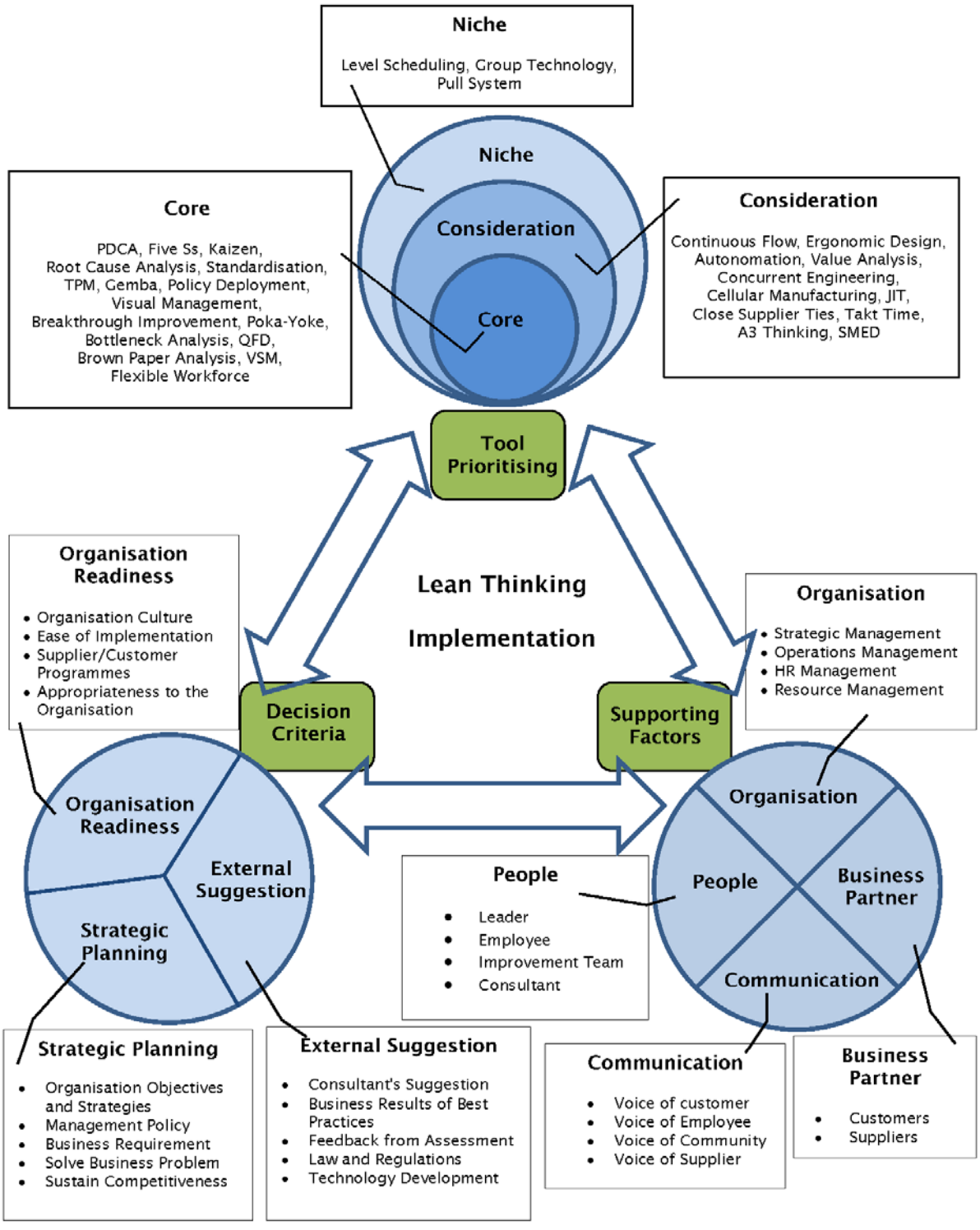


Figure 6-2: Lean Thinking Elements and Interaction Model in the Manufacturing Sector

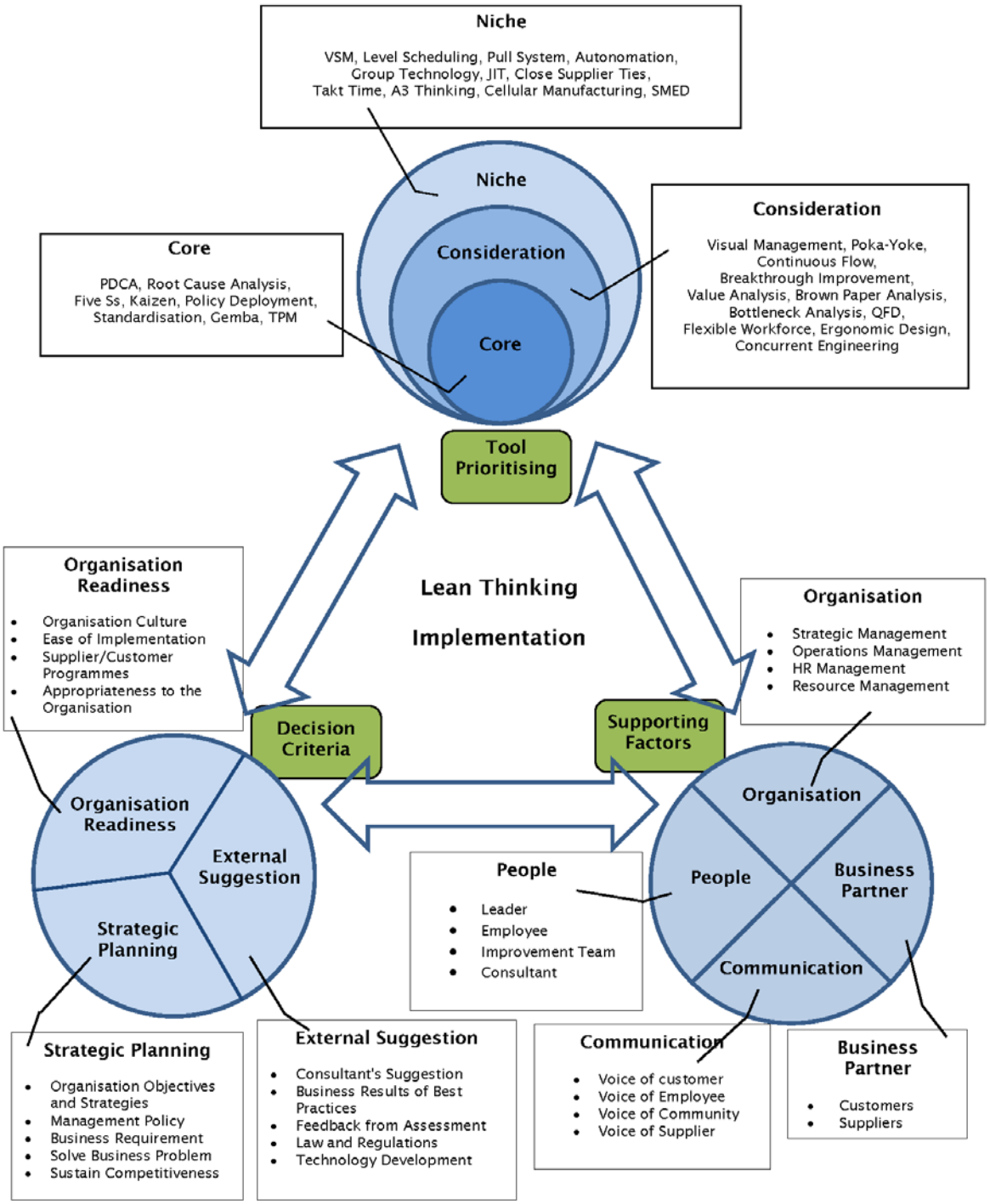
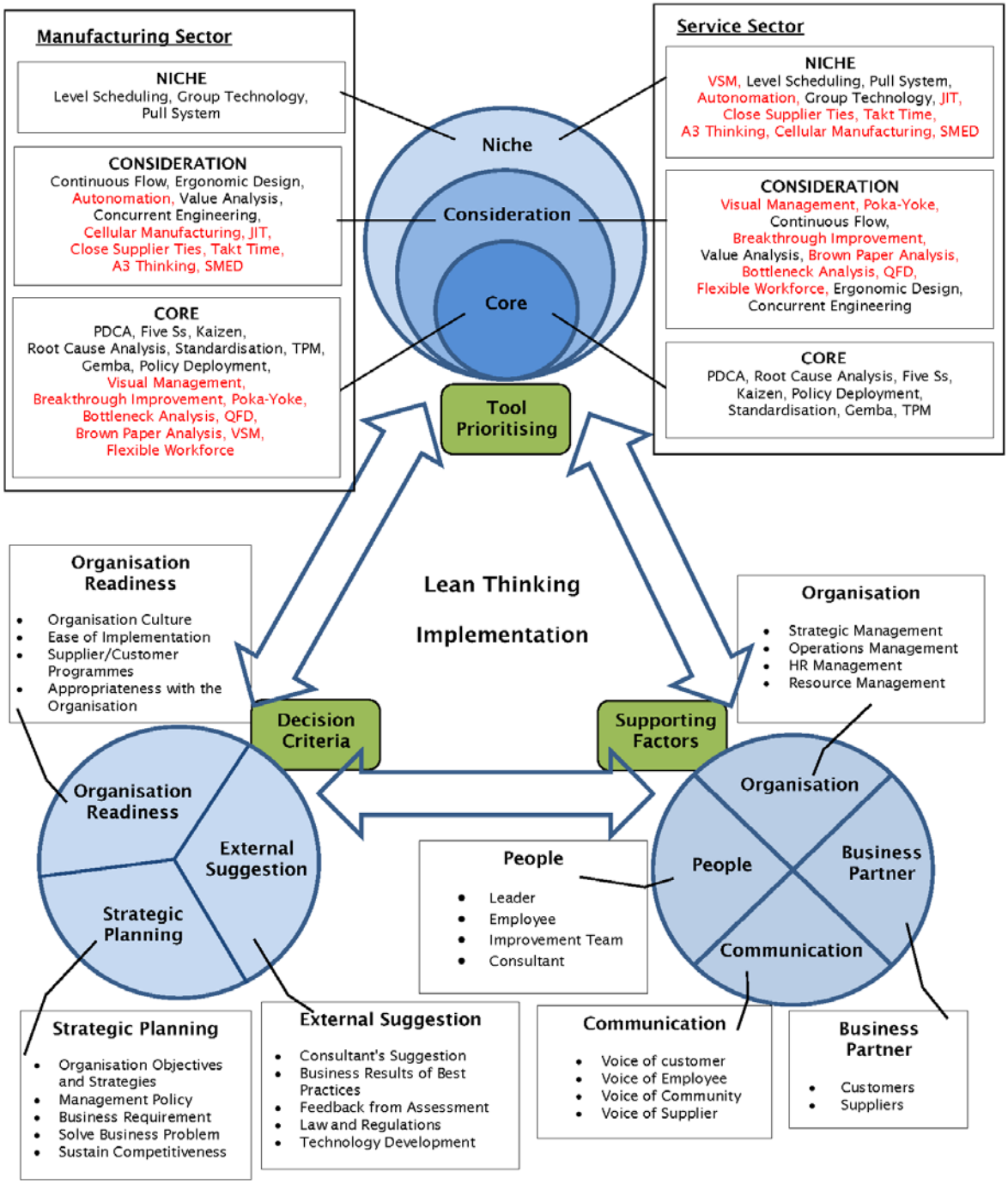


Figure 6-3: Lean Thinking Elements and Interaction Model in the Service Sector

In these models, Lean tools in three categories, i.e. Core, Consideration and Niche are presented visibly in order to show how the unique business sector prioritised Lean tools. In fact, there are a small number of literatures that advised on the sequence of Lean tool implementation. This study, therefore, suggests the essential tools as being the Core tools that should be implemented in the early stages of each sector. As discussed in the previous section, Lean tools in the manufacturing sector were prioritised differently from those in the service business. It can be said that these models offer a particular application in the specific sectors. In this study, not all lean tools were applied universally and there were different contextual factors at play which suggests that a simplistic view, that Lean is the same for everyone, is indeed too simplistic. Management choices and priorities always suggest that not everything in the lean toolbox will fit all circumstances all of the time.

In addition, sub-decision criteria are provided in these models in order to provide a clear understanding on important aspects that should be considered to make effective decisions for Lean Thinking implementation. From the literature review, the existing literature on the decision criteria of Lean Thinking implementation was limited. Most of them had not provided details of the decision criteria in any depth. This resulted in both academic and practical debates on what need to be considered before making a decision on Lean Thinking implementation. This study, therefore, addresses this gap by offering sub-criteria that need to be considered in order to reach successful quality improvement through Lean Thinking implementation.

Furthermore, these developed models also provide supporting factors which are important in assisting an organisation to reach its quality goals. The existing researches generally identified these aspects as key success factors in implementation. However, the existing literatures rarely included these elements in their proposed models. This study, therefore, aims to create a complete model of Lean Thinking implementation. Supporting factors which influence the achievement of quality improvement are suggested as one of the significant parts of Lean Thinking application.



Note: Where the tools appear in different parts of the table in the two sectors they are shown in red.

Figure 6-4: Lean Thinking Elements and Interaction Model in the Sector Comparison

These models therefore fill gaps in the existing literature and contribute to the academic debate about the universality and significant elements of Lean Thinking application. As explained above, different Lean tools tended to be applied at different levels by the award winning organisations. Organisation units in manufacturing and service sectors were likely to implement these Lean tools differently. In addition, organisation units which operate in the same company implemented Lean tools uniquely. Therefore, it can be said that there are particular choices of Lean tools and implementation sequences in the particular context of businesses. This is similar to the study of Crute *et al.* (2003) on the "plant-specific" of Lean Thinking application.

In order to make clear the perspectives of the differences in implementation between the manufacturing and service sectors, the researcher developed a complete model of Lean Thinking application that presents a comparative view of different tools between two sectors. As shown in Figure 6-4, two sets of Lean tools in the unique sectors are clarified and compared. Red letters in the tool boxes refer to the Lean tools that appear in different categories in the two sectors. This model provides not only a comparative application of particular sectors on Lean tool choices and implementation sequences but also the essential bases that need to be thoroughly considered before making a decision on Lean Thinking implementation.

Thus, the developed models are named in this study as "Lean Thinking elements and interaction model". They are indeed the conceptual academic models which support the analysis of how Lean Thinking was implemented alongside Total Quality Management in the award winning organisations in Thailand.

6.3 Chapter Conclusion

In order to achieve improving organisational performance, not only should Lean tools be considered but also decision criteria and other supporting factors. These three factors are regarded as the significant elements of Lean Thinking application that lead to achieving quality improvement. Although the implementation of Lean tools is not equal to an entirely Lean system, it can be used to reach a desired result in quality development. Indeed, an application of

Lean tools needs to be considered carefully based on organisational environment.

The second important element of Lean Thinking application is decision criteria, which include Strategic Planning, Organisation Readiness and External Suggestion. These aspects should be considered before making a decision on Lean Thinking application. However, the selection of a powerful tool alone within reasonable decision criteria is not enough to ensure the smooth flow of the implementation. Another significant element in Lean Thinking implementation that needs to be considered is the supporting factors. These aspects which are defined in this study as People, Organisation, Communication and Business Partner, play important roles in supporting an organisation to reach successful quality improvement through Lean Thinking implementation.

It can be said that supporting factors and decision criteria are linked. These two Lean elements are vital bases that support the application of Lean tools to align and fit with the organisation environment. Therefore, in the implementation of Lean Thinking it is important to consider these three significant elements in a comprehensive way in order to achieve effective quality improvement.

Due to being essential elements of Lean Thinking, these three aspects then were used to develop a conceptual model for implementation. It might be said that tool prioritising, decision criteria and supporting factors are significant Lean elements that contribute to a conceptual model for implementing Lean practices.

In this study, models are developed in not only the particular sectors but also in the comparisons between sectors. In fact, these models reflect the particular application of the unique business sectors. Additionally, they challenge the universality of Lean Thinking implementation. These “Lean Thinking elements and interaction models” are, therefore, contributing to the academic debate about the universal application and significant elements of Lean Thinking and support the analysis of how Lean Thinking was implemented alongside TQM in the award winning organisations in Thailand.

Chapter 7: Model Validation

This chapter describes the validation of the model from a comparative analysis with the existing literature and the effectiveness of the implementation of the award winning organisations in Thailand. Subsequently, academic and consultant experts in Lean Thinking are used alongside the participating managers to examine the new model from an academic viewpoint (does it advance the academic argument of the universality or particularity of Lean Thinking application) as well as asking the participating managers for their views of whether it can be easily operationalized and if it has the potential to improve the implementation process. The model validation and refinement processes were associated with the fifth research objective by verifying and refining the developed model of Lean Thinking implementation on its theoretical soundness and potential for practical application and confirm an academic debate about significant elements of Lean Thinking implementation.

7.1 Validation of the developed model

From the literature review, Lean Thinking application has been of interest to a number of academics and practitioners for improving organisational performance. However, one of the critical causes of failure in Lean Thinking implementation was an improper framework (Anand and Kodali, 2010). An appropriate model, in contrast, can be used as a guideline to achieve the Lean Thinking application. Therefore, a comparative analysis with the existing literatures was conducted in order to check the validity of the developed model.

7.1.1 A comparative analysis with the existing literature

A comparative analysis was done by comparing and contrasting Lean elements of the developed model with those of the existing literature in order to verify the validity of the proposed model. Key frameworks of Lean Thinking implementation are included five principles of Lean Thinking (Womack and

Jones, 1996), the 4 P model of the Toyota Way (Liker, 2004) and the 8P's model of the Lean Business System (Hines, 2009).

7.1.1.1 Five principles of Lean Thinking

Lean Thinking was initially known as the Toyota Production System (TPS) before it was introduced as Lean by Womack *et al.* (1990). According to Womack and Jones (1996), Lean Thinking could be applied universally with five key principles – value, value stream, flow, pull and perfection – which were considered to be of critical significance (Bicheno and Holweg, 2009). In fact, these five principles are recognised as a fundamental framework for Lean Thinking implementation. It is, therefore, vital to compare the developed model with these key principles of Lean Thinking.

Firstly, customers' value is the key starting point of Lean Thinking (Womack and Jones, 1996). In other words, it is important to identify the exact requirements of customers. In order to do this, an organisation needs to know its customers (Bicheno, 2008; Bicheno and Holweg, 2009). Thus, this principle places emphasis on customers and their requirements. In the developed model, a customer is proposed as a business partner which is one of the critical elements of Lean Thinking. In the model, the researcher recommended an organisation to drive customer focus through customer relations management (CRM) in order to listen to the voice of customers and communicate the related information to them effectively. Customer involvement in quality development is also suggested in the proposed model in order to improve the organisational performance consistently with customers' value.

In the second principle, value stream is the processes which include problem solving, information management and transformation tasks (Womack and Jones, 1996). A consideration of an entire supply chain is recommended in order to understand the "demand network" (Bicheno and Holweg, 2009). Therefore, a focus on business partners, which include customers and suppliers, is vital and is suggested as a part of the key elements in Lean Thinking implementation in the developed model. An organisation should encourage its suppliers to become involved in quality improvement programmes to achieve transformation of tasks efficiently. Supplier evaluation and development are also crucial in improving a

whole supply chain. Additionally, the proposed model of this study identifies a number of Lean tools that can be used in process investigation and development, for examples, Root Cause Analysis, Brown Paper Analysis and Value Stream Mapping.

The third principle, flow, emphasises how to process raw material into finished product without defect, stoppage and repetition of work. In order to reach this, a number of Lean tools that make the flow of value were identified in the developed model. These tools include the Five Ss, Standardisation, Poka-Yoke (Error Proofing), and others. Furthermore, an important point in making value flow is the vision that guides an organisational strategy (Bicheno and Holweg, 2009). The developed model is also concerned with the importance of the vision. Thus, a vision is regarded as a part of strategic management that supports achieving in the Lean Thinking application. In parallel, a vision is considered to be one of the decision criteria in strategic planning which is used when considering what should be implemented in an organisation. Therefore, a clear vision is an important aspect that should be considered in Lean Thinking application in order to make value flow in an effective approach.

The next principle of Lean Thinking is pull. Womack and Jones (1996) explained that a product should be pulled by customers when they want it. An organisation needs to respond to customers' demand with low inventory (Bicheno, 2008). In order to make a pull system possible, a number of Lean tools were suggested in the developed model: Andon (Visual Management), Heijunka (Level Scheduling), Takt Time and Kanban (Pull System). Additionally, supplier management (as explained above) is one of the key parts in assisting an organisation to manage its inventory successfully. Therefore, vital elements which assist an organisation to achieve a pull system are already put in the proposed model.

The last principle is perfection. According to Womack and Jones (1996), zero defect and transparency are the important aspects in the fifth principle. Defect is one of the seven wastes that causes not only redundant costs but also customer unreliability (Bicheno and Holweg, 2009). According to Womack and Jones (1996), following the first four principles of Lean Thinking can assist Lean implementers to attain the defect-free. In addition, a prevention system needs to be installed in all processes from marketing to after-sales service (Bicheno, 2008). In fact, a number of Lean tools that can be used to achieve zero defect;

i.e. Poka Yoke (Error Proofing) and Total Productive Maintenance (TPM), were also suggested in the developed model as explained in the first four principles above. Furthermore, the model of this study concerns about an implementation in a whole system. It can be seen that it suggests not only a tool application but also a consideration on other important factors; i.e. strategic management and human resource management. Under a holistic management, it is possible that an implementation of the developed model leads to an achievement in the zero defect.

With a clear understanding, value creation could be done easily. In the developed model, a transparent communication to all stakeholders which included not only employees but also customers, suppliers and society was suggested in order to inform and receive the related information. Particularly, an employee who plays a vital role in implementing quality improvement programmes can reflect an actual situation at an operational level to top management. This information is considered in order to propose effective strategic planning. In addition, the management is able to provide positive feedback to employees who will then improve their performance to reach customers' value instantly.

In a comparison, it can be seen that the developed model covers and relates to all the important aspects of the five Lean principles which are recognised as being at the heart of Lean Thinking application. However, these five key principles omitted the importance of people (Hines, 2009) who apply Lean tools and techniques to improve their work continuously (Liker and Morgan, 2006). The developed model also includes the roles of human resources and decision criteria that can be used as guidelines to be successful in the implementation of Lean Thinking.

7.1.1.2 The 4 P model of the Toyota Way

Not only were five key principles of Lean Thinking used in a comparative analysis but also the 4 P model of the Toyota Way. The Toyota Production System (TPS) is recognised as the basis of Lean Production and has influenced the movement of Lean Thinking (Liker, 2004). Thus, it is worthwhile comparing and contrasting the developed model with the Toyota Way framework in order to verify the validity of the proposed model.

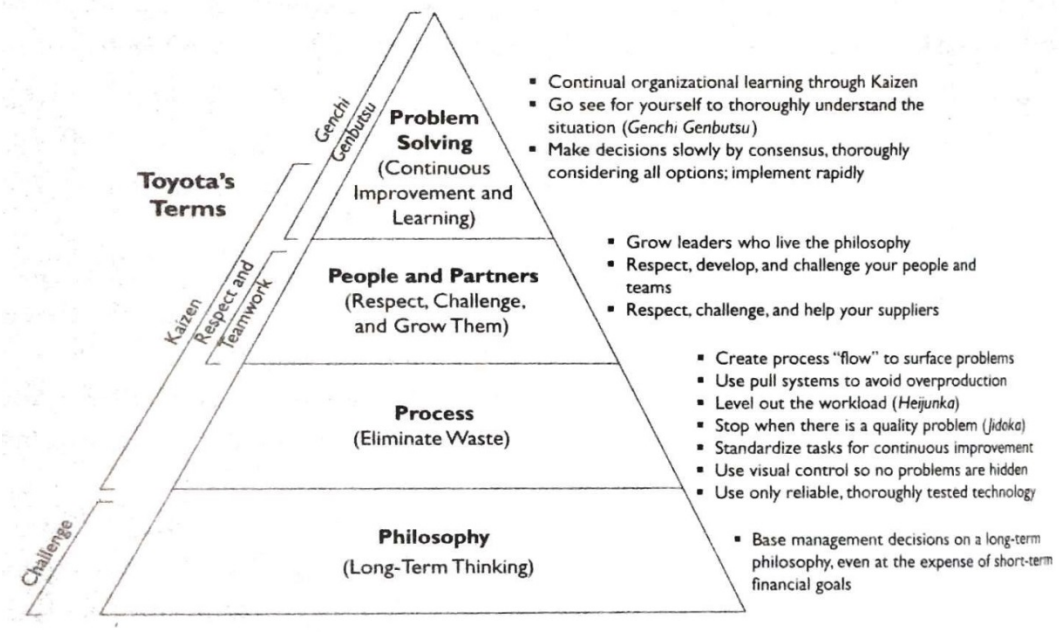


Figure 7-1: The 4 P model of the Toyota Way

(Source: Liker (2004)p. 6)

According to Liker (2004), four categories of the Toyota Way are Philosophy, Process, People and Partners as well as Problem Solving. As shown in Figure 7-1, the 4 P model of the Toyota Way is presented in a pyramid shape which begins with Philosophy or Long-term Thinking. Liker (2004) emphasises that it is important to understand Lean thinking as a whole system rather than be entirely focused on tool application. In this study, the developed model provides not only a set of Lean tools but also other significant elements of Lean Thinking which include decision criteria and supporting factors. In particular, the strategic planning of the management is identified as one of the key elements that need to be concerned about the organisation's direction before the implementation of Lean Thinking. In addition, strategic management, which is considered to include the long-term policies of the organisation, is suggested as an aspect that supports the achievement of the application. It can also be said that the developed model provides the long-term management decision that relates to the basis of the 4 P model.

Secondly, an organisation needs to concentrate on processes in order to achieve quality improvement. The key purpose of this stage is to eliminate waste and

increase flexibility (Liker, 2004). As shown in Figure 7-1, Liker (2004) suggests having Lean implementers to create process flow, pull system, workload levelling and so on. In the developed model, a number of Lean tools that can be used to reach these conditions are suggested. Additionally, a quality culture should be built in an organisation in order to run a process without a stoppage (Bicheno and Holweg, 2009). In this research, organisation culture and value for continuous improvement are suggested as two of the aspects that support the accomplishment of quality development through Lean Thinking implementation.

Consequently, people and partners are the third important aspect of the 4 P model of the Toyota Way. In the application of Lean Thinking, it is important for top management who propose a long-term philosophy to start quality programmes. After that, the management has to challenge and develop employees to apply those programmes to their responsibility both individually and in their team. In the developed model of this study, people, including leaders, employees, improvement teams and consultants, are suggested as supporting aspects that drive an organisation to achieve quality improvement from the implementation of Lean Thinking. Additionally, Liker (2004) further identifies suppliers who should be respected but challenged in Lean Thinking application. In the proposed model, Lean implementers are recommended to consider suppliers as crucial business partners by setting supplier development and evaluation alongside and allowing them to involve in quality improvement programmes.

The last section of the Toyota Way model is continuous improvement and learning. Liker (2004) explains that an organisation should continually improve its performance and learn through Kaizen. In fact, this tool has been identified as an essential tool which should be implemented in both the manufacturing and service organisations in the proposed model. In addition, the model of this study provides a number of decision criteria that need to be considered before making a decision on the application. These factors are related to an explanation by Liker (2004) in which an organisation should consider all influences in the implementation carefully. Thus, the decision criteria suggested in the developed model can be used as a consideration metric that assists an organisation to understand its situation clearly. Lean implementers can, therefore, select and apply the most appropriate tools and techniques that fit with their conditions.

Thus, it is found that the developed model of this study has covered and is consistent with the 4 P model of the Toyota Way. In fact, the proposed model provides more details that might be used in a practical way than the Toyota Way model. Liker (2004) describes that an organisation has to carefully consider all related aspects before implementation. However, he was unlikely to suggest which significant elements should be considered in the implementation. Therefore, it can be said that the developed model provides the all-important elements of Lean Thinking which relate to the Toyota Way model and might be worthwhile considering implementing.

7.1.1.3 The 8P's of Lean Business System

In order to make a strong argument on the validity of the developed model, another model that was used in a comparative analysis is the 8P's of the Lean Business System. As shown in Figure 7-2, the 8P's model is comprised of eight elements: purpose, process, people, pull, prevention, partnering, planet and perfection. It was developed by Hines (2009) after he found the five principles of Lean Thinking limited. Hines (2009) claims that this 8P's model is a complete framework which provides more contingent and sustainable approaches. In fact, it is challenging to compare the model of this study with the 8P's of Lean Business System. This is because the developed model has already been compared with the five principles of Lean Thinking and a number of consistencies between the two models identified. However, several aspects do not exist in the classic principles but they are suggested in the developed model. Thus, it is interesting to find out how the developed model focuses on the essential aspects of Lean Thinking when compared to the 8P's model of Hines (2009).

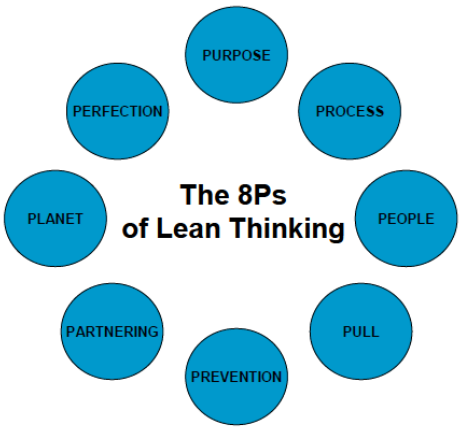


Figure 7-2: The 8P's of the Lean Business System

(Source: Hines (2009) p.4)

Firstly, Lean implementers needs to set a clear purpose and align their entire organisation in the same direction. In other words, the strategic management is also a part of the success in Lean Thinking application. After that, it is important to communicate the organisation's purpose to motivate an employee in quality improvement. Hence, Hines (2009) suggests that Lean Thinking application could be achieved if an organisation focuses not only on the voice of employees but those of customers, owners and society as well. In this study, the developed model has focused on both strategic management and two-way and transparent communication of employees, customers and communities as supporting factors that are vital to consider in Lean Thinking implementation. Although the voice of the owner had not originally been placed in this study model, an employee was considered to be one of the owners under the concepts of quality management. Therefore, it can be said that these two models have focused on the same aspects, which are strategic management and communication.

Secondly, Hines (2009) suggests Lean organisations to consider a comprehensive system instead of only one process. A holistic system is comprised of steering, key and supporting processes. The first process refers to strategic management while the second one is the production process which is entirely focused on by an organisation that has experience in a failure in the Lean Thinking application. The supporting processes assist the achievement of running the core processes. The developer of the 8P's model claims that a

complete view of these processes would improve customer services, waste reduction and organisational profits. In this research, the proposed model has emphasised the importance of all three procedures. As explained above, the strategic management that focuses on organisational direction, strategic planning and alignment of the application, is suggested in the developed model. The core and supporting processes which are defined in this study as the operations management, human resource management and resource management are placed in the developed model. It might be said that the model of this study provides a complete overview of the entire processes, similar to the study by Hines (2009).

The third aspect in the 8P's model is people. Hines (2009) explains that it is important to consider both the leader's role and human resource management. A leader has to propose a vision, policy and organisation culture for quality improvement. After that, he or she needs to encourage employees to apply Lean Thinking through effective communication and an improved job design. In order to sustain quality development, a leader should propose a policy of people management which includes a reasonable evaluation system, reward and recognition, as well as education and training. In this study, the developed model proposes one supporting factor that is also defined as people. For this element, focus was placed not only on the roles of leaders but also employees, improvement teams and consultants. As explained in the findings chapter, an achievement of Lean Thinking application can be reached if a whole organisation takes part in the implementation programmes. Leadership is the most significant aspect in initiating, driving and achieving Lean Thinking application. Therefore, similar aspects in the two models are the importance of leadership and human resource management. However, the developed model in this study provides more views on the roles of employees, teams and consultants as other vital aspects that support accomplishing the implementation of Lean Thinking.

In the fourth element of the 8P's model, there are three key areas of pull: delivery, improvement and training. In the first area, Hines (2009) claims that a pull system might not be the most important activity to focus in Lean Thinking application due to its limitations in several businesses. This is consistent with the findings of this study. Kanban or a pull system is likely to be rarely implemented by the majority of award winning organisations in Thailand. None

of them is in the automotive industry. This tool, therefore, was categorised in the Niche group which was used only in particular circumstances. Additionally, this evidence indicates that Lean Thinking might not be a universal application.

Furthermore, Hines (2009) identified the problem of a lack of consideration on the requirements of business and stakeholders in Lean Thinking implementation. It was, indeed, important to have a clear business purpose that considered customers, employees and the community before communicating it to relevant people. In this study, these aspects are considered to be crucial decision criteria that should be concerned with Lean Thinking application. The developed model suggests Lean implementers to thoroughly evaluate not only strategic planning but also organisation readiness and external suggestions. In other words, the proposed model considers both internal and external factors in making a decision on Lean Thinking implementation. Hines (2009) further explains that a manager needs to provide the training for employees based on the needs of teams and/or suggestions by a consultant. The model of this study also recommends education and training as supporting aspects which could enhance the capabilities of employees in running quality improvement.

In the fifth element of the 8P's model, Hines (2009) explains that a number of organisations experienced a failure in Lean Thinking application. This is because they are too focused on the use of specific tools and/or techniques. In fact, Lean implementers have to make processes stable before being able to improve on them. In order to reach that stage, a specific tool needs to be applied based on the requirements of the organisation. In the developed model, a number of tools are suggested and categorised based on the frequency of the application. These tools cover all aspects of Lean as explained in the findings chapter. It can be said that the model of this study provides suggestions for the use of several Lean tools rather than recommends only particular tools. Therefore, the developed model offers a crucial set of Lean tools that should prevent implementers from a failure in application similar to the 8P's model.

In the next element, supply chain management was suggested in the 8P's model. It was, indeed, considered as a fundamental competitive advantage of the Toyota system (Hines, 2009). Thus, a good relationship between an organisation and its suppliers needs to be managed. In the model of this study, a supplier is suggested as one of the key business partners who must be managed prudently.

The evaluation, development and involvement of suppliers are placed in the proposed model as supporting factors that need to be managed in order to be successful in Lean Thinking implementation. Therefore, the model of this study and the 8Ps model place an emphasis on the importance of supplier management. However, the model of this study is concerned with the inter-company development which considers the management of not only suppliers but also customers. In fact, customer management assists an organisation to understand customers' values that are important in quality improvement through Lean Thinking implementation.

The planet is the seventh element in the 8P's model of Hines (2009). In Lean Thinking application, it is significant to balance a focus on profit, society and the environment. In other words, a key purpose of an organisation is economic benefit; however, in order to sustain a business a manager should consider improvements to the community and environment alongside making a profit. This study also provides a consistent concern with the 8P's model. In this research, the voice of the community is considered to be one of the supporting factors that help an organisation to understand the requirement of society. This can be used in both environmental and societal development. In addition, safety and environmental management is placed in the developed model. It emphasises the development of not only the quality of workplace for employees but the quality and welfare of societies as well.

In the final element of the 8P's model, Hines (2009) suggests a particular organisation should create its own Lean system by applying value stream mapping to understand its situation. This suggestion is related to the purpose of this study which is aimed at understanding the implementation of Lean Thinking in Thai organisations. Under different circumstances, the manufacturing and service organisation units tend to apply a number of Lean tools differently, as explained in the findings chapter. Therefore, this led to a specific development of a Lean Thinking model in each industrial sector. However, Hines (2009) recommends value stream mapping as a key tool in creating a model. In this study, this Lean tool is likely to be rarely used in service organisations. This might create a significant contrast between the two models.

From a comparative analysis, it can be seen that the model of this study and that of Hines (2009) are relatively consistent. The 8 P's model focuses on not only

internal aspects but also external elements that are related to Lean Thinking implementation. It also considers the economic benefits as well as society and environmental welfare. Similarly, the developed model of this study provides a consideration of not only the application of Lean tools but also decision criteria and supporting factors. In the use of Lean Thinking, the internal aspects are evaluated in parallel with inter-company consideration and management. Therefore, it can be said that both models provide essential elements in Lean Thinking implementation similarly, although a number of key elements are categorised into different groups. As explained above, the 8P's model was developed to address gaps in the five key principles of Lean Thinking. Therefore, it might be supposed that the model of this study was built on the classical principles of Womack and Jones (1996).

7.1.1.4 The Sustainable Lean Iceberg Model

Furthermore, Hines *et al.* (2011) suggest another model of Lean Thinking implementation. They define this model as the Sustainable Lean Iceberg Model, as shown in Figure 7-3. Hines *et al.* (2011) explain that it is important to be aware of both above and below the waterline. However, Lean implementers generally focus on the application of tools and techniques alongside process management in the application. In fact, a manager needs to be careful and aware of the other three aspects underneath the waterline in order to sustain quality improvement. These elements include strategy and alignment, leadership and behaviour and engagement which all mainly emphasise the human aspects.

The first aspect under the waterline is strategy and alignment. Hines *et al.* (2011) claim that Lean implementers are required to propose clear vision and purpose as well as make sure that all strategies are aligned throughout an entire organisation. After that, communication is needed to inform all related information throughout the workplace. In this study, these aspects of strategic management and communication are considered to be significant elements in the implementation of Lean Thinking and are placed in the developed model as supporting factors.

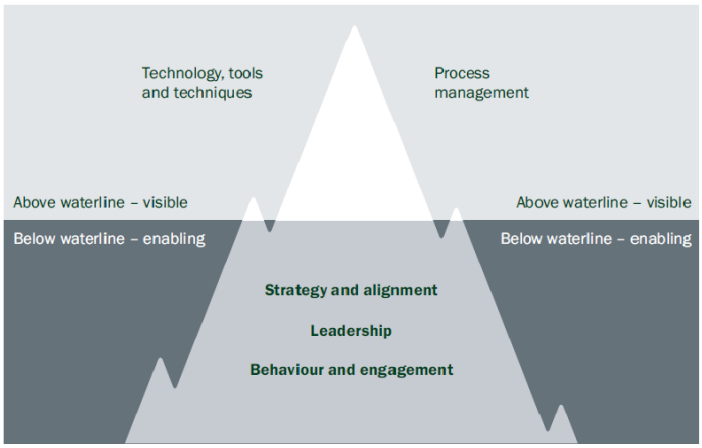


Figure 7-3: The Sustainable Lean Iceberg Model

(Source: Hines *et al.* (2011) p.9)

Secondly, a leader needs to inspire employees to apply and continue quality development (Hines *et al.*, 2011). This can be done if a leader places emphasis on the human resources by creating trust and an innovative environment. Compared to the Sustainable Lean Iceberg Model, the model of this study similarly focused on the importance of leadership. The developed model suggested a leader should commit, buy-in, be involved, act as a role model and support employees in applying Lean Thinking into their responsibilities in order to continue with and sustain quality development.

Another aspect in the Sustainable Lean Iceberg Model is behaviour and engagement. In order to achieve quality development, it is vital to encourage employees to be aware, understand and have a positive attitude towards Lean Thinking (Hines *et al.*, 2011). Similarly, the model of this study also focuses on the roles of employees in running quality improvement through Lean Thinking implementation. Without the engagement of human resources, an organisation cannot be successful in Lean Thinking application. The developed model suggests Lean implementers should focus on people by creating a positive attitude, employee empowerment, commitment and involvement. In parallel, appropriate training programmes should be provided in order to prepare and increase employee skills and knowledge in Lean Thinking application.

Hence, the Sustainable Lean Iceberg Model focused on not only the application of tools, techniques and process management but also strategy and alignment,

leadership as well as behaviour and engagement. In fact, Hines *et al.* (2011) claimed these aspects as significant factors that led an organisation to sustain quality improvement. When compared to the Sustainable Lean Iceberg Model, the model of this study also provides above five elements completely. The two models place emphasis on the implementation of Lean tools, strategic management and roles of people who are leaders and employees. It might be said that both models are consistent.

7.1.1.5 Other existing frameworks of Lean Thinking implementation

From the literature review, a number of researchers have developed frameworks and/or models of Lean Thinking implementation. However, the majority of them (Motwani, 2003; Pavnaskar *et al.*, 2003; Anand and Kodali, 2009; Anand and Kodali, 2010; Dombrowski *et al.*, 2010; Yamamoto and Bellgran, 2010) focused on the frameworks and/or models of Lean Production/Manufacturing instead of Lean Thinking implementation. These frameworks provided a separated view rather than an integrated focus. Although 101 Lean tools were suggested in a classification scheme of Pavnaskar *et al.* (2003), this framework was unlikely to identify decision criteria and supporting factors that are essential to be considered in Lean Thinking application. On the other hand, the model of Motwani (2003) suggests strategic initiatives which include culture, learning and IT capacities, and human relationships as key aspects that needed to be evaluated in Lean Thinking implementation. These elements are consistent with a consideration of the strategic management and human resource management which were placed as supporting factors in the developed model of this study. However, Motwani (2003) rarely focused on the application of Lean tools in his model.

When considering the models of Anand and Kodali (2009, 2010), these two frameworks provided 65 Lean elements which included tools and other important aspects. Leadership, human respect, supplier relationship and customer focus were placed in the framework of Anand and Kodali (2009) similar to the developed model of this study. Although these aspects were not included in their further framework, 65 Lean elements were prioritised into different steps of Lean Thinking application similar to the model of this study. However, these frameworks of Anand and Kodali (2009, 2010) focused on Lean Manufacturing

instead of Lean Thinking implementation. Thus, this is a key difference between these two frameworks and the developed model of this research.

In the model of Dombrowski *et al.* (2010), strategic planning, resource management, communication and leadership were identified as crucial aspects that needed to be considered in Lean Thinking applications in small and medium enterprises (SMEs). These consideration aspects are similar to the devloped model of this study. However, the model of Dombrowski *et al.* (2010) focused on the implementation steps which were unlikely to provide any details on how to proceed with the above aspects. Additionally, there was a rare explanation of tool implementation. These are the differences between the models of Dombrowski *et al.* (2010) and this study.

Another framework that was used in a comparative analysis is the model of Jaaron and Backhouse (2011). In this model, leadership is emphasised as the most important aspect in supporting the achievement of Lean Thinking implementation. This is consistent with the finding of this study therefore it was placed as one of the critical supporting factors in the developed model. Other elements which were considered in the framework of Jaaron and Backhouse (2011), i.e. communication, team building and process management, were placed in the model of this study as well. However, it can be seen that Jaaron and Backhouse (2011) mainly focused on internal aspects in Lean Thinking application instead of the whole supply chain.

From the above comparative analysis, it can be seen that the developed model of this study provides a number of significant aspects consistent with the existing literature. Strategic management, leadership, human resource management and communication are key Lean elements that are placed in a number of the existing frameworks. However, these literatures tended to focus on the frameworks of Lean Manufacturing/Production instead of Lean Thinking. In addition, they had a particular focus rather than an integrated view of the supply chain. Therefore, it can be said that there is a gap in the literature not only in the comprehensive focus of Lean Thinking implementation but also in the framework of Lean Thinking both in the manufacturing and service sectors. The developed model of this study can fill these gaps by providing an integrated view of Lean Thinking application. Both internal and external elements that have an impact on Lean Thinking implementation are placed in the developed model.

In addition, this study provides a particular model for different industrial sectors, i.e. the manufacturing and service organisation units.

Furthermore, the developed model of this study answers to research problems on the university and important elements of Lean Thinking implementation. In order to be successful in quality improvement, tool prioritising, decision criteria and supporting factors are key elements that need to be carefully managed and aligned in the same direction.

7.1.2 The effectiveness in the implementation of the award winning organisations in Thailand

In order to assess the validity of the developed model, the effectiveness in the implementation of the award winning organisations in Thailand was evaluated as another measurement. As explained in the findings chapter, the balanced scorecard of Kaplan and Norton (1996) was used in assessing the improvements from Lean Thinking implementation. Four dimensions, which are financial, customer, internal business process and learning-and-growth, were investigated for the effectiveness of the implementation. This provides a comprehensive analysis of the organisational development from the application of Lean Thinking.

In the first dimension, mixed results were found in the financial performance of the award winning organisations. The participants had a significant improvement of revenue, operating income and inventory turnover; however, their cost of goods sold and cost per sale increased while gross and net profit margins were reduced after the implementation. In customers' perspectives, the award winning organisation were likely to have better relationships with their customers who had better experiences with higher satisfaction and fewer complaints. This was a result from the improvement of quality of product/service and on-time delivery. The significant developments in productivity and working environment were also evident in the internal business processes. Seven wastes or non-value-added (NVA) activities were reduced after the implementation of Lean Thinking as well. Due to an emphasis on human resource management, there are not only the increase of employee skill and contribution as well as

employee morale and satisfaction but also the decrease of employee turnover. These improvements are vital to create a learning-and-growth environment.

From the evaluation of the effectiveness of Lean Thinking implementation, it can be seen that there are improvements in all perspectives of the balanced scorecard except for the financial dimension. There are likely to be both positive and negative financial performances of the award winning organisations after the implementation of Lean Thinking. In fact, the model of this study was developed from the essential Lean elements which were applied by the award winning organisations in Thailand. Under the implementation of Lean elements, they could improve their organisational performance in several dimensions. Therefore, it can be assumed that the application of the developed model may result in improvements of these perspectives as well. Thus, it might be said that the developed model of this study has validity in the effectiveness of Lean Thinking implementation.

It can be seen that the developed model of this study has a number of Lean elements that are consistent with the existing literature. In particular, the developed model contains essential aspects of Lean Thinking which are related to the 4 P model of the Toyota Way created by Liker (2004). In addition, process, people and tools, which were crucial parts of the Lean Thinking application, needed to be integrated in the system model (Liker and Morgan, 2006). In fact, this proposed model provides a complete view of Lean Thinking implementation. It suggests not only tool prioritising but also a consideration of decision criteria and key supporting factors. This is found from a comparative analysis between the developed model and the 8P's model. The 8P's model of the Lean Business System was developed after finding limitations in the five principles of Lean Thinking (Hines, 2009). He claimed that the 8 P's model was a complete framework with more contingent and sustainable approaches. From the comparison, the model of this study and the 8 P's model shared a number of Lean elements. Therefore, it can be said that the model of this study has a comprehensive focus that covers all the important elements of Lean Thinking implementation.

In the evaluation of the model validation, the developed model of this study was proved from not only a comparative analysis with the existing literature but also the effectiveness of its implementation. As explained above, the proposed model

contains several Lean elements that are consistent with a number of key frameworks. Additionally, its effectiveness in the implementation was verified by an assessment of the organisational performance. Four perspectives of the balanced scorecard were applied to evaluate the improvements from Lean Thinking implementation. Although there were mixed results in the financial dimension, positive performances were evident in the other three perspectives. Therefore, it may be concluded that the developed model of this study has validity in both theoretical and practical application.

7.2 Refinement of the developed model

In the previous section, the developed model was compared and contrasted with the existing literature in order to verify its validity. In fact, the developed model of this study is comprised of a number of essential Lean elements similar to key literatures on Lean Thinking. In addition, the effectiveness of the implementation was proved by being based on four perspectives of the balanced scorecard. It was found that there were improvements in the majority of evaluation criteria. Therefore, it can be concluded that the developed model is valid in a real application.

However, in order to refine the developed model, a further review from both academics and practitioners who are experts in quality management and/or Lean Thinking was designed. A total of 25 professionals participated in evaluating the developed model. As shown in Table 7-1, 16 reviewers are practitioners operating in both manufacturing and service organisation units; they are top management, middle managers and internal consultants. These assessors from different responsibilities and/or levels of management in the award winning organisations could therefore provide the particular views that were integrated into a complete evaluation.

Table 7-1: Practitioners who participated in the model refinement process

Industry	Position in the Organisation Units			Total Respondents
	Top Management	Middle Management	Internal Consultants	
Manufacturing	3	3	2	**8**
Service	3	4	1	**8**
Total	6	7	3	**16**

Table 7-2: Academics who participated in the model refinement process

Area of Expertise	Years of Expertise			Total Respondents
	1-5	6-10	More than 10	
Operations, Supply Chain and Quality Management	2	3	1	**6**
Other Management Areas	3	0	0	**3**
Total	5	3	1	**9**

From a different perspective, nine academics participated in the model refinement process as shown in Table 7-2. They were interested not only in operations, supply chain and quality management but also in other areas of management such as marketing and financial management. Lean Thinking is indeed a system thinking (Bicheno and Holweg, 2009) that should be implemented in an entire organisation. Additionally, these scholars have ranges of experience from 1-5 years to more than 10 years. Therefore, a review from the scholars who have a variety of expertise and experience is valuable in providing different points of view that can be combined into a balanced evaluation. Thus, feedback from the assessment of the developed model from

qualified experts is worthwhile in improving the developed model to be an accurate and practical model of Lean Thinking implementation.

In the refinement process, an online questionnaire was designed based on three key elements of Lean Thinking in the developed model of this study. These Lean elements which are tool prioritising, decision criteria and supporting factors were individually reviewed by both practitioners and academics. After that, a complete picture of the developed model was evaluated for comprehensiveness, appropriateness and applicability. Overall, both practitioners and scholars weighted the developed model positively. The majority of them indicated that the model of this study was comprised of accurate and essential elements of Lean Thinking. Additionally, the developed model was valued in that it could be a useful application in real circumstances, i.e. that of the Thai contexts. However, a number of useful feedbacks were suggested by the reviewers. These suggestions therefore were applied to improve the developed model.

7.2.1 A review of tool prioritising

In a review of the first of the Lean elements, tool prioritising, all 25 experts considered that it was important to prioritise Lean tools in an implementation. They indeed weighted the degree of the importance of tool prioritising at approximately 84.67% on average. From the model development, a total of 30 Lean tools were categorised into three groups: Core, Consideration and Niche, as shown in Figure 7-4. The Core tools were likely to be usually applied in most award winning organisations in Thailand while the Consideration group is also important to be considered in the implementation. However, it tended to be applied in the award organisations less than the first group. The Niche tools were rarely implemented in these organisations in Thailand.

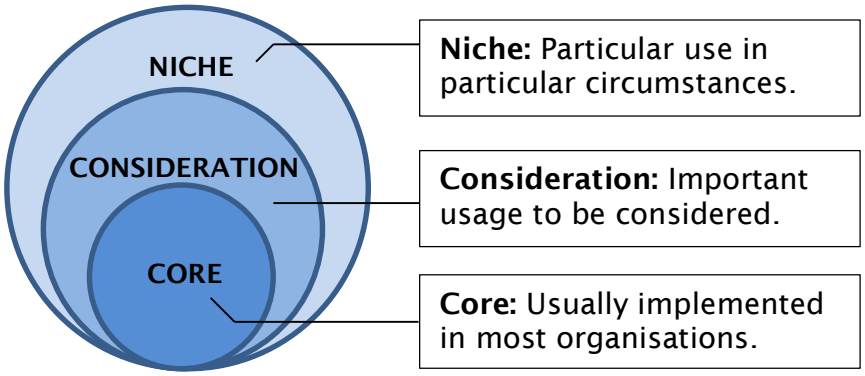


Figure 7-4: Three categories of Lean tools and their definitions

With these categories of Lean tools, 84% of the experts agreed that it was sensible to categorise Lean tools into the Core, Consideration and Niche groups, as shown in Figure 7-5. They explained that different Lean tools could be applied in different situations. In order to achieve quality improvement, Lean implementers need to consider their business requirements, organisational goals and objectives, internal processes and core competencies of their organisations. These aspects were indeed considered as decision criteria in the developed model of this study.

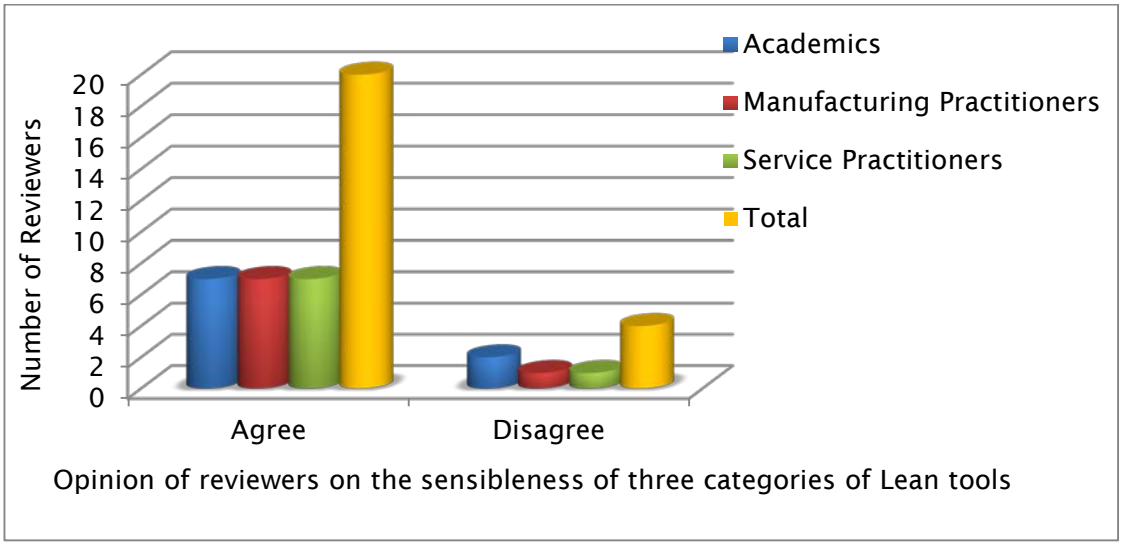


Figure 7-5: Opinion of reviewers on the sensibleness of three categories of Lean tools

The experts further weighted this tool prioritising as reasonable, clear and easy to understand that led to an ease of the implementation. These categories of Lean tools could not only assist a manager in making a decision but also guide an employee to select a proper tool by beginning from the Core group as the essential application. However, there are four experts who disagreed on these three categories of Lean tools. One interesting suggestion is that Lean tools need to be applied across functions. In the developed model of this study, the cross-functional team was suggested as one of the supporting factors that drive an organisation to achieve quality improvement programmes. Therefore, it can be said that it is sensible to categorise Lean tools into the Core, Consideration and Niche groups.

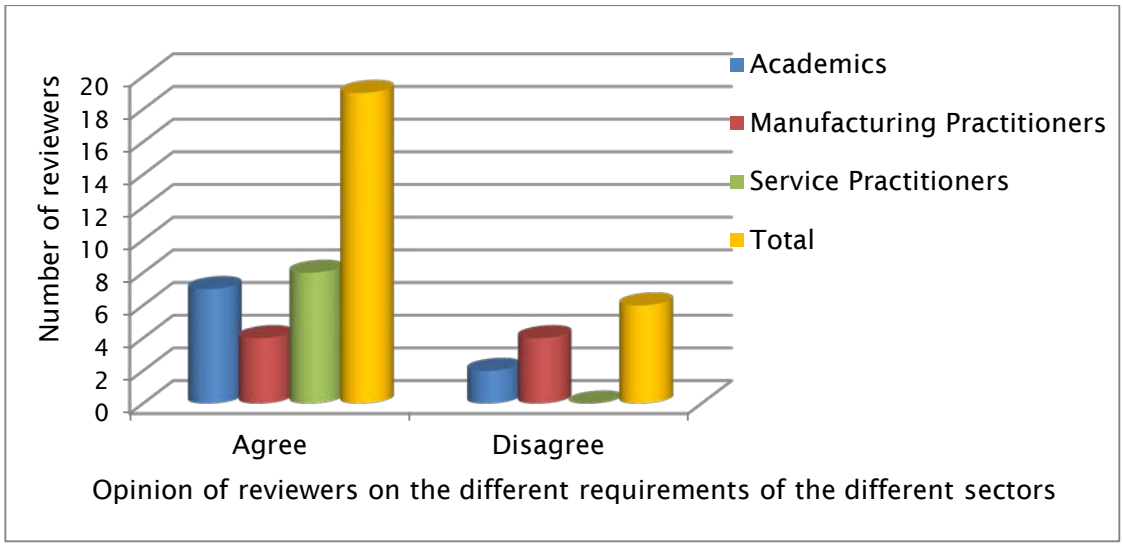


Figure 7-6: Opinion of reviewers on the different requirements between the manufacturing and service sectors

Furthermore, the majority of the reviewers agreed that organisations in the different sectors were required to prioritise Lean tools to meet their unique situations. As shown in Figure 7-6, no reviewer from the service sector believed that the manufacturing and service organisations could have the same priorities in Lean tool selection. A key reason for the particular requirement of tool application is the unique factors in running different businesses; service organisations have different contexts from manufacturing companies. Generally, procedures in the service sector are more flexible than those in the manufacturing businesses. This results in the differences of core competency and organisational strategies between two sectors. Due to having unique requirements, the manufacturing and service organisations therefore need to prioritise Lean tools differently.

However, approximately 25% of the reviewers disagreed that it was necessary to prioritise Lean tools differently between two sectors. This was because it was felt that both manufacturing and service sectors could apply the same Lean tools. In fact, the developed models of both sectors share the same set of Lean tools. However, these tools were prioritised differently between them. In other words, manufacturing and service organisations can apply the same Lean tools but in different situations. Therefore, there is a consistency between the suggestion of the experts and the proposed model that both industrial sectors

can apply the same set of Lean tools. In fact, the model of this study has a further recommendation. Although Lean tools can be applied in both sectors, in order to achieve quality development these Lean tools should be prioritised uniquely in the manufacturing and service businesses.

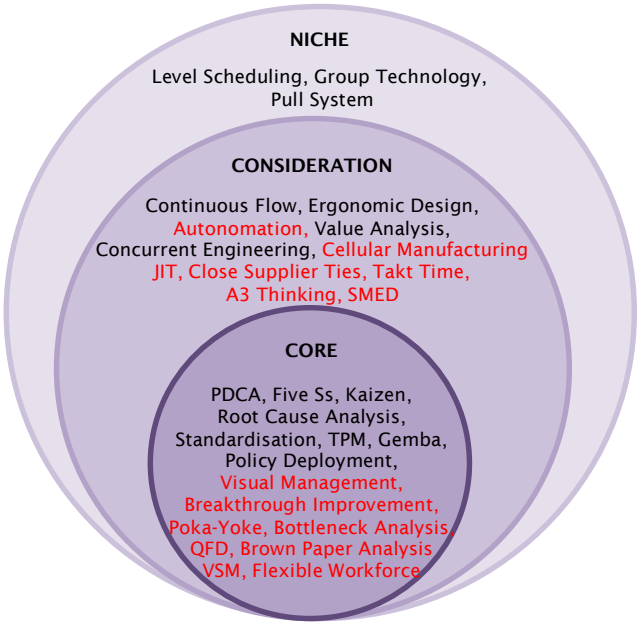


Figure 7-7: Tool prioritising in the manufacturing sector

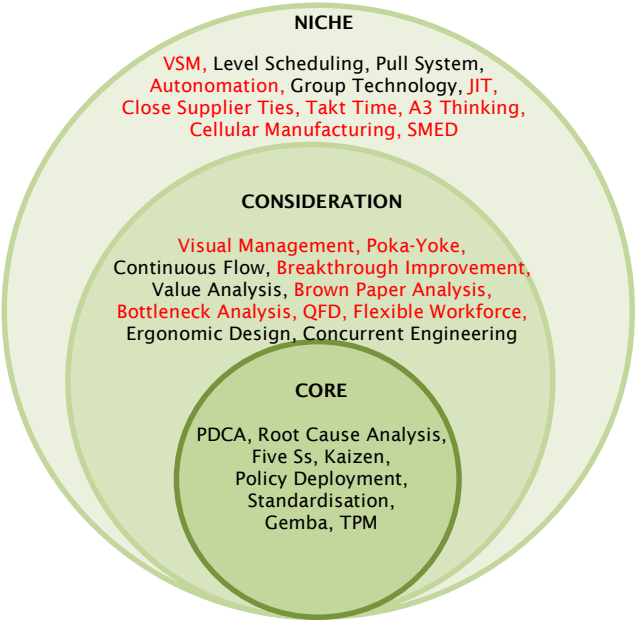


Figure 7-8: Tool prioritising in the service sector

Note: Where the tools appear in different parts of the diagram in the two sectors they are shown in red.

In the next evaluation of tool prioritising, the practitioners in both sectors weighted the accuracy of Lean toolboxes in the Core, Consideration and Niche categories. Due to having particular requirements in running their businesses, 30 Lean tools were likely to be applied by the award winning organisations in the manufacturing and service sectors differently, as explained in the empirical findings chapter. These implemented Lean tools were then prioritised uniquely between the two industrial sectors based on the frequency of the implementation. The tool prioritising of the manufacturing companies is shown in Figure 7-7, while that of the service organisations is shown in Figure 7-8.

In an evaluation of tool prioritising, only one expert in the manufacturing company disagreed with the tool arrangement, which is shown as Figure 7-7. A

reason for the disagreement was that Consideration and Niche could be integrated into one group. From the empirical findings, the Consideration and Niche tools were likely to be applied differently in the award winning organisations. Thus, there is no evidence to support an integration of the Consideration and Niche groups. On the other hand, manufacturing managers who weighted positively on tool prioritising explained that Lean toolboxes were categorised clearly and rationally. This led to easier implementation in a practical situation. Similarly, approximately 75% of practitioners in the service sector agreed on Lean toolboxes which were prioritised into the three categories. Thirty Lean tools were categorised reasonably, clearly and easy to understand. Particularly, the Core tools were likely to be the standard that could be applied in all types of organisations.

However, two experts in the service organisation units argued about the above tool arrangement. On the one hand, the value stream mapping (VSM) which was prioritised in the Niche group is the heart of Lean Thinking application. While, another expert suggested that some tools in the Consideration group could be used in all situations. In fact, 30 Lean tools were prioritised based on the frequency of the implementation of the award winning organisations in Thailand. This aimed to reflect the application of Lean Thinking in the real situation of the Thai contexts. Although Womack and Jones (1996) proposed the value stream as one of the key principles of Lean Thinking, in the Thai contexts the VSM was rarely implemented as explained in the empirical findings chapter. One tool may or may not be implemented frequently in the different organisations. Therefore, these categories of Lean tools, as shown in Figure 7-8, might challenge the universal applicability of Lean Thinking.

Furthermore, the differences of Lean toolboxes between the manufacturing and service organisations are presented in red letters in Figure 7-7 and Figure 7-8. Although two academics claimed that Lean tools could be applied similarly in both sectors, more than 75% of the scholars agreed on the differences of Lean tools between the manufacturing and service organisations. Due to having unique factors in running their businesses, both industrial sectors therefore need to prioritise their implementation of Lean tools uniquely. In fact, the most important thing that has to be considered is a process. Generally, service organisations require Lean tools that are more flexible than for manufacturing.

Therefore, the differences of Lean toolboxes which were categorised based on the frequency of the implementation are reasonable.

7.2.2 A review of decision criteria

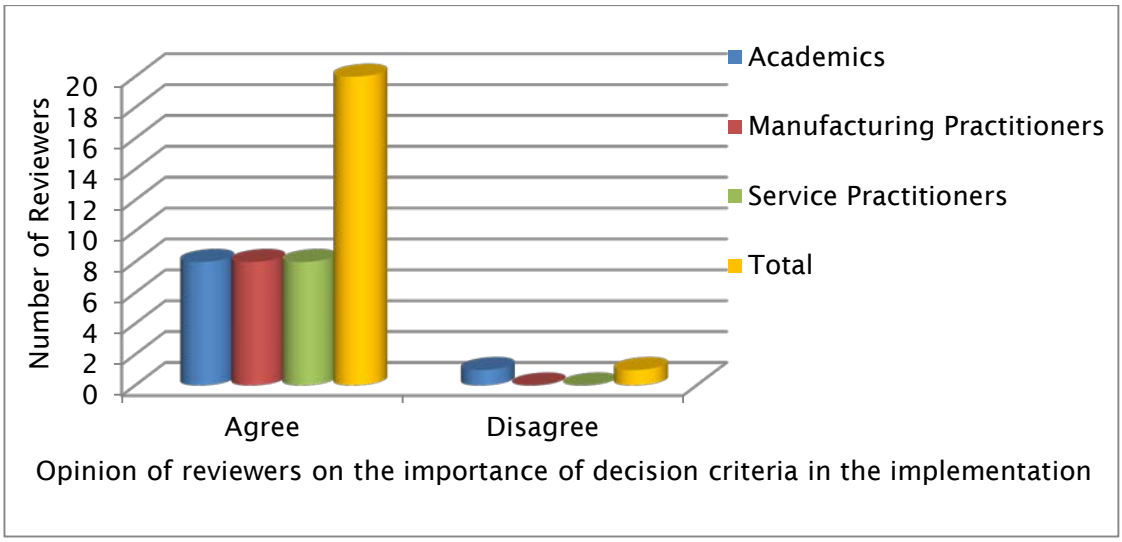


Figure 7-9: Opinion of reviewers on the importance of decision criteria in Lean Thinking implementation

In the second Lean element of the developed model, the decision criteria were suggested as significant factors which need to be considered before the implementation of Lean Thinking. From the survey, 96% of the reviewers considered that it was important to propose key criteria in making a decision on Lean Thinking implementation. As shown in Figure 7-9, only one academic disagreed on the importance of the decision criteria in Lean Thinking application. He claimed that Lean is the culture and thinking of people who plan to strive towards an organisation excellence. In fact, the second element of Lean Thinking in the developed model was decision criteria that need to be considered before making a decision on Lean Thinking application. These criteria include Strategic Planning, Organisation Readiness and External Suggestion as shown in Figure 7-10. The organisational culture and resources were indeed concerned in the model of this study.

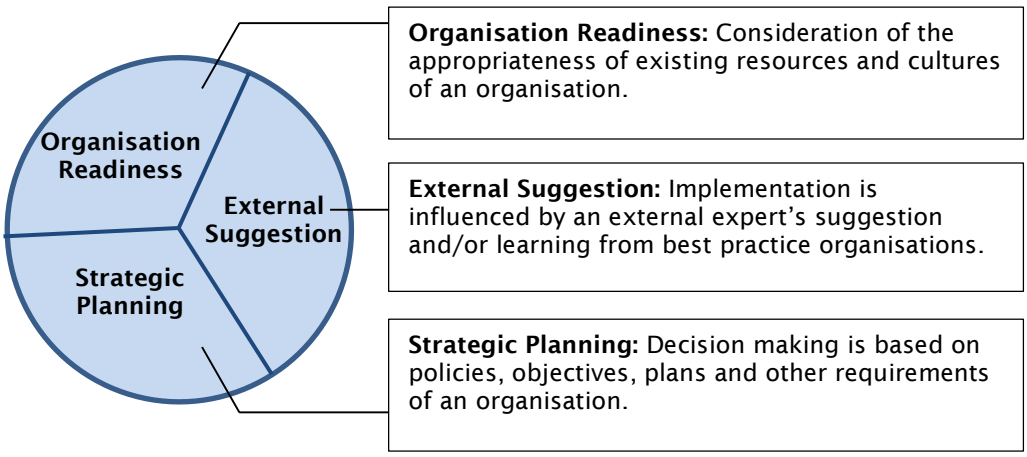


Figure 7-10: Decision criteria that need to be considered in Lean Thinking implementation

On the other hand, the majority of the reviewers weighted the decision criteria as guidelines that assisted Lean implementers in making a proper decision regarding their application. This is because Lean Thinking implementation cannot be applied in all circumstances. In contrast, it depends on the requirements and situation of the organisation. Without considering the decision criteria, Lean Thinking implementation cannot be achieved. In other words, the decision criteria can assist Lean Thinking implementers to select the most appropriate tools and techniques in practice due to a clear understanding of the need of their organisations.

Approximately 80% of total experts agreed that it is sensible to categorise decision criteria into three groups as shown in Figure 7-11. It can be seen that no reviewer from the manufacturing sector disagreed on the three categories of the decision criteria. They explained that these criteria were categorised reasonably and covered all important aspects that need to be considered before making a decision on Lean Thinking application. Two aspects that are vital in a consideration are Strategic Planning and Organisation Readiness. However, 20% of the reviewers did not totally agree on the three decision criteria. They suggested that although these criteria covered a number of significant aspects that had to be considered in the implementation of Lean Thinking, another factor that was equally important was the external aspect. Competition, law and

regulations, economics and technology should be evaluated before making a decision on Lean Thinking application.

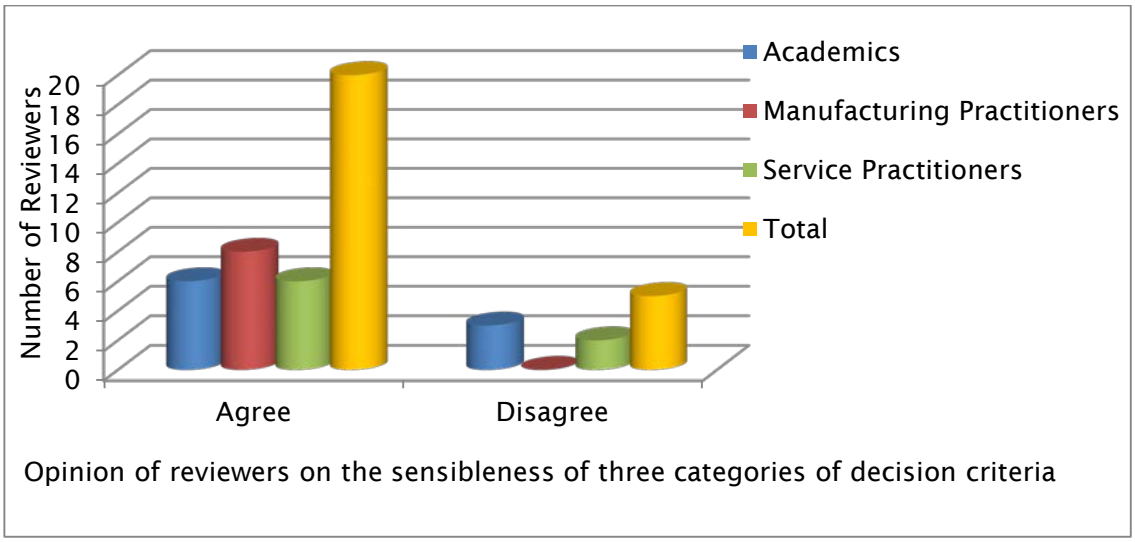


Figure 7-11: Opinion of reviewers on the sensibleness of three categories of decision criteria in Lean Thinking implementation

According to Porter (1985), a competitor as one of the five forces and other external environments need to be thoroughly analysed in order to formulate an appropriate strategy that is resulted in competitive advantage. In other words, in order to formulate a powerful strategy all external factors that affect an operation of an organisation need to be considered prudently. Thus, the well-informed managers would already have considered the suggested external aspects in setting their priorities and visions in planning the organisational strategies. Therefore, the external factors that were suggested by the reviewers are already subsumed in the developed model.

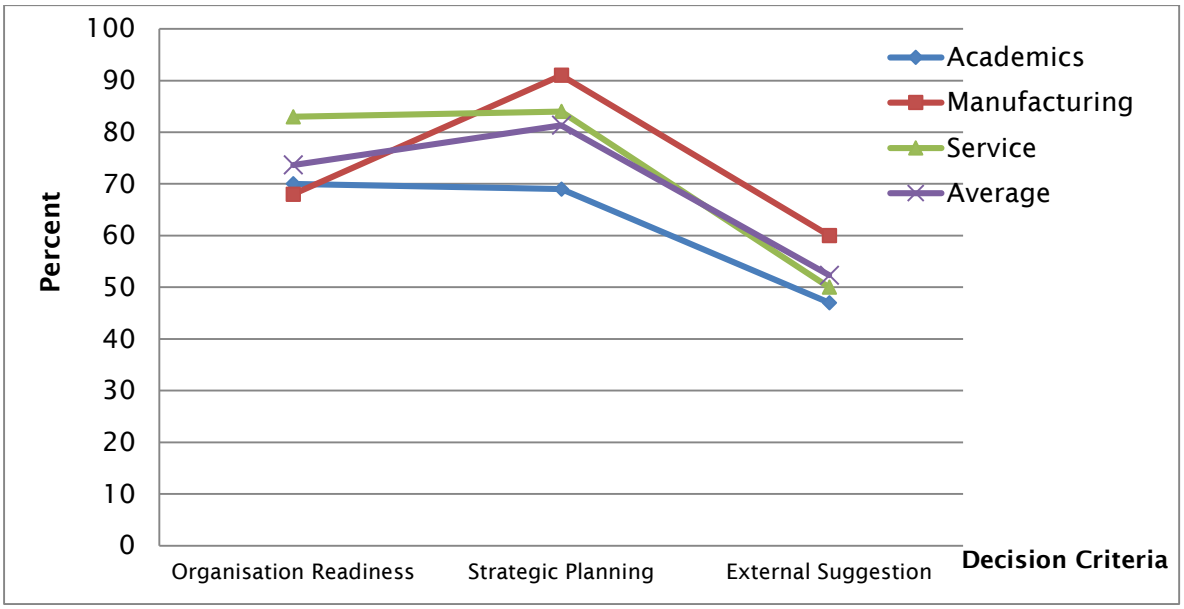


Figure 7-12: An evaluation of the degree of importance of the decision criteria

As shown in Figure 7-12, both academics and practitioners in the manufacturing and service sectors were likely to weight the importance of three categories of decision criteria differently. On average, Strategic Planning was ranked, at approximately 80%, as the most important factor that needed to be considered before making a decision on the Lean Thinking application, followed by Organisation Readiness and the External Suggestion. This evaluation was similar to the findings in the empirical study, i.e. that the majority of the award winning organisations were likely to consider organisational goals and objectives, vision and strategies as the most significant aspects that had to be assessed before implementing Lean tools and/or techniques. This is also consistent with the suggestion of Bendell (2005) that key decision aspects should be the primary needs of the organisation. One manufacturing practitioner further explained that:

> *"Due to being the company-wide approach, it was important to focus on a clear understanding, an organisational culture and a proper selection of tools. In parallel, after the implementation an organisation should propose a system to monitor, evaluate and receive feedback. Particularly, an assessment programme needed to be focused on the employee performance and recognition."*

This reflects the importance of strategic planning in supporting Lean Thinking implementation. Obviously, the manufacturing practitioner valued Strategic Planning significantly higher than Organisation Readiness. Conversely, it can be seen that the academics and service practitioners considered the significance of Strategic Planning and Organisation Readiness almost equally. These reviewers insisted that Lean implementers needed to consider the existing situation of their organisations in order to prepare their organisational resources to support the implementation of Strategic Planning. In other words, Organisation Readiness should be considered in parallel with Strategic Planning in Lean Thinking implementation.

However, the External Suggestion was considered to be the least important criteria by both academics and practitioners in the two industrial sectors. It was weighted at approximately 52% on average. The external suggestion was indeed influenced by the suggestions and learning from the external experts and the business excellence organisations. This assessment is similar to the study by Thawesaengskulthai and Tannock (2008) that states the suggestion and learning from the outside organisation is generally weighted as the least important factor in making a decision on the implementation of quality management. Therefore, this evaluation from the experts who are scholars and practitioners in both manufacturing and service organisations may suggest that the decision criteria that are used in making a decision on Lean Thinking implementation are mostly focused within organisations.

7.2.3 A review of supporting factors

More than 95% of the total reviewers agreed that an organisation needs to consider a number of supporting factors in order to achieve the implementation of Lean Thinking. However, only one scholar disagreed with this statement, as shown in Figure 7-13. He claimed that Lean Thinking was not a quick win therefore it needed time in the application. In the developed model, time was considered as one of the vital resources of the organisation. In the Japanese organisations, quality was learned and improved many years before reaching the operational excellence (Brown, 1997). Thus, it needs to be managed wisely in order to reach the best results from the Lean Thinking application. It can be said

that this academic and the researcher have the same point of view on the importance of time management.

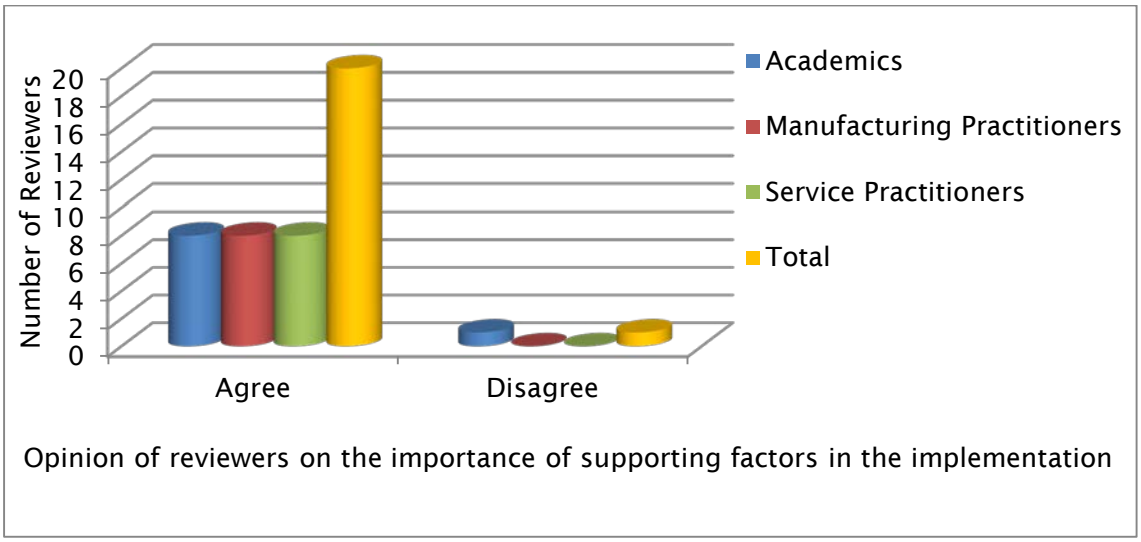


Figure 7-13: Opinion of reviewers on the importance of supporting factors in Lean Thinking implementation

The majority of the reviewers highlighted that supporting factors were indeed influential in the achievement of Lean Thinking application. Hence, it was crucial to consider both internal and external factors in order to prepare employees to be responsible for the improvement programmes. From the consideration of these factors, if an organisation has a limitation, it can select tools that are appropriate to its condition in parallel with a proper management by considering the value of customers. The reviewer further suggests that the most important aspect that supports success in Lean Thinking implementation is leadership. Again, this explanation is consistent with the empirical finding that without management support, Lean Thinking application cannot be achieved.

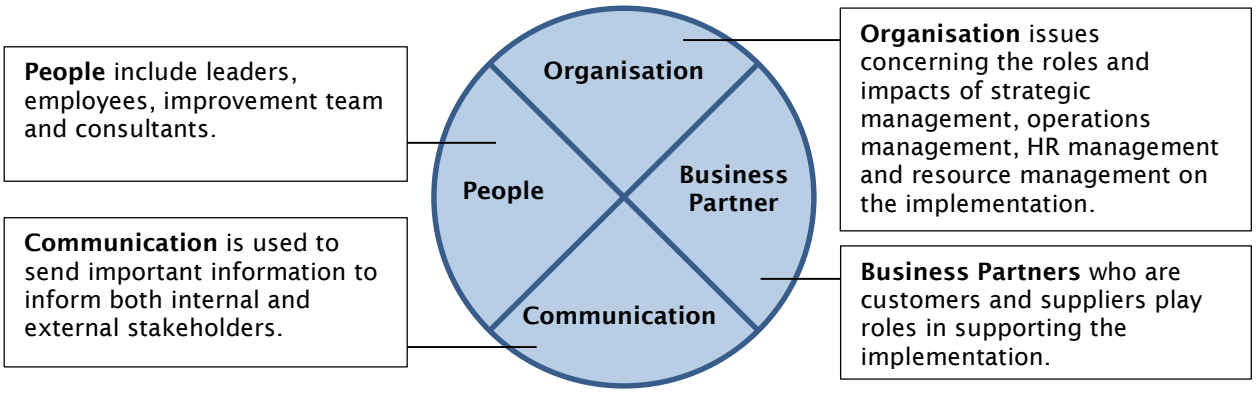
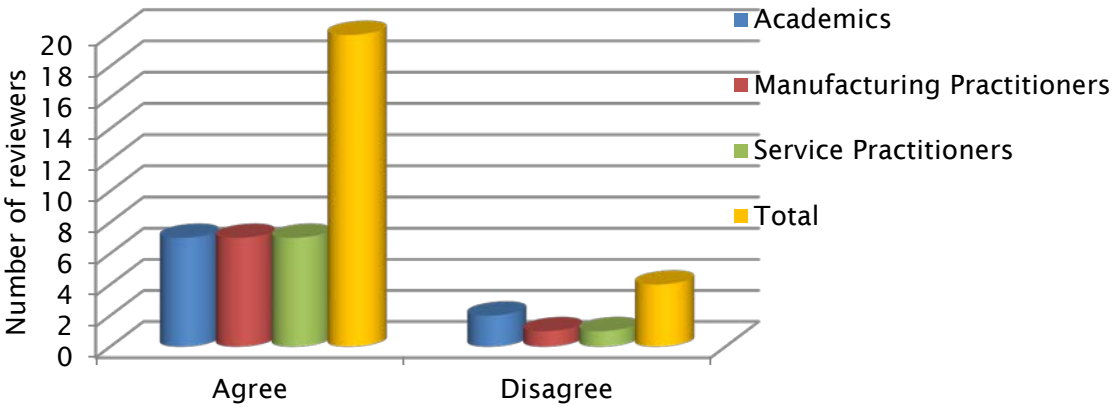


Figure 7-14: Supporting factors in Lean Thinking implementation

In the third Lean element of the developed model, four categories of supporting factors were identified, as shown in Figure 7-14. These aspects have been defined in this study as People, Organisation, Communication and Business Partner. Approximately 84% of the reviewers agreed that these four categories of the supporting factors played important roles in supporting the achievement of Lean Thinking implementation, as shown in Figure 7-15. They explained that these supporting factors were clarified clearly and covered all related aspects of Lean Thinking application. It was important to consider Lean Thinking as a system (Bicheno and Holweg, 2009). Therefore, a number of the reviewers suggested Lean implementers to carefully manage these supporting factors in an entire organisation rather than focus on only a specific area.



Opinion of reviewers on the sensibleness of four categories of supporting factors

Figure 7-15: Opinion of reviewers on the sensibleness of four categories of supporting factors in Lean Thinking implementation

Additionally, these four categories of supporting factors in the developed model included both internal and external influences; however, a competitive environment was advised to be placed in the developed model. Although they are not obviously presented, a competitive environment and other external environments are included in the developed model. As explained in the previous section, managers must consider all external environments in order to drive their strategic management effectively. In order to achieve in the Lean Thinking application, the developed model of this study therefore suggests Lean implementers to formulate and implement the strategic management carefully. In order to do that, an analysis of not only a competitive environment but also other external factors has to be done thoroughly (Porter, 1985).

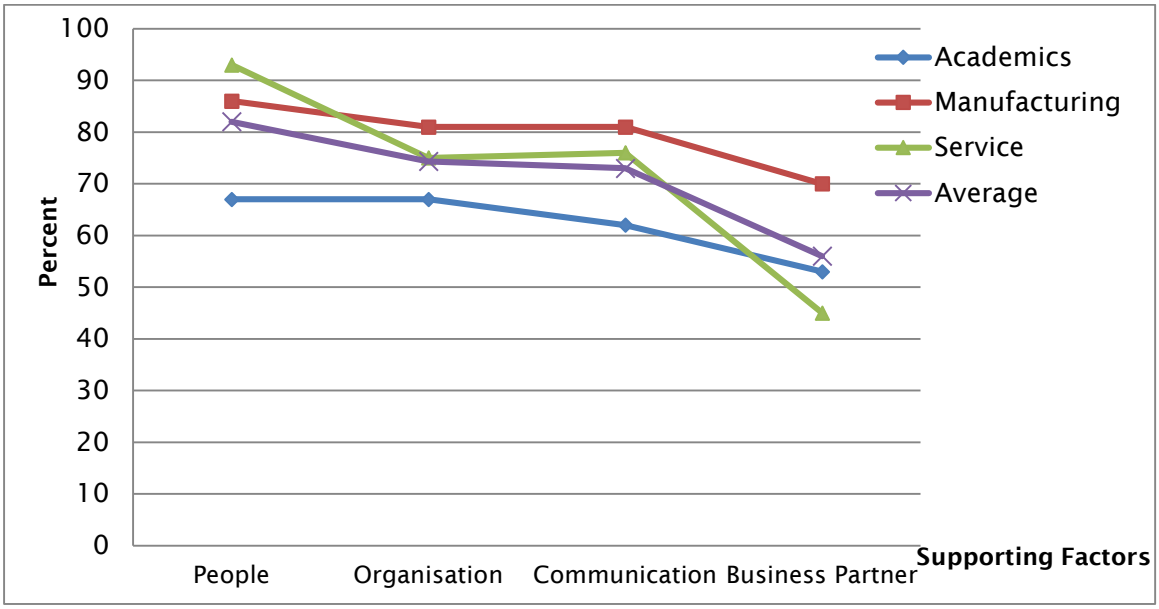


Figure 7-16: An evaluation of the degree of importance of the supporting factors

Nevertheless, a number of the reviewers claimed that when compared to other factors, the business partner might be the least important aspect in supporting the implementation of Lean Thinking. As shown in Figure 7-16, it is evident that both scholars and practitioners in the manufacturing and service businesses were likely to weight the importance of the Business Partner in Lean Thinking implementation at approximately 55% on average. Once again, this reflected a low concern about the roles of suppliers and customers in running quality improvement in Thailand. This is similar to the findings of both Pradabwong *et*

al. (2012) and the empirical findings of this study. It might be said that Lean Thinking implementation in Thailand is likely to be mostly based within individual organisations rather than spanning the whole supply chain.

On the other hand, People, which included the leaders, employees, improvement teams and consultants, were considered as the highest rank of supporting factors at approximately 82% by the academics and practitioners in both sectors. Particularly, a leader was considered to be a key person in initiating and sustaining Lean Thinking implementation. The Organisation and Communication were evaluated as the second and third important factors, respectively. The majority of the reviewers claimed that four categories of the supporting factors covered a number of essential aspects that needed to be considered and managed wisely. In fact, it was important to consider both internal and external environments in order to adapt the Lean Thinking application to be appropriate with the organisation situations.

From the above evaluation, three Lean elements in the developed model, which are tool prioritising, decision criteria and supporting factors, were individually reviewed. It can be seen that the majority of the reviewers agreed on these three elements in the developed model. In addition, they weighted the importance of each sub-element at least at 52% on average. Thus, it may be said that tool prioritising, decision criteria and supporting factors in the model of this study are accurate in both theoretical and practical application. In order to verify the developed model, the degrees of comprehensiveness, structural appropriateness as well as usefulness and applicability of the developed model were further evaluated by the academics and the practitioners in the manufacturing and service sectors.

7.2.4 A review of a complete picture of the developed model

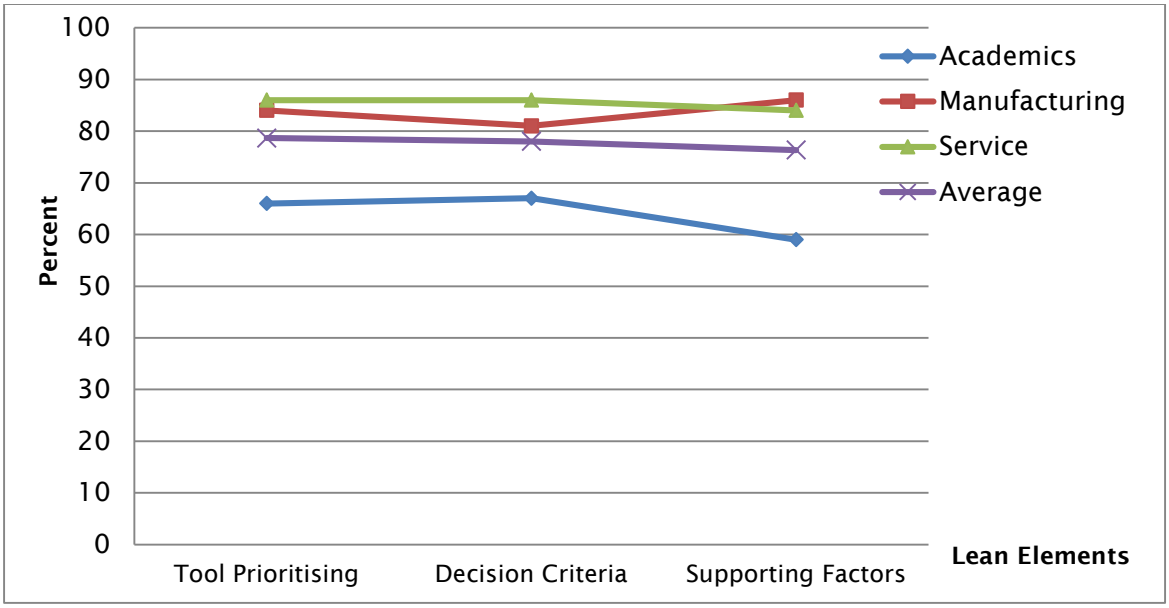


Figure 7-17: An evaluation of the degree of comprehensiveness of Lean elements

As shown in Figure 7-17, the degree of comprehensiveness of three Lean elements was assessed by the experts. It can be seen that the practitioners in both sectors tended to have similar points of view on the comprehensiveness of tool prioritising and supporting factors. They weighted these two Lean elements at approximately 85%. It can be noticed that the scholars tended to determine the comprehensiveness degree of three Lean elements lower than the practitioners. However, their comprehensiveness was weighted at least at 59%. On average, the comprehensiveness degrees of tool prioritising, decision criteria and supporting factors were evaluated at more than 75%. Therefore, it might be said that the degree of comprehensiveness of three Lean elements were confirmed by not only academics but also practitioners in both the manufacturing and service businesses.

The developed model was further evaluated on its degree of appropriateness as shown in Figure 7-18. The reviewers considered that the developed model was easy to understand. They therefore weighted the degree of clarity at approximately 75% on average. Additionally, the experts evaluated that Lean elements in the developed model were related, at more than 80% of the total

score. Both academics and practitioners also affirmed that the structure of the developed model was accurate. They weighted the degree of accuracy at 79% on average. It can be seen that all evaluation criteria of the model structure were evaluated positively at approximately 78% on average. Therefore, the structure of the developed model was likely to be valued on not only its clarity and accuracy but its relatedness to Lean elements as well.

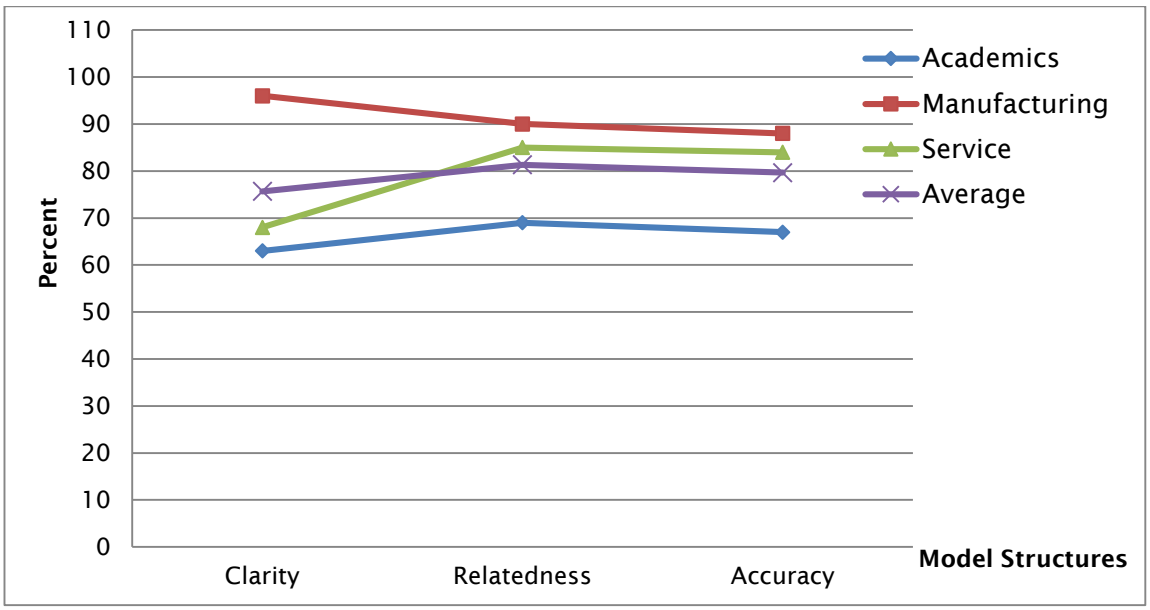


Figure 7-18: An evaluation of the appropriate degree of the structure of the developed model

Another evaluation was on the degree of usefulness and applicability of the developed model. As shown in Figure 7-19, the academics and practitioners in both sectors affirmed that the developed model could be used to assist Lean implementers to prioritise their works at approximately 76% on average. Additionally, several important elements of Lean Thinking were identified in the developed model. These elements needed to be considered both before and during the implementation in order to reach the best result from Lean Thinking. Hence, the usefulness of the vital Lean elements was weighted at more than 75% on average. The developed model was also recognised for its applicability in a real situation at approximately 75% on average. This might be because the model provides various Lean elements which can be used to prioritise Lean

implementers' work. Overall, both academics and practitioners were likely to weight the developed model at approximately 80% on average. It can be said that the model of this study was verified on both its usefulness and applicability in a real situation.

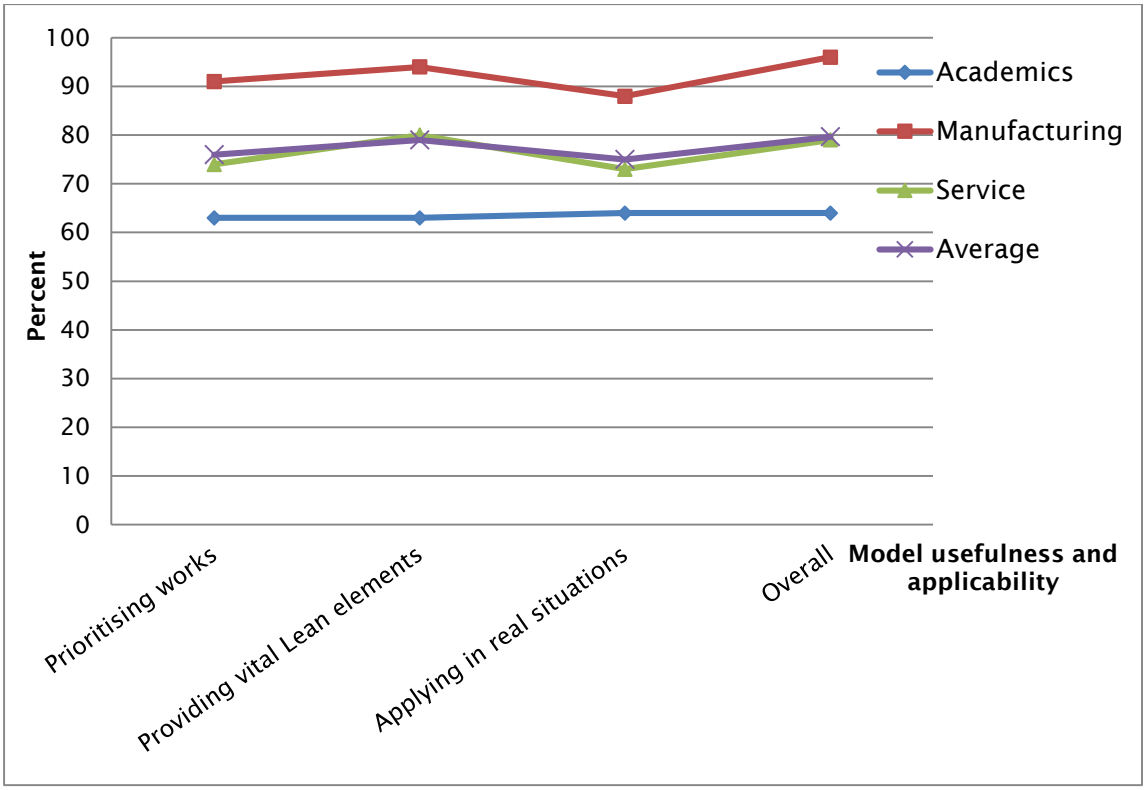


Figure 7-19: An evaluation of the degree of usefulness and applicability of the developed model

The scholars and practitioners in the two sectors affirmed that the developed model covered several significant aspects that needed to be considered in Lean Thinking application. Lean elements which included both the hard-side and soft-side of Lean Thinking were reasonably arranged. A key strength of the developed model was therefore completeness. This was because it provided a number of related aspects which had an impact on Lean Thinking implementation. The model was also clear and easy to understand. In addition, there were particular models for both manufacturing and service organisations due to the uniqueness in running their businesses.

One evaluation from a professional who is not only in top management but also the internal consultant in a manufacturing company concluded the reviews from all experts as follows:

> *"All significant aspects which are Lean tools, decision criteria and supporting factors are related and covered essential elements in Lean application. It also recognises not only internal aspects but also external factors that can be utilised practically. This model may be a complete model that supports an achievement in Lean implementation which leads to organisational excellence."*

However, a number of reviewers were concerned about the complication of the developed model. Due to having numerous elements and sub-elements in Lean Thinking implementation, the model of this study might cause a Lean implementer to be confused in its application. Particularly, people who are not familiar with Lean Thinking might find it somewhat difficult to understand. In fact, the model of this study was developed to present a complete picture of Lean Thinking implementation. Therefore, it is essential to place all related elements of Lean Thinking into the model. If a reader begins from a particular element in the developed model, he or she may understand the model as a guideline for Lean Thinking implementation more clearly.

Another concern from one scholar emphasised the applicability of the model in a real situation. He suggested that it would be better to learn from the organisations that implemented Lean Thinking as day-to-day operations. However, this study aims to study how Lean Thinking was implemented alongside Total Quality Management (TQM) in the award winning organisations in Thailand. Therefore, the suggestion from this academic may be applied in a future research that focuses on how Lean tools and other essential elements are applied in the mature operator of Lean Thinking. After that, a comparative analysis on the Lean Thinking application between the beginners and the advancers in Thailand is sensible to be investigated as a future work.

From the above evaluation, it can be seen that the majority of the reviewers assessed the developed model positively. They evaluated three Lean elements, which are tool prioritising, decision criteria and supporting factors, as important features that needed to be prepared and managed thoroughly in Lean Thinking

implementation. The developed model was valued on its comprehensiveness of three Lean elements at 78% on average. The professionals claimed that these Lean elements in the developed model were clearly structured, related and accurate. This leads to an ease of implementation in a real situation. Additionally, the experts considered that the developed model could be used to assist Lean implementers to prioritise their work. Overall, the model of this study was weighted at approximately 80% on average.

Therefore, it can be said that the developed model is accurate theoretically and appropriate practically. The evidence for this statement is verified by the model validation and refinement processes. In the model validation, a comparative analysis was done by comparing and contrasting the elements and sub-elements of the developed model to those of the existing literature. A number of consistencies between the model and the existing literature were identified. The developed model can indeed fill the gap on both the comprehensive focus of Lean Thinking implementation and the framework of Lean Thinking in both manufacturing and service sectors by providing an integrated view of Lean Thinking application. In addition, this study provides a particular model for different industrial sectors, i.e. the manufacturing and service organisation units.

The model of this study was also used to answer to research problems that tool prioritising, decision criteria and supporting factors are significant aspects in Lean Thinking implementation. In order to achieve quality improvement, these three Lean elements need to be managed thoroughly. Additionally, the developed model might be used to solve a practical struggle in a real application by suggesting why it is important to do quality improvement, how to be successful in Lean Thinking application and what Lean tools should be selected to be fitted with an organisational circumstance.

7.3 The refined model of Lean Thinking implementation

In the model refinement, experts who are academics and practitioners in both the manufacturing and service sectors evaluated the developed model on a number of evaluation criteria positively. The model of this study was evaluated on the comprehensiveness of Lean elements, appropriateness of the structure

and usefulness and applicability of the model. However, in order to create a complete model some suggestions from the experts in the model refinement process were used to improve the model.

Table 7-3: Decision criteria used in the consideration of Lean Thinking implementation

Decision Criteria	Definition and sub-criteria
Strategic Planning	Decision making is based on policies, objectives, plans and other requirements of an organisation. • Organisation Objectives and Strategies • Management Policy • Business Requirement • Solve Business Problem • Sustain Competitiveness
Organisation Readiness	Consideration of the appropriateness of existing resources and cultures of an organisation. • Organisation Culture • Ease of Implementation • Appropriateness for the Organisation • Organisation Resources • Employee skill and knowledge
External Suggestion	Implementation is influenced by an external expert's suggestion, learning from best practice organisations and/or other external environments. • Consultant's Suggestion • Business Results of Best Practices • Feedback from Assessment • Law and Regulations • Technology Development • Supplier/Customer Programmes
Note: Where sub-criteria were added from the model refinement they are shown in red.	

Another model refinement was in the Organisation Readiness, although no expert suggested any additional aspects for this criterion. In order to provide a

complete understanding of the decision criteria, organisation resources as well as employee skill and knowledge were additionally identified as another two sub-criteria that needed to be considered before making a decision on the Lean Thinking application. Additionally, a definition of the External Suggestion was edited in order to cover new additional sub-criteria as shown in Table 7-3.

Firstly, the supplier/customer programmes were initially placed in the Organisation Readiness criterion. However, some experts considered that these programmes should be categorised as an External Suggestion because if they were not, this might cause Lean implementers to be confused in a real application. In order to prevent this problem, the supplier/customer programmes were therefore removed from the Organisation Readiness and placed in the External Suggestion criterion, as shown in Table 7-3.

In the evaluation of the supporting factors, the experts advised placing a competitive environment in the developed model. In fact, all external environments need to be considered in formulating and implementing the strategic management. Thus, an analysis of external environment is implied as a part of the Strategic Management that is already suggested in the model of this study. Therefore, there is no refinement in the supporting factors in the developed model as shown in Table 7-4.

Table 7-4: Supporting factors in Lean Thinking implementation

People	Organisation	Communication	Business Partner
1. Leader - Commitment of Senior Management - Lean Leadership - Buy-in - Role Model - Involvement - Management Support **2. Employee** - Employee Attitude - Commitment and Involvement - Employee Skill and Knowledge - Employee Empowerment **3. Improvement Team** - Cross Functional Team - Functional Team **4. Consultant** - Internal Expert - External Expert	**1. Strategic Management** - Management Policy - Strategic Planning - Organisation Objectives - Organisation Culture and Value - Alignment and Integration - Trust Environment - Open Door Policy **2. Operations Management** - Safety and Environmental Management - Risk Management - Project Management - Change Management - Waste Management - System of Product/service Management - Market Service Logistics **3. Human Resource Management (HRM)** - Discipline and Regulation - Employee Motivation - Education and Training - Knowledge Management - Job Rotation - Job Enrichment - Cross-Trained Worker - Reward and Recognition - Happiness Workplace **4. Resource Management** - Fact and Data - Budget - Equipment - Time - Infrastructure	**1. Two-way and Transparency** **2. Voice of Employee** **3. Voice of Customer** **4. Voice of Community** **5. Voice of Supplier**	**1. Customer** - Customer Focus - Customer Relations Management - Customer Involvement - **2. Supplier** - Supplier Evaluation - Supplier Development - Supplier Involvement

Therefore, the developed model was refined in only one Lean element: decision criteria. In the decision criteria, the organisation's resources and employees' skill and knowledge were added as sub-criteria of the Organisation Readiness. In order to avoid confusion in a real application, the supplier/customer programmes were moved from the organisation Readiness to the External Suggestion criterion. A definition of the External Suggestion was also edited in order to cover new sub-criteria which were added in the developed model.

The model of Lean Thinking implementation was therefore refined, as shown in Figure 7-20. In this model, three Lean elements, which are tool prioritising, decision criteria and supporting factors, are identified in parallel with their definitions. Due to having unique requirements in running the businesses, the manufacturing and service organisations prioritised Lean tools differently. The model of Lean Thinking implementation in the manufacturing sector is shown in Figure 7-21 while that in the service sector is shown in Figure 7-22. Furthermore, in order to make clear the perspectives of differences in the implementation between the two sectors, a complete model of Lean Thinking application that presents a comparative view of different tools between the manufacturing and service sectors is shown in Figure 7-23. These developed models therefore support the analysis of how Lean Thinking was implemented alongside Total Quality Management in the award winning organisations in Thailand.

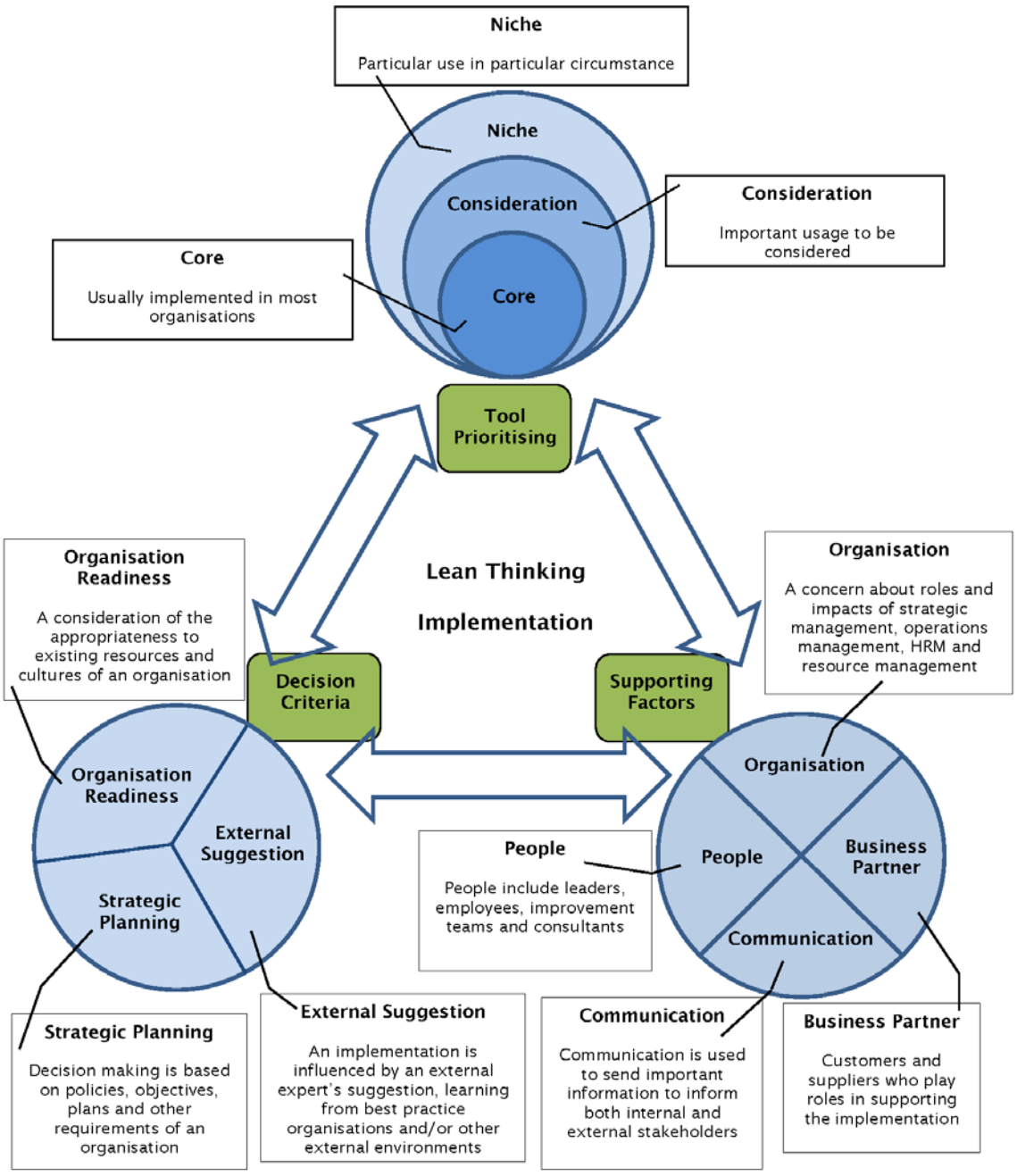


Figure 7-20: Lean Thinking Elements and Interaction Model

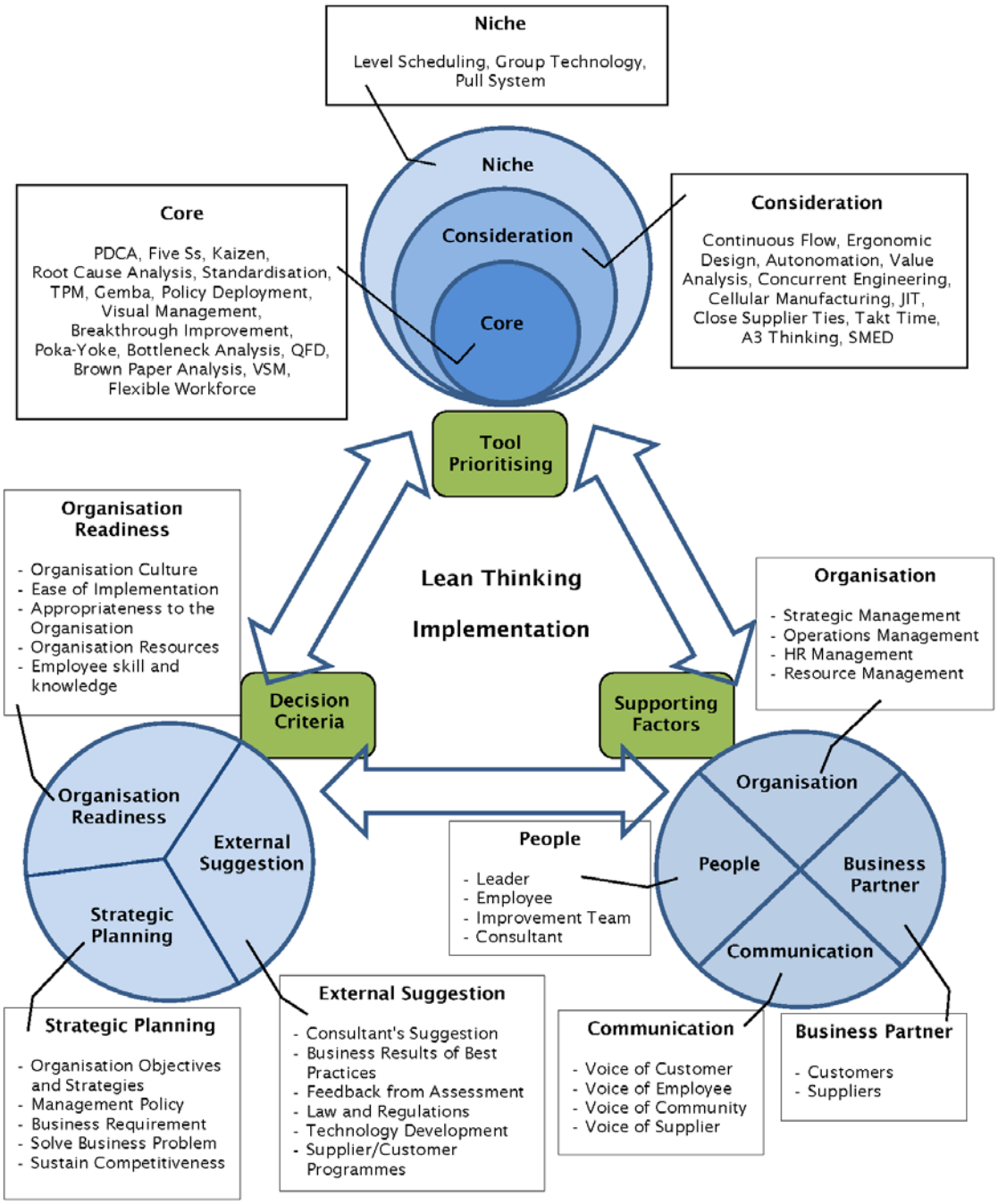


Figure 7-21: Lean Thinking Elements and Interaction Model in the Manufacturing Sector

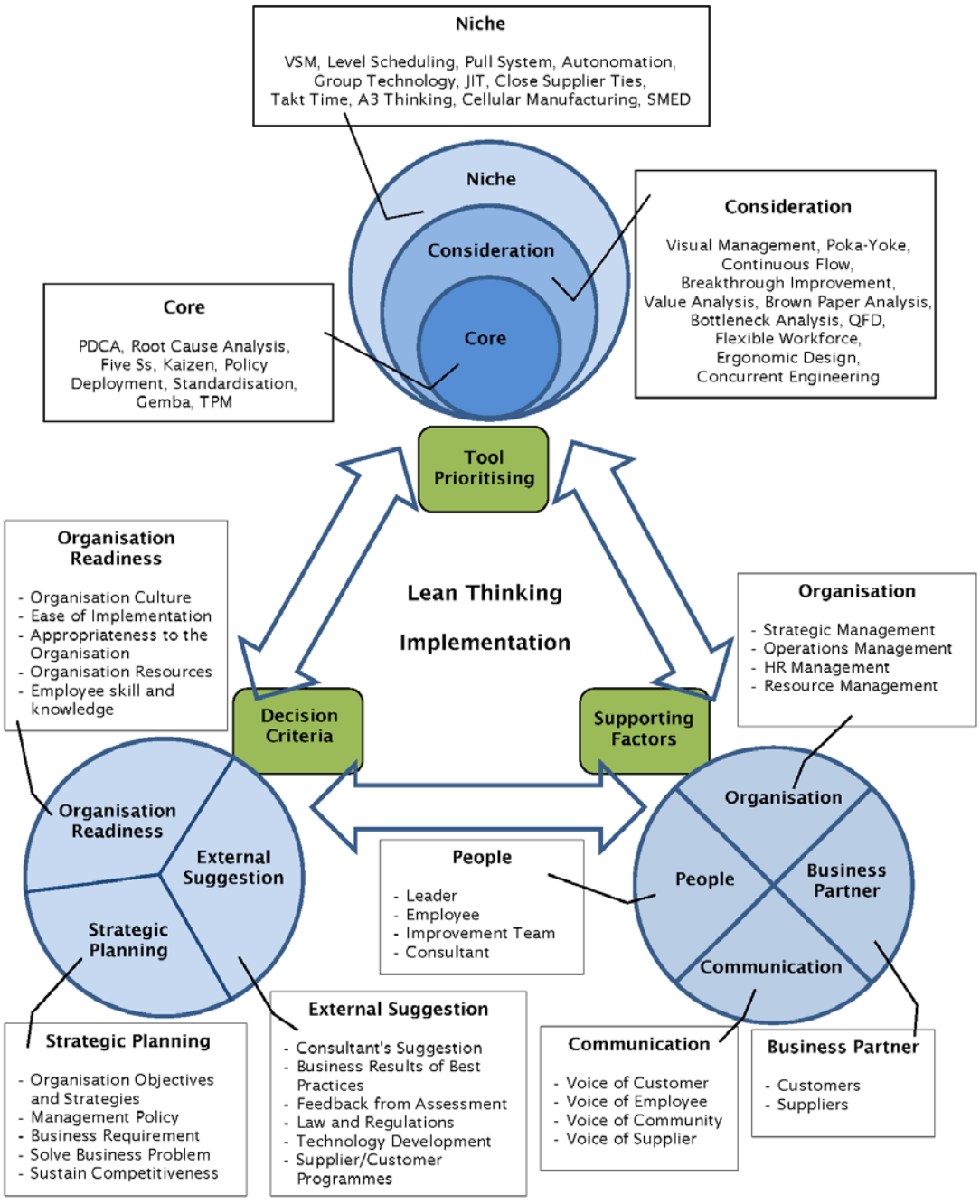
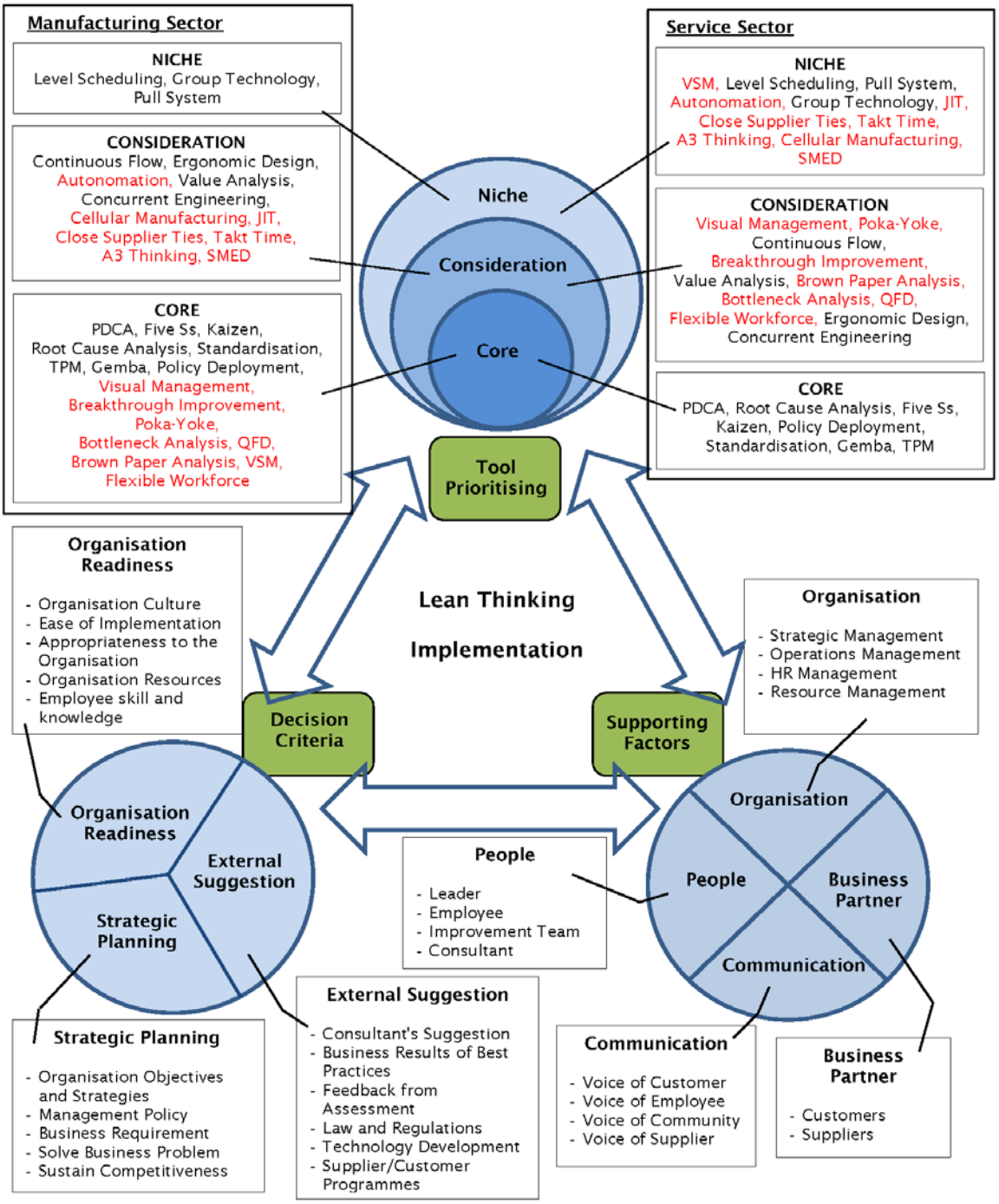


Figure 7-22: Lean Thinking Elements and Interaction Model in the Service Sector



Note: Where the tools appear in different parts of the diagram in the two sectors they are shown in red.

Figure 7-23: Lean Thinking Elements and Interaction Model in the Sector Comparison

7.4 Chapter Conclusion

In order to examine the validity of the model, a comparative analysis was done by comparing and contrasting Lean elements of the developed model with those of the existing literature. In the analysis, Lean Thinking frameworks or models were searched from books and journal articles. This aimed to compare the developed model with the frameworks which were created from both theoretical and practical bases. From the analysis, the model of this study provides a number of significant aspects that are consistent with the existing literature. Strategic management, leadership, human resource management and communication are key Lean elements that were found in both the model of this study and a number of the existing frameworks.

In the evaluation of the model validation, the developed model of this study was proved from not only a comparative analysis with the existing literature but also the effectiveness of implementation. The proposed model contains several Lean elements that are consistent with a number of key frameworks. Additionally, the model's effectiveness in the implementation was verified by an assessment of the organisational performance. Four perspectives of the balanced scorecard were applied to evaluate improvements to the Lean Thinking implementation. Although there were mixed results in the financial dimension, positive performances were evident in the other three perspectives. Therefore, it may be concluded that the developed model of this study has validity in both theoretical and practical application.

In order to refine the developed model, a further review from both academics and practitioners who are experts in quality management and/or Lean Thinking was thoroughly designed. A total of 25 experts participated in the model refinement process. Nine of them are scholars who work in a number of universities in Thailand while the remainder are practitioners in both the manufacturing and service organisations. Three Lean elements of the developed model, which are tool prioritising, decision criteria and supporting factors, were individually reviewed by the experts. After that, a complete picture of the developed model was evaluated for its comprehensiveness, appropriateness and applicability. Overall, both practitioners and scholars weighted the developed model positively. Three Lean elements were evaluated as important features that

needed to be prepared and managed thoroughly in Lean Thinking implementation.

The developed model was valued on its comprehensiveness of three Lean elements at 78% on average. The professionals claimed that these Lean elements in the developed model were clearly structured, related and accurate. This leads to an ease of the implementation in a real situation. Additionally, the experts considered that the developed model could be used to assist Lean implementers to prioritise their work. The developed model of this study was therefore verified as accurate in its theoretical and practical applicability. Overall, the model of this study was weighted at approximately 80% on average and was valued as being a useful application in the real circumstances of the Thai contexts.

From the literature review, there is a gap in the existing literature not only on a comprehensive focus on Lean Thinking implementation but also on the framework of Lean Thinking in both the manufacturing and service sectors. The developed model of this study can fill these gaps by providing an integrated view of Lean Thinking application. Both internal and external elements that have an impact on Lean Thinking implementation are placed in the developed model. In addition, this study provides a particular model for different industrial sectors, i.e. the manufacturing and service organisation units.

Furthermore, the model of this study answers to research problems on the significant elements of Lean Thinking implementation. It provides three key elements that managers need to manage prudently. In addition, the developed model also identifies why it is important to do quality improvement, how to be successful in Lean Thinking application and what Lean tools should be selected to be fitted with an organisational circumstance. Thus, the developed model of this study not only contributes to an academic debate about significant elements of Lean Thinking implementation but also solve a practical struggle on where and how to begin an implementation of Lean Thinking.

Chapter 8: Conclusion and Contribution

This chapter concludes the thesis and discusses the research findings against the research objectives and propositions. Discussion of the logics and process of the developed model is also presented. The new contribution to knowledge that has been gained from the research outcomes is also highlighted. The limitations of the study are indicated and the possible areas for future research are also suggested in this chapter.

8.1 Summary of the research findings

This research aimed to examine the two underlying assumptions of the supposed universality of application of Lean Thinking and the second assumption was that all elements of possible application were equally important in Lean Thinking applications. The first assumption was tested by identifying whether there were particular and different choices of Lean tools and implementation sequences in the particular context of the selected businesses in Thailand. The second assumption was challenged by identifying which elements or features of Lean Thinking were considered to be essential to the different implementations, how this was decided and in what sequence they were implemented in order to achieve success in the quality improvement programmes of the different business units.

Although a number of researches have investigated how Lean Thinking has been implemented, most of them place emphasis on its application in a specific organisation which is either in the manufacturing or service sector. In fact, there are a very small number of researches that compare and contrast Lean application between the two sectors.

In addition, a framework which combines a set of tools, decision criteria and supporting factors in Lean Thinking implementation has until now been only partially and rarely constructed. In particular, a framework on Lean implementation in the context of Thailand is rarely presented. In order to address these problems and gaps, an academic model of Lean Thinking implementation has been developed as a new theoretical construct. This initially

developed conceptual model was used to evaluate the Lean Thinking application and to identify essential elements of Lean Thinking in the context of the selected Thai organisations.

The development of a conceptual academic model of Lean Thinking implementation is therefore the key outcome of this research. This model was developed to not only support the analysis of how Lean Thinking was implemented alongside Total Quality Management (TQM) but also to assist managers to do quality improvement through the Lean Thinking application successfully. In order to provide a complete theoretical construct, tool prioritising, decision criteria and supporting factors are given as the essential Lean elements in the developed model.

The model of Lean Thinking implementation was developed based on the findings from the empirical study. Lean Thinking implementation in the 22 award winning organisations in Thailand was investigated in order to understand what the essential parts of Lean Thinking were in their business context. In the investigation, not only was a set of Lean tools examined but also the roles of human resources in the Lean Thinking application through an online questionnaire and semi-structured interviews. Both internal and external aspects that were related to the implementation of Lean Thinking were studied as well. The findings from the investigation were used to discuss the universal application of Lean Thinking and to develop an academic model of Lean Thinking implementation.

From the developed model, Lean Tools, Decision Criteria and Supporting Factors were identified to be the significant elements in the implementation of Lean Thinking. These key Lean elements needed to be considered and managed thoroughly in order to achieve quality improvement. After that, the developed model was validated, through a comparative analysis with the existing literature and the effectiveness of the implementation of the award winning organisations. In order to refine the developed model, a further review from twenty five experts in quality management and/or Lean Thinking was applied through an online questionnaire. The developed model of this study was verified as valid and appropriate in both theoretical and practical applicability.

A summary of the research findings against the five research objectives and four propositions is shown in Table 8-1. Key findings are summarised in order to

indicate how the five research objectives and four propositions, which were listed in Chapter 1 and Chapter 2, have been achieved.

Table 8-1: Summary of the research findings against five research objectives and four research propositions

Research Objectives and Propositions	Key Findings
Research Objective: 1. To determine and compare which aspects of the Lean toolbox are widely implemented in the Business Excellence (BE) organisations.	- It was found that the BE organisations tended to apply Lean tools at different levels. - Overall, the PDCA, Five Ss, Kaizen, Root Cause Analysis and Policy Deployment are the top-five tools that were likely to be frequently applied in most BE organisations. - In contrast, the Pull System, SMED, Group Technology, A3 Thinking and Level Scheduling were probable the least implemented in these organisations. - The manufacturing and service organisation units were likely to weight PDCA, Five Ss, Kaizen, Root Cause Analysis, Standardisation, TPM, Gemba and Policy Deployment as the most frequently implemented, even though they were sequenced differently between the two sectors. - Hence, it might be said that these eight Lean tools tended to be essential to all businesses for quality improvement. The logic of these results suggests that an organisation, in whatever business sector, should implement these eight Lean tools at an early stage. - A key difference in the application of Lean tools between two sectors is likely to be the implementation of the VSM. It was generally applied in the manufacturing organisations; however, the service sector rarely implemented this tool.
Proposition: 1. Thai BE managers from different organisational groupings prioritise different choices of Lean tools in the implementation of Lean Thinking.	From the findings, not all Lean tools are implemented widely in the target organisations. Lean tools are only applied if they are consistent with the organisational circumstances. The manufacturing and service organisation units tended to applied Lean toolboxes differently. Thus, these findings confirm the first proposition that Thai BE managers prioritise different choices of Lean tools to be fitted with their business environments. Furthermore, the findings of this study are opposed to a claim of Womack *et al.* (1990) on the universality of Lean application. It might be possible to say that the Lean Thinking cannot be applied universally. It needs to be adapted to be appropriate with an organisational situation.

Research Objectives and Propositions	Key Findings
Research Objective: 2. To identify key decision criteria used by the BE managers in selecting which aspects of the Lean toolbox to implement.	- Key decision criteria that were likely to be mostly applied in the BE organisations in the two sectors were an alignment with organisational objectives and the purpose for increasing organisational performance. - Both internal and external factors were considered in making a decision on Lean Thinking implementation. - The internal factors include management policy, business requirement, solving business problems, sustaining competitiveness, organisation culture and resources, and ease of implementation. - On the other hand, the external aspects were learning from best practice organisations, consultant's suggestion, feedback from the assessment and external business environment, which includes supplier and customer. - Importantly, the TQA organisations in both sectors tended to have a low level of concern about the links to supplier/customer programmes being important criteria influencing a decision about the Lean application.
Proposition: 2. Current situations, future requirements and external factors are key criteria used by different Thai BE managers when deciding on which Lean tools to implement.	It was found that the BE organisations in Thailand tended to consider both internal and external aspects in making a decision on Lean Thinking implementation. This study proposed and defined three key decision criteria as Strategic Planning, Organisation Readiness and External Suggestion. Although these criteria are named differently from those in the second proposition, it can be confirmed that Thai BE managers were likely to consider not only current situations (Organisation Readiness), i.e. organisation culture and resources as well as future requirements (Strategic Planning), i.e. business requirement but also external factors (External Suggestion), i.e. consultant's suggestion. Furthermore, these findings confirm that a change should begin from a recognition of a need for an improvement (Kotter, 1995a) which was defined in this study as Strategic Planning, Organisation Readiness and External Suggestion. Additionally, a number of sub-decision criteria are similar to the studies of Thawesaengskulthai and Tannock (2008), Bendell (2005) and Kornfeld and Kara (2013).

Research Objectives and Propositions	Key Findings
Research Objective: 3. To explore how these managers support human resource roles and manage other important factors in their implementation of Lean Thinking.	- Leadership and management support were believed to be the most important factors in achieving quality improvement followed by the involvement of employees in both manufacturing and service organisation units. - Employees were considered to be their most precious asset, similarly to the Toyota concept. They therefore both motivated and educated their people and communicated with and listened to their employees regularly. - An Involvement of customer and supplier were likely to be the least important factors in the application of Lean Thinking in both manufacturing and service organisations. - Key barriers that were likely to obstruct the application process in the service organisation units were a resistance to change while in the manufacturing sector it was a short-term focus. Two-way and transparent communication as well as education and training were used to solve these problems in order to not only inform and receive important data but also adjust employees' attitude and improve their knowledge and skill.
Proposition: 3. Organisational management, intercompany management and human resource management are significant factors which need to be thoroughly managed in order to achieve quality improvement in selected Thai BE organisations.	The TQA organisations tended to place emphasis on human resource roles in Lean Thinking implementation. These findings confirm that in order to achieve in quality improvement it is important to place an emphasis on human resource roles similar to the studies of Liker (2004), Bicheno (2008) and Liker and Hoseus (2010). It was also found that Lean Thinking implementation was likely based within the individual organisation units rather than spanning across organisations into the supply chains. This finding is similar to the study of Pradabwong *et al.* (2012); however, it is opposed to the logics of Lean Thinking which were presented in the works of Womack and Jones (1996), Brown (1998c) and Bicheno and Holweg (2009) that Lean Thinking should be applied with a consideration on a development of an entire supply chain. This study proposed four key supporting factors as People, Organisation, Communication and Business Partner in which were related to the significant Lean elements in third proposition. It can therefore confirm that the Thai BE organisation managed these Lean elements thoroughly by considering an alignment in a management of both internal and external stakeholders in order to support the achievement of Lean Thinking implementation.

Research Objectives and Propositions	Key Findings
Research Objective: 4. To define critical Lean elements that support an achievement in quality improvement in these contexts.	- Lean tools, decision criteria and supporting factors are considered to be significant elements that lead to achieving quality development through Lean Thinking implementation. - Lean tools in the Core group were likely to be used by most organisations. The Consideration tools have specific and important uses, and ought to be considered. The Niche group tools are very context specific in their application and tended to be used by few BE organisations in the study. - Decision criteria which are considered when making a decision on Lean Thinking implementation are defined in this study as Strategic Planning, Organisation Readiness and External Suggestion. - People, Organisation, Communication and Business Partner are defined in this study as significant supporting factors that influence the achievement of quality improvement. - Decision criteria and supporting factors form the basis of the application of Lean tools to align and fit with an organisation's environments. These three elements are therefore essential and need to be linked to each other.
Proposition: 4. In the implementation of Lean Thinking, selected Thai BE managers consider reasons why it is important to implement Lean Thinking, how to implement in order to achieve quality development and what tools should be implemented in an organisation.	The developed model of this study provides three key elements in Lean Thinking implementation which are Tool Prioritising, Decision Criteria and Supporting Factors. These three key elements are related to those in the fourth proposition that Lean implementers should begin from considering Decision Criteria about why it is important to implement Lean Thinking in their organisations. Consequently, an organisation should consider how to manage People, Organisation, Communication and Business Partner as the Supporting Factors in order to achieve quality development. Then, Tool Prioritising should be considered to select what Lean tools are fitted with the organisational requirements and business circumstances. The logic in the use of the developed model suggests that Tools Prioritising, Decision Criteria and Supporting Factors should be managed in the same direction in order to ensure that all quality improvement strategies are aligned throughout an entire organisation. Therefore, the fourth proposition is confirmed that it is important to consider reasons for an application, supporting factors and a selection of proper tools in Lean Thinking.

Research Objectives and Propositions	Key Findings
Research Objective: 5. To refine, validate and develop the research model for Lean Thinking implementation.	- A comparative analysis of the existing literature and the effectiveness of the implementation by the TQA organisations were used to prove the validity of the developed model. - It was found that the developed model contained a number of aspects that were consistent with key literatures. - Positive performances were evident in three perspectives of the balanced scorecard; however, there were mixed results in the financial dimension. - A further review from 9 academics and 16 practitioners who are experts in quality management and/or Lean Thinking was undertaken in order to refine the developed model through an online questionnaire. - On average, the comprehensiveness degrees of Lean elements were evaluated at more than 75% while the model structure was evaluated positively at approximately 78%. - The developed model was also recognised for its applicability in a real situation at approximately 75% on average. Overall, it was weighted at approximately 80% on average.
Proposition: 4. In the implementation of Lean Thinking, selected Thai BE managers consider reasons why it is important to implement Lean Thinking, how to implement in order to achieve quality development and what tools should be implemented in an organisation.	From the model validation, it was confirmed that the model of this study was useful and applicable in a real situation. In other words, the developed model of this study has validity in both theoretical and practical application. Therefore, it can be another confirmation on the fourth proposition that the Thai BE managers consider Decision Criteria why it is important to implement Lean Thinking, how to manage Supporting Factors to achieve quality development and deciding what Tool Prioritising is appropriate with their organisational circumstances. Hence, in order to be successful in Lean Thinking implementation an organisation should manage an alignment of Tool Prioritising, Decision Criteria and Supporting Factors both within a whole organisation and across its supply chain. Thus, the developed model of this study suggests a process model that provides key features in Lean Thinking implementation which not only fill gaps in the existing literature but also contribute to research problems on both academic debate and practical struggle of an application of Lean Thinking.

8.2 Discussion on the logics and process to use the developed model

This study provides Lean Thinking elements and interaction model as the significant outcome. In this model, three key elements of Lean Thinking implementation which are tool prioritising, decision criteria and supporting factors are identified along with their definitions. In addition, this study provides the unique model for the manufacturing and service organisations. It is believed that a particular model might be a precise guideline for each sector to be successful in an implementation. Furthermore, a comparative model between two sectors is also offered in this study in order to present different implementation of Lean tools between them.

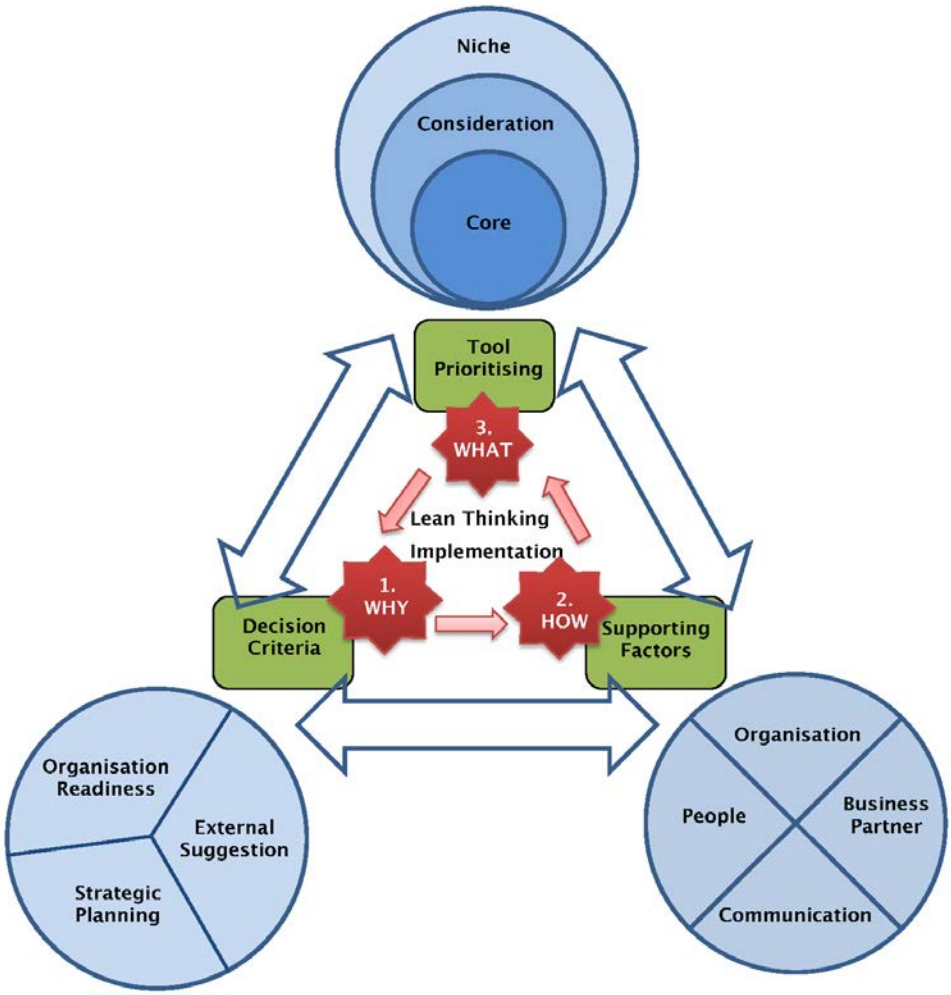


Figure 8-1: Logic of implementation processes of the developed model

In order to be successful in quality improvement, a use of the developed model should begin from the decision criteria to consider reasons why an organisation needs to implement Lean Thinking as shown in Figure 8-1. This suggestion is similar to the 8-step Process for Leading Change of Kotter (1995a) that a change should begin from a recognition on a need of an improvement (which was discussed earlier in Chapter 2, p. 54).

As presented in the developed model, there are categories of decision criteria which were defined in this study as Strategic Planning, Organisation Readiness and External Suggestion. This study suggests that Lean implementers should begin from a consideration of their organisation requirement in the Strategic Planning. After that, they should investigate the availability of their organisation resources, i.e. capabilities of human resources in the Organisation Readiness. In some cases, an organisation learns from an influence from the external environment, i.e. a consultant's suggestion which is categorised as an External Suggestion in the developed model. However, it is still important to consider the business unit's needs and readiness after obtaining the external suggestion. Hence, it can be said that Strategic Planning, Organisation Readiness and External Suggestion should be used as a complementary factors in making a decision as the first step in implementing the developed model of this study.

Consequently, Lean implementers should consider supporting factors as the second step in applying the developed model. People, Organisation, Communication and Business Partner are defined in this study as supporting factors that assist an organisation to achieve in quality improvement. In order to be successful in the application of Lean Thinking, Lean implementers therefore need to carefully consider how to manage these supporting factors effectively.

Lean Thinking, indeed, is a systematic thinking that requires the involvement of a whole organisation (Bicheno, 2008). Therefore, it needs an involvement of an entire organisation (People) to commit in quality improvement programmes that align to all levels of organisational management (Organisation). In order to create a trust environment and better understanding, two-way and transparent Communication should be used to send important information to and receive feedback from both internal and external stakeholders. In fact, parts of People, Organisation and Communication are also suggested as significant aspects that assist an organisation to achieve a change process in the 8-step model of (Kotter

(1995a)). In addition, an organisation should span its quality improvement across organisations into its supply chain by persuading customers and suppliers as key Business Partners to become involved in and support Lean Thinking implementation.

It is important to note that all four supporting factors which are linked and complement each other should be planned, aligned and operated in the same direction in order to support Lean Thinking implementation successfully.

The third step in implementing the developed model of this study is prioritising Lean tools. There are three categories of Lean tools which are defined in this study as Core, Consideration and Niche. This study suggests that in the beginning stage an organisation should apply Lean tools from the Core group in the quality improvement process. The manufacturing and service organisations in the Thai sample made different choices of Core tools. However, PDCA, Five Ss, Kaizen, Root Cause Analysis, Standardisation, TPM, Gemba and Policy Deployment are essential to both manufacturing and service sectors. In order to achieve in a Lean Thinking application, it might be said that an organisation (in whatever business sector) should implement these eight Lean tools in an early stage. This is a proposition which could be tested in future research.

The Consideration and Niche tools might be appropriate to an advanced implementation of Lean Thinking. This is because although both categories of Lean tools are useful in developing organisational performance, they might require a complicated application process. Thus, Lean implementers have to carefully consider what Lean tools are appropriate to their organisational circumstances. Therefore, Lean implementers need to re-consider their goals in the implementation and current situations of their organisations in the decision criteria section. Lean implementers should implement the selected Lean tools only if these tools can assist an organisation to achieve its goal and are appropriate to its circumstances. In contrast, if the existing resources of an organisation are unavailable, Lean implementers should solve this problem in the first instance by considering how to manage the four supporting factors in order to prepare their organisation to be ready for an advanced implementation of Lean Thinking.

Thus, it can be said that the developed model of this study is the interaction model. In order to reach an achievement in quality improvement, it is important to begin from a consideration of decision criteria to understand why an organisation needs to implement Lean Thinking. After that, Lean implementers need to consider how to manage supporting factors in order to prepare an organisation to be ready for Lean Thinking implementation. Consequently, it is significant to select what Lean tools should be implemented in order to reach the defined requirement of a particular organisation. After a selection of Lean tools, Lean implementers have to ensure that the selected Lean tools are also appropriate to their organisational circumstances. Therefore, it can be concluded that the developed model of this study is the interaction model that needs to be considered as an alignment of three key elements which are tool prioritising, decision criteria and supporting factors in order to do continuous improvement successfully.

Furthermore, the two key assumptions of the universality and essential features of Lean Thinking implementation can be examined through the developed model. Firstly, it can be said that the claim of Womack *et al.* (1990) that Lean Thinking could be implemented "anywhere by anyone" is not fully demonstrated in this study. Aspects of Lean were applied but the Universality of the whole Lean Thinking 'package' was not demonstrated. As evidence using the factor of tool prioritising, not all Lean tools were selected to apply in the Thai BE organisations. In contrast, they tended to implement only Lean toolboxes that fitted with their organisational circumstances.

The developed model of this study also suggests that essential elements in Lean Thinking implementation are tool prioritising, decision criteria and supporting factors in which are influencing each other. It might be said that all elements of Lean Thinking implementation are always required. Therefore, the developed model proves the second assumption that only a use of only one Lean element is not adequate to reach quality improvement in the implementation of Lean Thinking. On the other hand, it is important to note that each of these Lean three elements needs to be carefully managed and aligned in order to support each other and reach quality improvement effectively.

8.3 Contribution of this study

This research provides a significant contribution to knowledge on quality management and Lean Thinking, including the universal application of Lean Thinking, the comprehensive model of Lean Thinking, the validation and refinement of the developed model, the identification of significant Lean elements and the proof of an application of a hybrid approach between TQM and Lean Thinking.

1. Proving a claim on the universal application of Lean Thinking

From the literature review, a number of researches have focused on Lean Thinking after the claim of Womack *et al.* (1990) about the universality of its application. However, there is still an academic argument among both supporters and opponents of this assertion. In this study, it was found that not all Lean tools were applied universally. The award winning organisations in Thailand were likely to consider implementing only those Lean elements which fitted with their organisational circumstances. They made particular choices of Lean tools and implementation sequences which were seen as appropriate to driving their businesses forward. Thus, the outcome of this study proves that the universal application of Lean Thinking as one defined entity might not be real in the context of the selected business units.

2. Developing the comprehensive and interaction model of Lean Thinking implementation

A key outcome of this study is a comprehensive model of Lean Thinking implementation. It was found that although the implementation of Lean Thinking has been of interest to both academics and practitioners as a way to improve an organisational performance, there is still an academic debate and a practical struggle on what are significant Lean elements that need to be thoroughly managed and where to begin.

In order to address these problems, the developed model of this study presents tool prioritising, decision criteria and supporting factors as key Lean elements that need to be carefully considered in the implementation. Thus, the developed model of this study is the interaction model in which all three Lean elements are influencing to each other. It can, therefore, be said that in order to be successful

in Lean Thinking application it is important to align reasons, significant supporting factors and Lean toolboxes that are fitted with an organisation's circumstances. Not only are there particular models for the two sectors, but also a model which makes sector comparison is illustrated. Therefore, this study contributes to developing a comprehensive academic model of Lean Thinking implementation.

3. Validating and refining of the developed model

After developing the model, a comparative analysis with the existing literature was undertaken in order to test the validity of the developed model. In addition, the model of this study was evaluated by both academics and practitioners who are experts in quality management and/or Lean Thinking. This aimed to refine the model in order to create a complete model. In fact, the same practitioners who participated in data collection phase 1 also participated in the refinement process. This proved the credibility of the findings.

These processes in the refinement and validation of the conceptual model, therefore, contribute not only to theoretical soundness but also to the potential for the practical application of Lean Thinking from both the comparative analysis and the review by the qualified experts.

4. Identifying the significant features of Lean Thinking implementation

The developed model of this study which was developed based on the findings from the empirical study of the 22 TQA organisations in Thailand and was used to prove an assumption that tool prioritising, decision criteria and supporting factors are essential elements of Lean Thinking implementation. In addition, these three key Lean elements were also verified from not only a comparative analysis with the key existing literature and an effectiveness of the implementation from the Thai BE organisations but also a refinement process from experts who are both academics and practitioners. Hence, it can be said that tool prioritising, decision criteria and supporting factors are significant features of Lean Thinking implementation that need to be thoroughly managed based on an alignment in the same direction in order to achieve quality improvement across an entire supply chain through Lean Thinking implementation.

5. Exploring the possibility of a hybrid approach between TQM and Lean Thinking

From the literature review, a number of researchers suggested the advantage of using an integration of TQM and Lean Thinking. In this study, it was also found that Lean Thinking can be implemented alongside TQM in the award winning organisations in Thailand. This integration resulted in better performance in three perspectives of the balanced scorecard although there was a mixed result in the financial perspective. Thus, this study suggests that an application of a hybrid approach between TQM and Lean Thinking is one of the managers' choices that might result in better organisational performance.

8.4 Limitations of this study

All processes in this research were designed thoroughly in order to answer the research questions effectively. However, there are some limitations to this study which include:

1. Limitations on the testing of the developed model

This research sets out to accomplish the objectives already discussed and achieved these goals. However the developed model of this study was the final outcome of this research project and this research project was not designed to apply the developed model in a new set of circumstances with new organisations. The outcomes of this research suggest that this model is both comprehensive and sensible from both academic and practitioner perspectives and the proposition for future research is that a new application using this model will be both easier and quicker for a new organisation. This is to be tested in a future project.

2. A small number of participants

A detailed statistical analysis could not be performed in this study due to the small number of participants. Although all 38 organisations that achieved the Thailand Quality Award were contacted to request their participation, only 22 of them agreed to take part in this research. Therefore, it is difficult to perform a

quantitative analysis with these small numbers of participants. If a larger sample size could be generated then a statistical analysis could be done however it would be more difficult to control their starting points if they had not already completed the national quality award standard. Over time, as more organisations apply for the quality award then the testable population will increase. One possibility for future research is to engage with the Thai NQA organisation to see if a trial of the developed model could be set up with new organisations interested in developing their TQM and Lean Thinking agendas. A proposition for the future therefore is that use of the developed model will ensure more success in applications for the NQA.

3. Participants in a variety of businesses

The award winning organisations that participated in this study operate over a wide range of businesses. The manufacturing organisation units are in paper, chemicals and plastics, cement, fibre and product, food industries. In the service sectors, there are education, telecommunications, energy, payment services, hospitals, maintenance and retailing industries. Because of this, an analysis of the collected data and a development of the Lean Thinking implementation model were mainly based on the manufacturing and service sectors instead of a particular business. Again as more organisational units apply this thinking the populations in different categories will increase allowing for a different research design in any future replication.

4. Information limit

This study focuses on quality improvement programmes through Lean Thinking implementation in award winning organisations in Thailand. A number of them are private companies that have to keep their operations confidential in order to maintain their competitive advantage. Therefore, much valuable information was inaccessible for a further analysis, which might have revealed a number of interesting issues on Lean Thinking implementation. Additionally, the government organisations could not provide a financial statement to the author. Therefore, the financial analysis that was used to prove the effectiveness of the implementation could be done only for private organisations.

In spite of the limitations, the study provides credible results although it was affected by these constraints.

The model of this study was developed and refined to be consistent with theory and practice and is seen as a major improvement on all previous ones.

8.5 Areas for future research

The future works are outlined from the above limitations.

1. Implementing the developed model in a new real application.

A new application in a wider range of organisations may introduce other conditional factors that need to be considered and planned in order to achieve quality improvement through Lean Thinking implementation. Thus, an action research would be an interesting alternative when conducting a future research in order to test the model of this study in these new circumstances.

2. Exploring a position of Lean Thinking application in Thailand

Due to a limitation on a small number of the award winning organisations in Thailand, it was not possible to perform a quantitative analysis on the implementation of Lean Thinking. In addition, this study was mainly focused on Lean Thinking implementation in the TQA organisations rather than that in other organisation types. Therefore, it might be worthwhile to study an implementation of Lean Thinking in various organisations by collecting data with a high number of participants. Recognising the discussion about quality starting points above nevertheless a survey is suggested as a future strategy to gather data from a higher number of various organisation types. Subsequently, a detailed statistical analysis can be done in order to gain a better understanding of the status of Lean Thinking implementation in Thailand.

3. Examining the Lean Thinking implementation in the particular business.

As the study was limited to a small number of participants in a wide range of businesses, it had to conduct an analysis based on the manufacturing and service sectors instead of a particular business. In fact, although they operate in the same industrial sectors, organisations in different businesses are perhaps operating in unique conditions in running their businesses. Therefore, it is

possible that a specific business has a unique plan in its Lean Thinking application. In order to gain an understanding of these unique features an in-depth case study of the Lean Thinking implementation of a particular business is suggested as a future work. This would perhaps reveal how to achieve quality improvement through Lean Thinking in a unique business scenario.

4. **Investigating the application in organisations that have excellent performance in Lean implementation.**

At the suggestion of the reviewer in the refinement process, it would be interesting to examine an organisation that is outstanding in Lean Thinking. In this study, the investigation was done in TQA organisations that have been regarded as having business excellence in TQM. The Lean organisations and the TQA organisations may have different strategies in implementing Lean Thinking. Thus, a comparative analysis of the Lean Thinking application between the TQA and Lean organisations is credible as a future work. This would further explore the belief in the universality of Lean application and gain knowledge on how Lean Thinking has been applied in the best practices of those organisations that approached the common improvement agendas from a different starting position.

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Appendix A : A copy of formal letter that used to request the participation in the study

Name,

Company name

Address

Dear ……,

I would like to introduce myself and my PhD candidate, Ms. Udomlak Srichuachom. I am Professor of Purchasing and Supply Chain Management in the Management School of Southampton University UK, which is in the top 20 of UK Universities and a member of the Worldwide University Network. Ms. Udomlak Srichuachom is a lecturer in Business Management at Naresuan University in Phitsanulok, Thailand. After winning the scholarship from the Royal Thai Government, she registered as a full-time PhD student in the Management School here. Her research title is 'The Impact of Lean Approaches to Support Quality Developments in Thailand' which is focused on those excellent organisations in Thailand which are recognised by both a high ranking in competitiveness and outstanding reputation but also by winning the Thailand Quality Award (TQA) and/or Thailand Quality Class (TQC).

We are very keen to understand the relationship between the logic of Lean production and its interaction with Quality thinking and achievement and are undertaking a study of companies like yours in Thailand.

We would like to gather data and opinion from your organisation in terms of completing a simple survey document and ideally also interviewing a number of your key executives and managers.

We hope that this will be possible and look forward your organisation becoming part of this study which we believe will be of great importance to the development of globally competitive businesses based in Thailand.

Can you therefore please indicate if you are willing to be part of this study and respond to myself and / or Ms Srichuachom at the email addresses below. Ms. Srichuachom will respond to provide more details.

I confirm that all confidential information will be kept securely and no company information will be used in any way likely to compromise confidentiality. No individual or company will be identified in any published materials.

Management, University of Southampton, Highfield Campus, Southampton SO17 1BJ United Kingdom
Tel: +44 (0)23 8059 7677 Fax: +44 (0)23 8059 3844 www.management.soton.ac.uk

We can offer you the results of the study in an executive summary and of course the complete PhD will be published for open access, on completion.

If you have any inquiries, please do not hesitate to contact either Ms.Udomlak Srichuachom via her e-mail (us1c10@soton.ac.uk) or (udomlaks@nu.ac.th) or me via my e-mail (d.k.macbeth@soton.ac.uk).

Yours sincerely

Douglas K Macbeth
Professor of Purchasing and Supply Chain Management
Southampton Management School
University of Southampton
Room 4021, Building 2, Highfield Campus
Southampton SO17 1BJ
Tel: +44 (0) 23 80 59 89 67
Mobile: +44 (0) 77 20 40 55 71
d.k.macbeth@soton.ac.uk

Appendix B : Survey Questionnaire in the Empirical Study

ผลกระทบของแนวคิดแบบลีนในการสนับสนุนการพัฒนาคุณภาพในประเทศไทย (The Impact of Lean Approaches to Support Quality Developments in Thailand)

ข้อมูลจากการตอบแบบสอบถามนี้จะถูกเก็บเป็นความลับและนำไปใช้เพื่อดำเนินการวิจัยเท่านั้น
This questionnaire is the part of the PhD study on "All confidential information will be kept securely and no company information will be used in any way likely to compromise confidentiality. Thank you for being part of this study.

Section 1. ส่วนที่ 1: ข้อมูลทั่วไปขององค์กร (Part 1: Organisational Information)

Question 1.1

องค์กรของท่านดำเนินธุรกิจอยู่ในอุตสาหกรรมใด? (Which industry are you operating in?)

- กระดาษ (Paper)
- การศึกษา (Education)
- ค้าปลีก (Retailing)
- เคมีภัณฑ์ (Chemicals and plastics)
- ซีเมนต์ (Cement)
- โทรคมนาคม (Telecommunication)
- พลังงาน (Energy)
- ไฟเบอร์ (Fibre and product)
- รับชำระเงิน (Payment Service Provider)
- รถยนต์ (Automobile)
- โรงพยาบาล (Hospital)
- อาหาร (Food)
- อาหารสัตว์ (Animal Food)
- อุปกรณ์อิเล็กทรอนิกส์ (Electronics)
- อื่นๆ (Other)

Question 1.1b

โปรดระบุ (Please specify)

Question 1.2

องค์กรของท่านจดทะเบียนก่อตั้งเป็นสัญชาติใด? (Which nationality does your organisation register for?)

- ไทย 100% (100% Thai Owner)
- ต่างชาติ 100% (100% Foreign Owner)
- ร่วมทุน (Joint Venture)

Question 1.2b

โปรดระบุสัญชาติ (Please specify the nationality)

Question 1.3

องค์กรของท่านมีพนักงานจำนวนทั้งหมดเท่าใด? (How many employees does your organisation have?)

Question 1.4

ท่านรับผิดชอบหน้าที่ใดในองค์กร? (What is your responsibility in the organisation?)

- ผู้บริหารระดับสูง (Top Management)
- ผู้จัดการคุณภาพ (Quality Manager)
- ผู้จัดการฝ่าย/แผนก (Departmental Manager)

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อื่นๆ (Other)

Question 1.4b

โปรดระบุ (Please specify)

Section 2. ส่วนที่ 2: ข้อมูลด้านการจัดการคุณภาพขององค์กร (Part 2: Quality Management Information)

Question 2.1

องค์กรของท่านได้รับรางวัลคุณภาพแห่งชาติ และ/หรือ รางวัลการบริหารสู่ความเป็นเลิศในปีใด?

(When did you receive the Thailand Quality Award (TQA) and/or Thailand Quality Class (TQC))?

พ.ศ. 2545 (2002)
พ.ศ. 2546 (2003)
พ.ศ. 2547 (2004)
พ.ศ. 2548 (2005)
พ.ศ. 2549 (2006)
พ.ศ. 2550 (2007)
พ.ศ. 2551 (2008)
พ.ศ. 2552 (2009)
พ.ศ. 2553 (2010)
พ.ศ. 2554 (2011)

Question 2.2

ท่านได้นำระบบหรือรางวัลคุณภาพใดบ้างเข้ามาประยุกต์ใช้ในองค์กร? โดยท่านสามารถเลือกตอบได้มากกว่าหนึ่งข้อ

(Which quality approaches have you adopted in your organisation? Select all that apply.)

- การบริหารคุณภาพโดยรวม (Total Quality Management:TQM)
- การรื้อปรับระบบทางธุรกิจ (Business Process Reengineering: BPR)
- ซิกซ์ ซิกมา (Six Sigma)
- ไทยแลนด์ ไคเซ็น อวอร์ด (Thailand Kaizen Award)
- ไทยแลนด์ ลีน อวอร์ด (Thailand Lean Award)
- มาตรฐาน ISO 9001(ISO 9001)
- มาตรฐาน ISO 14001 (ISO 14001)
- มาตรฐาน OHSAS 18001 (OHSAS 18001)
- รางวัลเดมมิ่ง (Deming Prize)
- หลักเกณฑ์วิธีการที่ดีในการผลิต (Good Manufacturing Practice: GMP)
- อื่นๆ (Other)

Question 2.2b

โปรดระบุ (Please specify)

Question 2.3

ท่านได้นำแนวคิดแบบลีนเข้ามาใช้ในองค์กรหรือไม่?

(Do you apply lean thinking in your operations?)

ใช่ (Yes)
ไม่ใช่ (No)

Question 2.3b

3.1 ท่านได้นำแนวคิดแบบลีนเข้ามาใช้ในองค์กรเมื่อใด (เปรียบเทียบกับช่วงเวลาในการสมัครเข้ารับรางวัลคุณภาพแห่งชาติ)?

(When did you implement lean thinking (Compare to the time you applied for the TQA))?

ก่อนสมัคร (Before)
ระหว่างสมัคร (During)

หลังสมัคร (After)

Question 2.3c

3.2 ฝ่ายหรือแผนกใดได้มีส่วนร่วมในการนำแนวคิดแบบลีนเข้ามาใช้ในองค์กรของท่าน? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน

(Which functions have participated in the lean implementation in your organisation? Please select where appropriate to your organisation)

วิศวกรรม (Engineering)	○	○	○	○	○
ทรัพยากรมนุษย์ (Human Resource)	○	○	○	○	○
การผลิต/การบริการ (Manufacturing/ Service)	○	○	○	○	○
การพัฒนาผลิตภัณฑ์และกระบวนการ (Product and Process Development)	○	○	○	○	○
จัดซื้อ (Purchasing)	○	○	○	○	○
การจัดการคุณภาพ (Quality Management)	○	○	○	○	○
วิจัยและพัฒนา (Research and Development)	○	○	○	○	○
การตลาดและการขาย (Marketing and Sales)	○	○	○	○	○

Question 2.4

ท่านได้นำเครื่องมือคุณภาพใดบ้างมาประยุกต์ใช้ในการดำเนินงานขององค์กร? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน โดยท่านสามารถดูคำอธิบายเครื่องมือต่างๆได้จากเอกสารประกอบคำศัพท์ที่สำคัญ

(Which tools have you applied in your organisation? Please select where appropriate to your organisation. You can find the definitions of these tools from the glossary.)

Concurrent Engineering	○	○	○	○	○
Quality Function Deployment (QFD)	○	○	○	○	○
Standardisation	○	○	○	○	○
Value Analysis	○	○	○	○	○
Continuous Flow	○	○	○	○	○
Jidoka (Autonomation)	○	○	○	○	○
Poka-Yoke (Error Proofing)	○	○	○	○	○
Single Minute Exchange of Die (SMED)	○	○	○	○	○
Takt Time	○	○	○	○	○
5S (Five Ss)	○	○	○	○	○
Andon/ Visual Management	○	○	○	○	○
Bottleneck Analysis/ Theory of Constraint	○	○	○	○	○
Breakthrough Improvement	○	○	○	○	○
Brown Paper Analysis/Process Flow Analysis	○	○	○	○	○
Close Supplier Ties	○	○	○	○	○
Ergonomic Design	○	○	○	○	○
Heijunka (Level Scheduling)	○	○	○	○	○
Just-In-Time (JIT)	○	○	○	○	○
Kaizen (Continuous Improvement)	○	○	○	○	○
Kanban (Pull System)	○	○	○	○	○
PDCA (Plan, Do, Check, Act)	○	○	○	○	○
Root Cause Analysis	○	○	○	○	○
Total Productive Maintenance (TPM)	○	○	○	○	○
Value Stream Mapping	○	○	○	○	○
A3 Thinking	○	○	○	○	○
Cellular Manufacturing	○	○	○	○	○
Group Technology	○	○	○	○	○
Flexible Workforce	○	○	○	○	○
Gemba (The Real Place)	○	○	○	○	○
Hoshin Kanri (Policy Deployment)	○	○	○	○	○

Question 2.5

จากคำถามข้อที่ 4 เครื่องมือคุณภาพใดเป็นเครื่องมือที่มีบทบาทสำคัญหำอันดับแรกในองค์กรของท่าน? กรุณาเรียงลำดับ โดยลำดับที่ 1 คือเครื่องมือที่มีความสำคัญมากที่สุด และลำดับที่ 5 คือเครื่องมือที่มีความสำคัญน้อยที่สุด

(From Question 4. What are the top-five tools applied in your organisation? Please rank the answers with 1 being the most important and 5 being the least important)

อันดับที่ 1
(The most ○

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importance)	
อันดับที่ 2 (The second importance)	
อันดับที่ 3 (The third importance)	
อันดับที่ 4 (The fourth importance)	
อันดับที่ 5 (The least importance)	

Question 2.6

เหตุใดองค์กรของท่านจึงตัดสินใจเลือกใช้เครื่องมือคุณภาพข้างต้นในการดำเนินงานขององค์กร? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน

(Why did your organisation decide to apply above tools in your operations? Please select where appropriate to your organisation)

คำแนะนำจากผู้เชี่ยวชาญ (Consultant's Suggestions)	
ผลการดำเนินธุรกิจจากองค์กรที่เป็นเลิศ/วารสารทางธุรกิจ (Business Results of Best Practices/Publication)	
สร้างความพึงพอใจแก่พนักงาน (Enhance Employee Satisfaction)	
ปรับปรุงการดำเนินงานขององค์กร (Increase Organisational Performance)	
รักษาความสามารถในการแข่งขัน (Sustain Competitiveness)	
แก้ปัญหาทางธุรกิจ (Solve Business Problems)	
สอดคล้องกับวัตถุประสงค์และกลยุทธ์ขององค์กร (Alignment with Organisation Objectives and Strategies)	
สอดคล้องกับวัฒนธรรมองค์กร (Alignment with Organisation Culture)	
ง่ายในการประยุกต์ใช้ (Ease of Implementation)	
สอดคล้องกับการดำเนินงานของผู้ขายปัจจัยการผลิต/ลูกค้า (Association with Supplier/ Customer Programmes)	

Question 2.7

ท่านได้นำกิจกรรมคุณภาพใดบ้างเข้ามาประยุกต์ใช้ในการดำเนินงานขององค์กร? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน โดยท่านสามารถดูคำอธิบายกิจกรรมคุณภาพต่างๆได้จากเอกสารประกอบคำศัพท์ที่สำคัญ

(Which quality activities have you applied in your organisation? Please select where appropriate to your organisation. You can find the definitions of these quality activities from the glossary.)

Balanced Scorecard (BSC)	
Benchmarking	
Change Management	
Continuous Improvement	
Knowledge Management	
Market Service Logistics	
Project Management	
Risk Management	
Safety and Environmental Management	
System of Product/ Service Development	
Waste Management	
Commitment of Senior Management	
Lean Culture	
Lean Leadership	
Lean Office	
Lean Organisation	
Two-way and Transparency Communication	
Cross Functional Team	
Cross-trained Worker	
Education and Training	
Employee Commitment and Involvement	
Employee Empowerment	

Job Enrichment	○ ○ ○ ○ ○
Job Rotation	○ ○ ○ ○ ○
Supplier Development	○ ○ ○ ○ ○
Supplier Evaluation	○ ○ ○ ○ ○
Supplier Involvement	○ ○ ○ ○ ○
Customer Relations Management	○ ○ ○ ○ ○
Customer Involvement	○ ○ ○ ○ ○
KPI on Competitiveness	○ ○ ○ ○ ○
KPI on Cost Saving	○ ○ ○ ○ ○
KPI on Delivery	○ ○ ○ ○ ○
KPI on People Development	○ ○ ○ ○ ○
KPI on Quality	○ ○ ○ ○ ○
KPI on Safety	○ ○ ○ ○ ○
KPI on Team/ Group Performance	○ ○ ○ ○ ○

Question 2.8

จากคำถามข้อที่ 7 กิจกรรมคุณภาพใดเป็นกิจกรรมที่มีบทบาทสำคัญห้าอันดับแรกในองค์กรของท่าน? กรุณาเรียงลำดับ โดยลำดับที่ 1 คือกิจกรรมที่มีความสำคัญมากที่สุด และลำดับที่ 5 คือกิจกรรมที่มีความสำคัญน้อยที่สุด

(From Question 7. What are the top-five activities applied in your organisation? Please rank the answers with 1 being the most important and 5 being the least important)

อันดับ 1 (The most importance)	○ ○
อันดับ 2 (The second importance)	○ ○
อันดับ 3 (The third importance)	○ ○
อันดับ 4 (The fourth importance)	○ ○
อันดับ 5 (The least importance)	○ ○

Question 2.9

เหตุใดองค์กรของท่านจึงตัดสินใจเลือกใช้กิจกรรมคุณภาพข้างต้นในการดำเนินงานขององค์กร? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน

(Why did your organisation decide to apply above activities in your operations? Please select where appropriate to your organisation)

คำแนะนำจากผู้เชี่ยวชาญ (Consultant's Suggestions)	○ ○ ○ ○ ○
ผลการดำเนินธุรกิจจากองค์กรที่เป็นเลิศ/วารสารทางธุรกิจ (Business Results of Best Practices/Publication)	○ ○ ○ ○ ○
สร้างความพึงพอใจแก่พนักงาน (Enhance Employee Satisfaction)	○ ○ ○ ○ ○
ปรับปรุงการดำเนินงานขององค์กร (Increase Organisational Performance)	○ ○ ○ ○ ○
รักษาความสามารถในการแข่งขัน (Sustain Competitiveness)	○ ○ ○ ○ ○
แก้ปัญหาทางธุรกิจ (Solve Business Problems)	○ ○ ○ ○ ○
สอดคล้องกับวัตถุประสงค์และกลยุทธ์ขององค์กร (Alignment with Organisation Objectives and Strategies)	○ ○ ○ ○ ○
สอดคล้องกับวัฒนธรรมองค์กร (Alignment with Organisation Culture)	○ ○ ○ ○ ○
ง่ายในการประยุกต์ใช้ (Ease of Implementation)	○ ○ ○ ○ ○
สอดคล้องกับการดำเนินงานของผู้ขายปัจจัยการผลิต/ลูกค้า (Association with Supplier/ Customer Programmes)	○ ○ ○ ○ ○

Question 2.10

เป้าหมายใดที่ท่านคาดหวังจะบรรลุ <u>ก่อน</u>การนำเครื่องมือและกิจกรรมคุณภาพข้างต้นมาประยุกต์ใช้ในการดำเนินงานขององค์กร? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน

(What are the critical goals you planned to achieve before applying above tools and activities? Please select where appropriate to your organisation)

การปรับปรุงอย่างต่อเนื่อง (Continuous Improvement)	○ ○ ○ ○ ○

Appendix B

การลดต้นทุน (Cost Reduction)	○	○	○	○	○
การสร้างความพึงพอใจแก่ลูกค้า (Customer Satisfaction)	○	○	○	○	○
การสร้างความสัมพันธ์ที่ดีกับลูกค้า/ผู้ขายปัจจัยการผลิต (Customer/Supplier Relationship)	○	○	○	○	○
การสร้างความพึงพอใจแก่พนักงาน (Employee Satisfaction)	○	○	○	○	○
ทักษะและการมีส่วนร่วมของพนักงาน (Employee Skills and Involvement)	○	○	○	○	○
การปรับปรุงคุณภาพของสินค้า/บริการ (Improve Quality of Product/Service)	○	○	○	○	○
การพัฒนาการดำเนินงานขององค์กร (Increase Company Performance)	○	○	○	○	○
การเพิ่มความยืดหยุ่น (Increase Flexibility)	○	○	○	○	○
องค์กรแห่งการเรียนรู้ (Learning Organisation)	○	○	○	○	○
การเติบโตทางการตลาด (Marketing Growth)	○	○	○	○	○
ความรวดเร็วในการส่งมอบ (Speed Delivery)	○	○	○	○	○

Question 2.11

ผลการปรับปรุงที่ได้รับ ภายหลังจากการนำเครื่องมือและกิจกรรมคุณภาพมาใช้ในองค์กรของท่านตรงกับข้อใด? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน

(What is the improvement after implementing above tools and activities? Please select where appropriate to your organisation)

รอบเวลาการผลิตลดลง (The Reduction of Cycle Time)	○	○	○	○	○
เวลาที่ล่าช้าลดลง (The Reduction of Delay Time)	○	○	○	○	○
เวลาในการตรวจสอบลดลง (The Reduction of Inspection Time)	○	○	○	○	○
เวลานำลดลง (The Reduction of Lead Time)	○	○	○	○	○
เวลาในการติดตั้งเครื่องจักรลดลง (The Reduction of Set-up Time)	○	○	○	○	○
เวลาการเคลื่อนขึ้นงานในระบบลดลง (The Reduction of Throughput Time)	○	○	○	○	○
ต้นทุนกิจกรรมลดลง (The Reduction of Activity Cost)	○	○	○	○	○
ต้นทุนการเก็บรักษาสินค้าลดลง (The Reduction of Inventory Holding Cost)	○	○	○	○	○
ต้นทุนการบริการลดลง (The Reduction of Service Cost)	○	○	○	○	○
การผลิตเกินความต้องการลดลง (The Reduction of Overproduction)	○	○	○	○	○
ของเสีย/การทำงานซ้ำลดลง (The Reduction of Defects/ Reworks)	○	○	○	○	○
สินค้าคงคลังที่ไม่จำเป็นลดลง (The Reduction of Unnecessary Inventory)	○	○	○	○	○
กระบวนการที่ไม่เหมาะสมลดลง (The Reduction of Inappropriate Processing)	○	○	○	○	○
การขนส่งที่มากเกินความจำเป็นลดลง (The Reduction of Excessive Transportation)	○	○	○	○	○
การรอคอยลดลง (The Reduction of Waiting)	○	○	○	○	○
การเคลื่อนไหวที่ไม่จำเป็นลดลง (The Reduction of Unnecessary Movement)	○	○	○	○	○
คำบ่นของลูกค้าลดลง (The Reduction of Customer Complaint)	○	○	○	○	○
ของส่งคืนจากลูกค้าลดลง (The Reduction of Rejection)	○	○	○	○	○
อัตราการลาออกจากงานลดลง (The Reduction of Employee Turnover)	○	○	○	○	○
ความแปรปรวนลดลง (The Reduction of Variability)	○	○	○	○	○
ความได้เปรียบในการแข่งขันมากขึ้น (The Improvement of Competitive Advantage)	○	○	○	○	○
การสื่อสารภายในองค์กรดีขึ้น (The Improvement of Internal Communication)	○	○	○	○	○
อัตราการหมุนเวียนสินค้าคงคลังดีขึ้น (The Improvement of Inventory Turnover)	○	○	○	○	○
การส่งมอบที่ตรงเวลามากขึ้น (The Improvement of On-time Delivery)	○	○	○	○	○
คุณภาพของสินค้าหรือบริการดีขึ้น (The Improvement of Product/ Service Quality)	○	○	○	○	○
ความยืดหยุ่นในการผลิตมากขึ้น (The Improvement of Production Flexibility)	○	○	○	○	○
ผลิตภาพดีขึ้น (The Improvement of Productivity)	○	○	○	○	○
ความปลอดภัยและคุณภาพในสถานที่ทำงานดีขึ้น (The Improvement of Safety and Quality in Working Environment)	○	○	○	○	○
ความสัมพันธ์กับลูกค้าดีขึ้น (The Improvement of Customer Relationship)	○	○	○	○	○
ความพึงพอใจของลูกค้ามากขึ้น (The Improvement of Customer Satisfaction)	○	○	○	○	○
ความสัมพันธ์กับผู้ขายปัจจัยการผลิตดีขึ้น (The Improvement of Supplier Relationship)	○	○	○	○	○
กำลังใจและความพึงพอใจของพนักงานดีขึ้น (The Improvement of Employee Morale and Satisfaction)	○	○	○	○	○
ทักษะและการสนับสนุนของพนักงานดีขึ้น (The Improvement of Employee Skill and Contribution)	○	○	○	○	○

Question 2.12

ปัจจัยแห่งความสำเร็จในการประยุกต์ใช้เครื่องมือและกิจกรรมคุณภาพในองค์กรของท่านตรงกับข้อใด? กรุณาเลือกช่องที่สอดคล้องกับการดำเนินงานในองค์กรของท่าน

(What are the key success factors in the application of above tools and activities? Please select where appropriate to your organisation)

การสื่อสารที่ชัดเจน (Clear Communication)	○	○	○	○	○
การมีส่วนร่วมของลูกค้า (Customer Involvement)	○	○	○	○	○
การศึกษาและการฝึกอบรม (Education and Training)	○	○	○	○	○
การมีส่วนร่วมของพนักงาน (Employee Involvement)	○	○	○	○	○
ทักษะและความรู้ของพนักงาน (Employee Skill and Knowledge)	○	○	○	○	○
อุปกรณ์และสิ่งอำนวยความสะดวก (Equipment and Infrastructure)	○	○	○	○	○
ทีมงานในการปรับปรุง (Improvement Team)	○	○	○	○	○
ความร่วมมือภายในองค์กร (Internal Cooperation)	○	○	○	○	○
การจัดการองค์ความรู้ (Knowledge Management)	○	○	○	○	○
ภาวะผู้นำและการสนับสนุนทางการจัดการ (Leadership and Management Support)	○	○	○	○	○
ความผูกพันในระยะยาว (Long-term Commitment)	○	○	○	○	○
คุณค่าและวัฒนธรรมองค์กร (Organisation Culture and Value)	○	○	○	○	○
ระบบการให้รางวัล (Reward System)	○	○	○	○	○
การวางแผนเชิงกลยุทธ์ (Strategic Planning)	○	○	○	○	○
การมีส่วนร่วมของผู้ขายปัจจัยการผลิต (Supplier Involvement)	○	○	○	○	○

Question 2.13

อุปสรรคในการประยุกต์ใช้เครื่องมือและกิจกรรมคุณภาพในองค์กรของท่านตรงกับข้อใด? กรุณาเลือกช่องที่ตรงกับการดำเนินงานในองค์กรของท่าน

(Are there any barriers in applying above tools and activities in your organisation? Please select where appropriate to your organisation)

การต่อต้านการปลี่ยนแปลง (Change Resistance)	○	○	○	○	○
ความแปรปรวนของกระบวนการ (Coping with Variability)	○	○	○	○	○
ไม่สามารถระบุถึงประโยชน์ (Inability to Justify Benefits)	○	○	○	○	○
อุปกรณ์และสิ่งอำนวยความสะดวกที่ไม่มีประสิทธิภาพ (Ineffective Equipment and Infrastructure)	○	○	○	○	○
ขาดความร่วมมือภายในองค์กร (Insufficient Cooperation)	○	○	○	○	○
ต้นทุนในการลงทุน (Investment Cost)	○	○	○	○	○
ขาดการติดต่อสื่อสาร (Lack of Communication)	○	○	○	○	○
ขาดความผูกพันของพนักงาน (Lack of Employee Commitment)	○	○	○	○	○
ขาดความรู้และทักษะ (Lack of Knowledge and Skill)	○	○	○	○	○
ขาดการวางแผนเชิงกลยุทธ์ (Lack of Strategic Planning)	○	○	○	○	○
ขาดการมีส่วนร่วมของผู้ขายปัจจัยการผลิต (Lack of Supplier Contribution)	○	○	○	○	○
วัฒนธรรมของชาติ (National Culture)	○	○	○	○	○
วัฒนธรรมองค์กร (Organisational Culture)	○	○	○	○	○
การให้ความสำคัญกับการดำเนินงานระยะสั้น(Short-term Focus)	○	○	○	○	○
การเสียเวลา (Time Consuming)	○	○	○	○	○

ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

Thank you for taking this questionnaire.

Appendix C : Interview Questions

1. Could you please advise me on the beginning of quality management?

2. What are key quality tools that have been implemented? Why?

3. What are key activities that create quality contribution? Why?

4. What is the improvement after implemented quality tools and activities?

5. How does lean thinking be implemented in this organisation?

6. How to motivate employees to accept and participate in the quality management?

7. Are there any education and training programmes to prepare employees to apply quality approaches?

8. How many communication channels that are used to communicate to and receive voice of stakeholders?

9. How to create the organisation culture and the company value?

10. What are significant factors that lead your organisation to a success in quality improvement?

11. Are there any barriers on quality management implementation? How to solve them?

12. Do you have any suggestions on how to implement quality approaches successfully?

Appendix D : Survey Questionnaire for Academics in the Model Refinement

The Impact of Lean Approaches to Support Quality Development in Thailand (For Academics)

องค์กรจำนวนมากนำแนวคิดทางการบริหารเชิงคุณภาพมาประยุกต์ใช้ เพื่อปรับปรุงการดำเนินงานขององค์กร โดยเฉพาะอย่างยิ่ง แนวคิดแบบลีน (Lean Thinking) ซึ่งเป็นแนวคิดที่มุ่งเน้นการลดกิจกรรมที่ไม่สร้างมูลค่าเพิ่ม (Non-value-added Activities/Wastes) โดยองค์กรจำนวนมากทั้งภาครัฐและภาคเอกชนได้มีการนำแนวคิดดังกล่าวนี้ไปประยุกต์ใช้มากมาย เนื่องจากมีหลักฐานที่ชัดเจนว่าแนวคิดแบบลีน (Lean Thinking) สามารถช่วยให้องค์กรหลายแห่งประสบความสำเร็จในการปรับปรุงการดำเนินงาน อย่างไรก็ตามยังคงมีข้อสงสัยว่าองค์กรควรจะมีการนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้อย่างไรจึงจะเหมาะสมกับความต้องการที่เฉพาะเจาะจงของแต่ละธุรกิจ ดังนั้นงานวิจัยนี้จึงมุ่งมั่นที่จะพัฒนากรอบความคิดในการนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้ร่วมกับการบริหารคุณภาพโดยรวม (Total Quality Management: TQM) ตามแบบองค์กรแห่งความเป็นเลิศ (Business Excellence Organisations) ในประเทศไทย

แบบสอบถามนี้เป็นส่วนหนึ่งของการศึกษาระดับปริญญาเอกในหัวข้อการวิจัย "ผลกระทบของแนวคิดแบบลีนในการสนับสนุนการพัฒนาคุณภาพในประเทศไทย"

ข้อมูลจากการตอบแบบสอบถามนี้จะถูกเก็บเป็นความลับและนำไปใช้เพื่อดำเนินการวิจัยเท่านั้น ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

In order to become a world-class organisation, a number of quality management approaches have been implemented to improve organisational performances. Particularly, Lean Thinking has been highlighted as one of the significant management approaches that focuses on the elimination of waste. Due to the success of reported improvement programmes, Lean Thinking has been applied in various organisations which include public and private sectors. However, there is still a question on how to implement Lean tools and techniques in a way suited to the particular needs of the business. This study therefore aims to generate a conceptual academic model which supports the analysis of how Lean Thinking was implemented alongside Total Quality Management in the Business Excellence organisations in Thailand.

This questionnaire is the part of the PhD study on "The Impact of Lean Approaches to Support Quality Developments in Thailand"

All confidential information will be kept securely and no company information will be used in any way likely to compromise confidentiality. Thank you for being part of this study.

Section 1. ข้อมูลของผู้ตอบแบบสอบถาม (Details of the respondent)

Question 1.1

ท่านมีความเชี่ยวชาญในงานวิจัยสาขาใด

(Areas of the research or expertise)

Question 1.2

ท่านดำเนินงานวิจัยในสาขาที่เชี่ยวชาญมาเป็นระยะเวลานานเท่าใด

(How long have you been in this area?)

- 1-5 ปี (1-5 years)
- 6-10 ปี (6-10 years)
- 10 ปีขึ้นไป (More than 10 years)

Section 2. เครื่องมือของแนวคิดแบบลีน (Lean Tools)

Question 2.1

จากประสบการณ์ของท่าน องค์กรควรจัดลำดับความเหมาะสมในการใช้งานเครื่องมือของแนวคิดแบบลีนหรือไม่

(Based on your experiences, do you think Lean tools should be prioritised in the implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.1c

กรุณาประเมินระดับความสำคัญในการจัดลำดับความเหมาะสมในการใช้งานเครื่องมือของแนวคิดแบบลีน

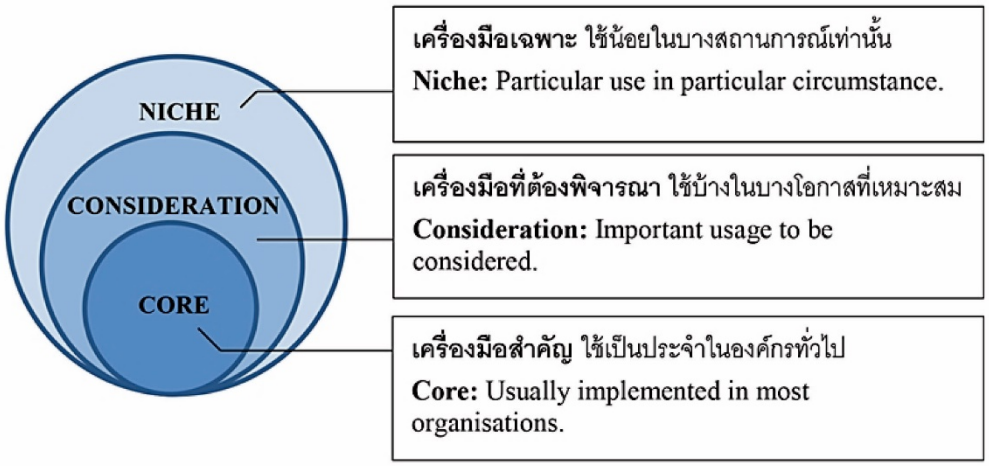
(Please weigh the importance of Lean tool prioritising in the implementation)

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%

Question 2.2

จากรูป ท่านเห็นด้วยหรือไม่ที่มีการจัดประเภทเครื่องมือของแนวคิดแบบลีนออกเป็นสามกลุ่ม คือ เครื่องมือที่สำคัญ (Core), เครื่องมือที่ต้องพิจารณา (Consideration) และเครื่องมือเฉพาะ (Niche) ดังรูป

(Based on the model, is it sensible to categorise Lean tools into three groups which are Core, Consideration and Niche?)



- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.3

ท่านเห็นด้วยหรือไม่ว่าองค์กรในอุตสาหกรรมการการผลิต และอุตสาหกรรมการบริการ ต้องการการจัดประเภทเครื่องมือของแนวคิดแบบลีน ที่แตกต่างกัน

(Based on your experiences, do you agree that organisations in different sectors are required to prioritise Lean tool uniquely?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.3b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.4

จากตารางด้านล่าง ท่านเห็นด้วยหรือไม่ที่การจัดประเภทเครื่องมือของแนวคิดแบบลีน (Lean Tools) **มีความแตกต่างกันระหว่างองค์กรในอุตสาหกรรมการผลิต และอุตสาหกรรมการบริการ**

(Based on the table below, do you agree on the differences of Lean tools in the Core, Consideration and Niche between the manufacturing and the service sectors?)

Appendix D

เครื่องมือของแนวคิดแบบลีน (Lean Tools)	อุตสาหกรรมการผลิต (Manufacturing Sector)	อุตสาหกรรมการบริการ (Service Sector)
เครื่องมือเฉพาะ ใช้น้อยในบางสถานการณ์เท่านั้น NICHE: Particular use in particular circumstance.	Level Scheduling, Group Technology, Pull System	VSM, Level Scheduling, Pull System, Autonomation, Group Technology, JIT, Close Supplier Ties, Takt Time, A3 Thinking, Cellular Manufacturing, SMED
เครื่องมือที่ต้องพิจารณา ใช้บ้างในบางโอกาสที่เหมาะสม CONSIDERATION: Important usage to be considered.	Continuous Flow, Ergonomic Design, Autonomation, Value Analysis, Concurrent Engineering, Cellular Manufacturing, JIT, Close Supplier Ties, Takt Time, A3 Thinking, SMED	Visual Management, Poka-Yoke, Continuous Flow, Breakthrough Improvement, Value Analysis, Brown Paper Analysis, Bottleneck Analysis, QFD, Flexible Workforce, Ergonomic Design, Concurrent Engineering
เครื่องมือสำคัญ ใช้เป็นประจำในองค์กรทั่วไป CORE: Usually implementation in most organisations.	PDCA, Five Ss, Kaizen, Root Cause Analysis, Standardisation, TPM, Gemba, Policy Deployment, Visual Management, Breakthrough Improvement, Poka-Yoke, Bottleneck Analysis, QFD, Brown Paper Analysis, VSM, Flexible Workforce	PDCA, Root Cause Analysis, Five Ss, Kaizen, Policy Deployment, Standardisation, Gemba, TPM
หมายเหตุ: ตัวอักษรสีแดง คือเครื่องมือของแนวคิดแบบลีน **ที่แตก**ต่างกันระหว่างอุตสาหกรรมผลิตและบริการ ตัวอักษรสีดำ คือเครื่องมือของแนวคิดแบบลีน **ที่เหมือน**กันระหว่างอุตสาหกรรมผลิตและบริการ Note: Showing in red the differences between two sector Showing in black the similarities between two sectors		

ตารางแสดงเครื่องมือของแนวคิดแบบลีน (Lean Tools) **ในอุตสาหกรรมการผลิตและการบริการ**

- ○ เห็นด้วย (Yes)
- ○ ไม่เห็นด้วย (No)
- ○

Question 2.4b

โปรดระบุเหตุผล (Please specify reasons)

Section 3. เงื่อนไขที่ใช้ตัดสินใจนำแนวคิดแบบลีนมาใช้ (Decision criteria in the implementation)

Question 3.1

จากประสบการณ์ ท่านเห็นด้วยหรือไม่ว่าองค์กรควรกำหนดเงื่อนไขที่สำคัญที่ใช้ในการตัดสินใจนำแนวคิดแบบลีน (Lean Thinking) **มาประยุกต์ใช้**

(Based on your experiences, is it important to propose key decision criteria that should be used when making a decision on Lean Thinking implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 3.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 3.2

จากรูป ท่านเห็นด้วยหรือไม่ว่า เงื่อนไขที่องค์กรใช้ในการตัดสินใจนำแนวคิดแบบลีน (Lean Thinking) **มาประยุกต์ใช้ สามารถแบ่งได้เป็นสามกลุ่ม คือ ความพร้อมขององค์กร** (organisation readiness), **แผนกลยุทธ์** (strategic planning) **และ คำแนะนำจากภายนอก** (external suggestion)

(Based on the model, is it sensible to categorise decision criteria that should be used in making a decision on Lean Thinking implementation based on organisation readiness, strategic planning and external suggestion?)

- เห็นด้วย (Yes)

- ไม่เห็นด้วย (No)

Question 3.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 3.3

กรุณาประเมินระดับความสำคัญของเหตุผลแต่ละข้อที่ใช้ในการตัดสินใจนำแนวคิดแบบลีนมาประยุกต์ใช้

(Please weigh the degree of **importance** of the decision criteria in Lean Thinking implementation.)

ความพร้อมขององค์กร (Organisation readiness)	○	○	○	○	○	○	○	○	○	○	○
แผนกลยุทธ์ (Strategic planning)	○	○	○	○	○	○	○	○	○	○	○
คำแนะนำจากภายนอก (External suggestion)	○	○	○	○	○	○	○	○	○	○	○

Question 3.4

ท่านมีข้อเสนอแนะอื่นๆ ที่เกี่ยวข้องกับเหตุผลที่ใช้ในการตัดสินใจนำแนวคิดแบบลีนมาประยุกต์ใช้หรือไม่

(Do you have any suggestions on the Decision Criteria of Lean Thinking implementation?)

- มีข้อเสนอแนะ (Yes)
- ไม่มีข้อเสนอแนะ (No)

Question 3.4b

โปรดระบุ (Please specify)

Section 4. ปัจจัยสนับสนุนในการประยุกต์ใช้แนวคิดแบบลีน (Supporting factors in Lean Thinking implementation)

Question 4.1

จากประสบการณ์ ท่านเห็นด้วยหรือไม่ว่าองค์กรจำเป็นต้องพิจารณาปัจจัยต่างๆที่ช่วยสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on your experiences, do you agree that an organisation needs to consider a number of supporting factors in order to achieve in the implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

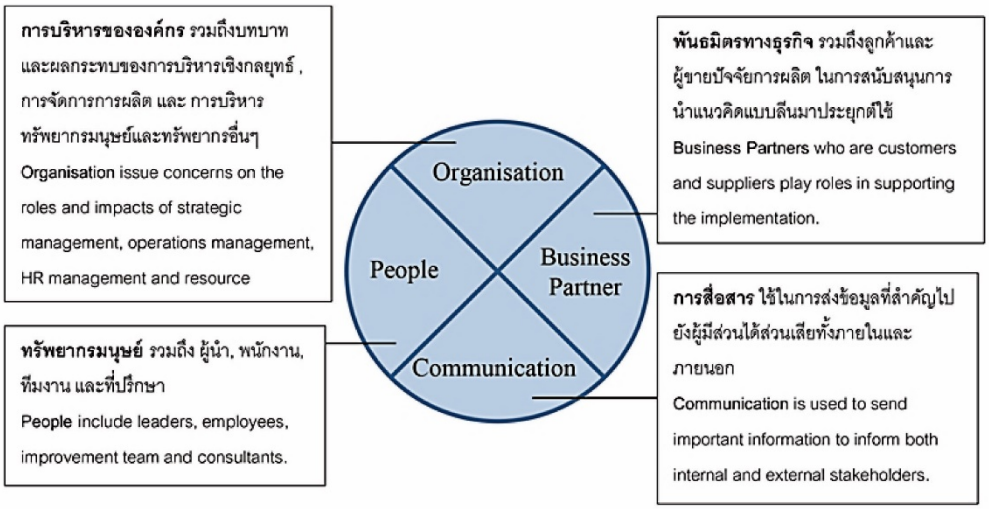
Question 4.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 4.2

จากรูป ท่านเห็นด้วยหรือไม่ว่า ทรัพยากรมนุษย์, การบริหารขององค์กร, การสื่อสาร และ พันธมิตรทางธุรกิจ มีบทบาทสำคัญในการสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on the model, do you agree that people, organisation, communication and business partner are significant aspects that support the achievement in Lean Thinking implementation?)



- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 4.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 4.3

กรุณาประเมินระดับความสำคัญของปัจจัยแต่ละข้อที่ช่วยสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on the table below, please weigh the degree of **importance** of the supporting factors in Lean Thinking implementation.)

ทรัพยากรมนุษย์ (People)	○	○	○	○	○	○	○	○	○	○	○
การบริหารองค์กร (Organisation)	○	○	○	○	○	○	○	○	○	○	○
การสื่อสาร (Communication)	○	○	○	○	○	○	○	○	○	○	○
พันธมิตรทางธุรกิจ (Business Partner)	○	○	○	○	○	○	○	○	○	○	○

Question 4.4

ท่านมีข้อเสนอแนะอื่นๆ ที่เกี่ยวข้องกับปัจจัยสนับสนุนในการนำแนวคิดแบบลีนมาประยุกต์ใช้หรือไม่

(Do you have any suggestions on the Supporting factors of Lean Thinking implementation?)

- มีข้อเสนอแนะ (Yes)
- ไม่มีข้อเสนอแนะ (No)

Question 4.4b

โปรดระบุ (Please specify)

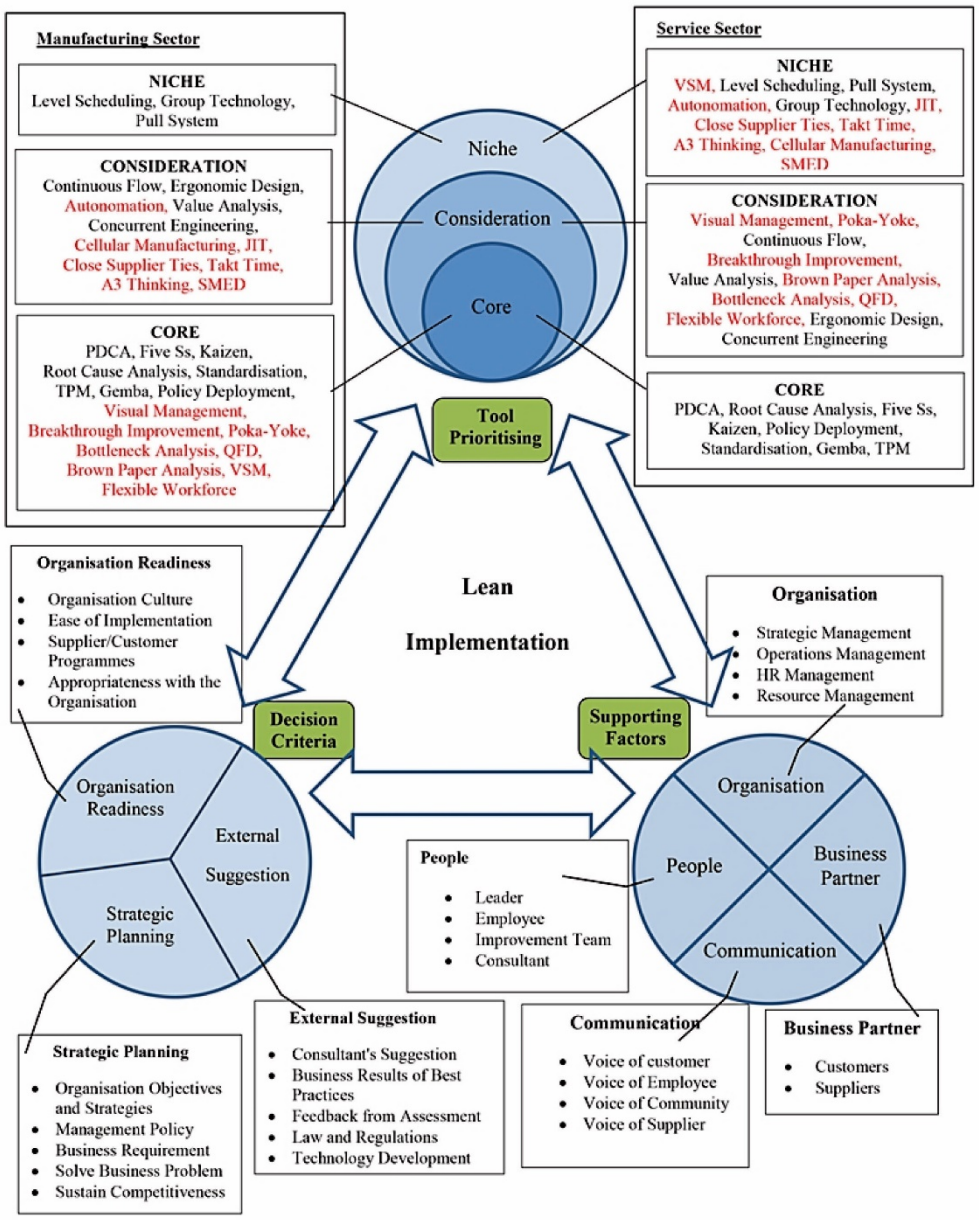
Section 5. ข้อเสนอแนะในการปรับปรุงกรอบแนวคิดแบบลีน (Suggestions for developing the proposed model on Lean Thinking

implementation)

Question 5.1

กรุณาประเมินระดับความครบถ้วนสมบูรณ์ขององค์ประกอบของแนวคิดแบบลีนในกรอบความคิดที่พัฒนาขึ้น

(Based on the model, please weigh the degree of comprehensiveness of Lean elements in the developed model.)



Lean Thinking Elements and Interaction Model

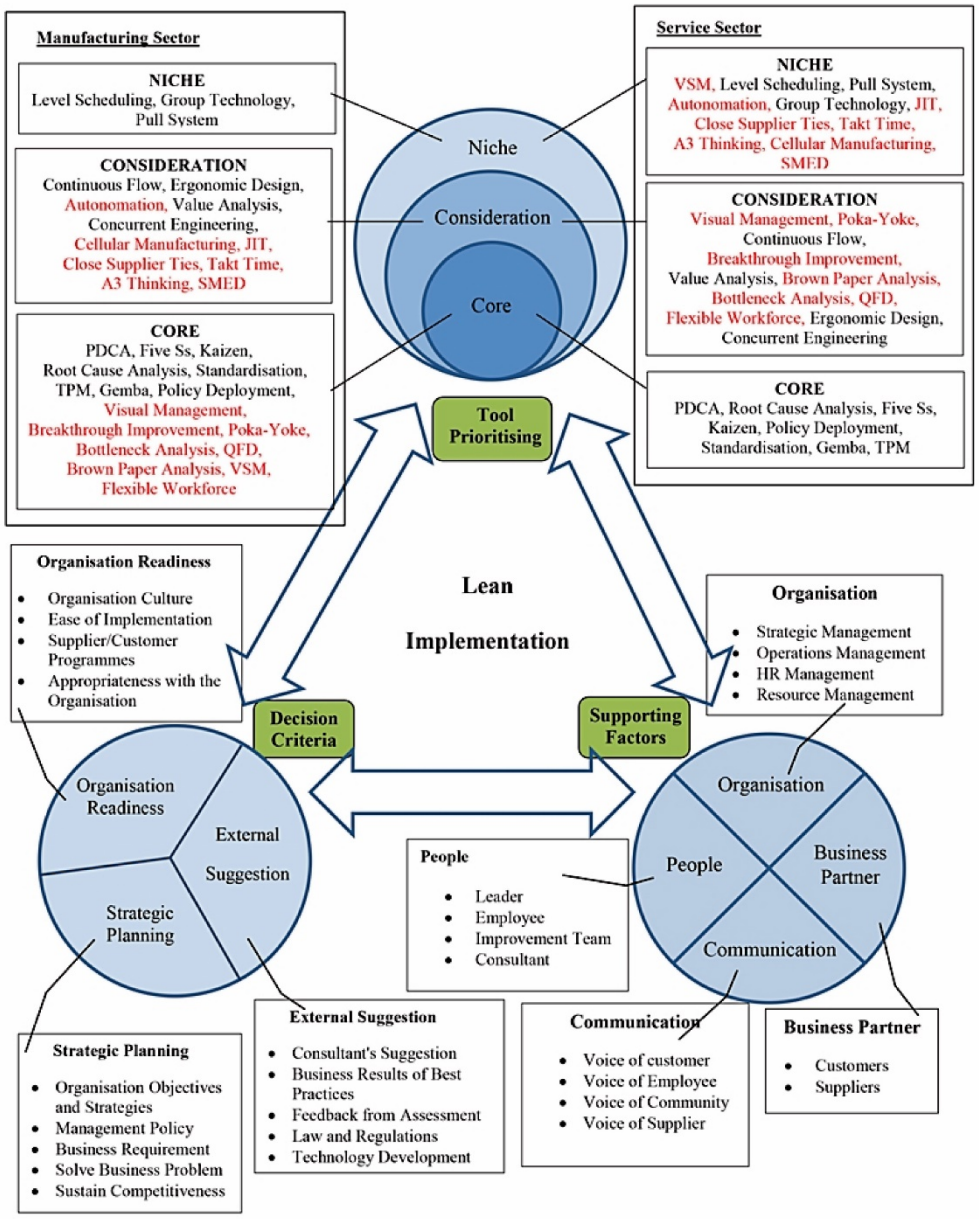
การจัดลำดับความสำคัญของเครื่องมือตามแนวคิดแบบลีน (Tool Prioritising)	○	○	○	○	○	○	○	○	○	○	○
เงื่อนไขที่ใช่ในการตัดสินใจ (Decision Criteria)	○	○	○	○	○	○	○	○	○	○	○
ปัจจัยสนับสนุน (Supporting Factors)	○	○	○	○	○	○	○	○	○	○	○

Question 5.2

กรุณาประเมินระดับความเหมาะสมของโครงสร้างของกรอบความคิดที่พัฒนาขึ้น

(Please weigh the degree of appropriateness of the structure of the developed model.)

Appendix D



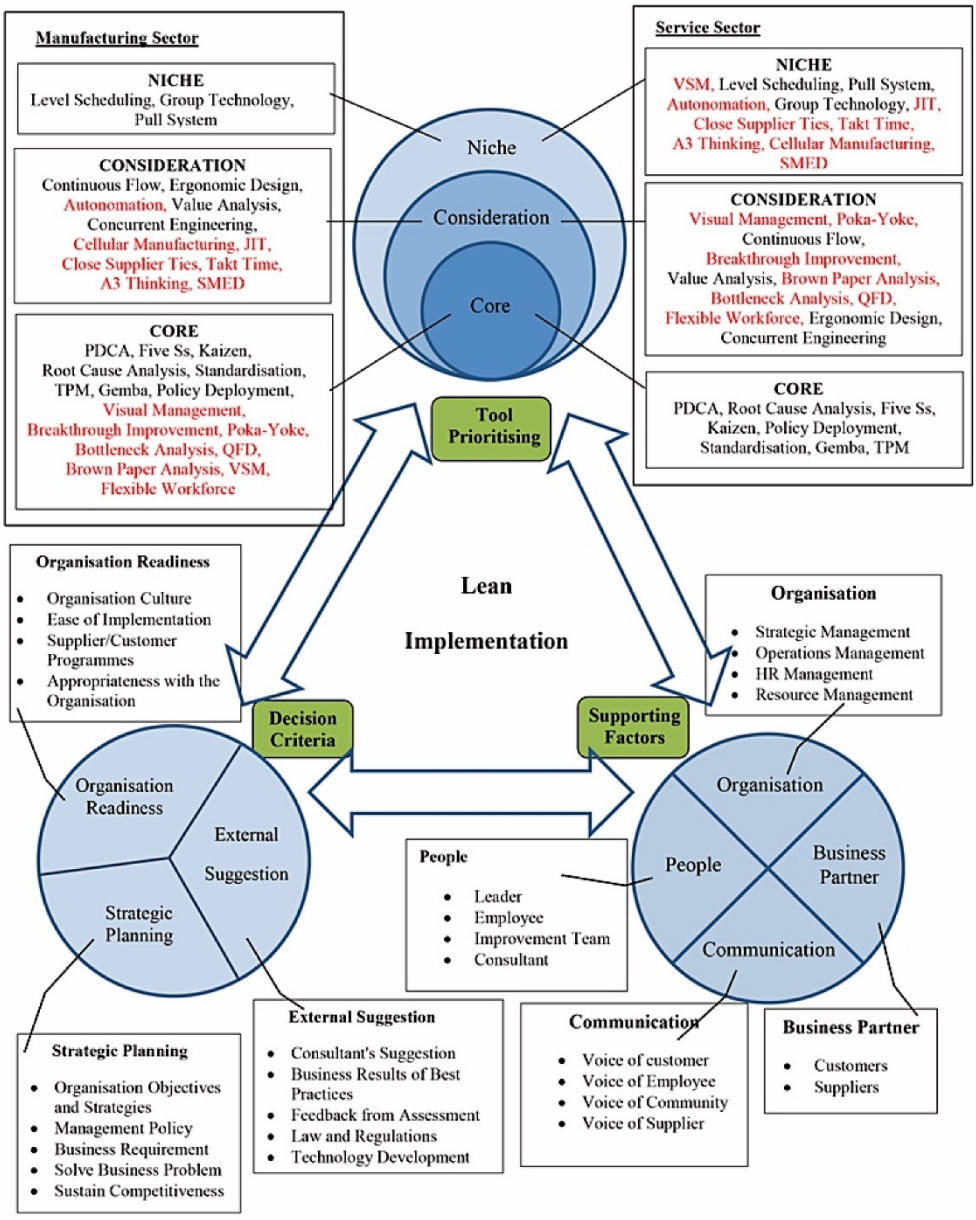
Lean Thinking Elements and Interaction Model

ขัดเจนและง่ายในการทำความเข้าใจ (Clarity: easy to understand)	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○
ความสอดคล้องขององค์ประกอบของแนวคิดแบบลีน (Relatedness of Lean elements)	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○
ความถูกต้องของกรอบแนวคิด (Accurateness of the proposed model)	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

Question 5.3

กรุณาประเมินระดับประโยชน์และความเป็นไปได้ในการนำกรอบความคิดที่พัฒนาขึ้นนี้ไปประยุกต์ใช้ในสถานการณ์จริง

(Please weigh the degree of usefulness and applicability of the developed model in the real situation.)



Lean Thinking Elements and Interaction Model

Appendix D

กรอบแนวคิดนี้สามารถช่วยผู้ปฏิบัติงานจัดลำดับความสำคัญในการทำงานได้ (This model would help implementers to prioritise their works.)	○	○	○	○	○	○	○	○	○	○	○
กรอบแนวคิดนี้ช่วยให้ท่านทราบว่าในการนำแนวคิดแบบลีนมาประยุกต์นั้น องค์กรจำเป็นต้องพิจารณาองค์ประกอบใดบ้าง (This model informs you of important elements that should be considered in the implementation.)	○	○	○	○	○	○	○	○	○	○	○
กรอบแนวคิดนี้สามารถนำไปประยุกต์ใช้ได้ในสถานการณ์จริง (This model can be applied in the real situation.)	○	○	○	○	○	○	○	○	○	○	○
ท่านเห็นว่ากรอบแนวคิดนี้มีประโยชน์และสามารถใช้เป็นแนวทางในการนำแนวคิดแบบลีนมาประยุกต์ใช้ (Overall, your view of the usefulness of this model as a guideline in Lean Thinking implementation.)	○	○	○	○	○	○	○	○	○	○	○

Question 5.4

ท่านคิดว่าจุดเด่นของกรอบแนวคิดนี้คืออะไร

(What are strengths of the proposed model?)

Question 5.5

ท่านคิดว่าจุดด้อยของกรอบแนวคิดนี้คืออะไร

(What are weaknesses of this model?)

Question 5.6

ท่านเห็นด้วยหรือไม่ว่ากรอบแนวคิดนี้ควรใส่องค์ประกอบอื่นๆเพิ่มเข้ามาเพื่อทำให้กรอบแนวคิดนี้สมบูรณ์มากยิ่งขึ้น

(Based on the proposed model, are there other aspects that should be added to present a more complete picture of Lean implementation?)

- ○ **เห็นด้วย** (Yes)
- ○ **ไม่เห็นด้วย** (No)
- ○

Question 5.6b

โปรดระบุ (Please specify)

Question 5.7

ท่านมีข้อเสนอแนะอื่นๆเพิ่มเติมหรือไม่

(Do you have any suggestions for improving the proposed model?)

- ○ **มี** (Yes)
- ○ **ไม่มี** (No)

Question 5.7b

โปรดระบุ (Please specify)

ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

Thank you for taking this questionnaire.

Appendix E : Survey Questionnaire for the Manufacturing Practitioners in the Model Refinement

The Impact of Lean Approaches to Support Quality Development in Thailand (For Practitioners in the Manufacturing Sector)

องค์กรจำนวนมากนำแนวคิดทางการบริหารเชิงคุณภาพมาประยุกต์ใช้ เพื่อปรับปรุงการดำเนินงานขององค์กร โดยเฉพาะอย่างยิ่ง แนวคิดแบบลีน (Lean Thinking) ซึ่งเป็นแนวคิดที่มุ่งเน้นการลดกิจกรรมที่ไม่สร้างมูลค่าเพิ่ม (Non-value-added Activities/Wastes) โดยองค์กรจำนวนมากทั้งภาครัฐและภาคเอกชนได้มีการนำแนวคิดดังกล่าวนี้ไปประยุกต์ใช้มากมาย เนื่องจากมีหลักฐานที่ชัดเจนว่าแนวคิดแบบลีน (Lean Thinking) สามารถช่วยให้องค์กรหลายแห่งประสบความสำเร็จในการปรับปรุงการดำเนินงาน อย่างไรก็ตามยังคงมีข้อสงสัยว่าองค์กรควรจะมีการนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้อย่างไรจึงจะเหมาะสมกับความต้องการที่เฉพาะเจาะจงของแต่ละธุรกิจ ดังนั้นงานวิจัยนี้จึงมุ่งมั่นที่จะพัฒนากรอบความคิดในการนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้ร่วมกับการบริหารคุณภาพโดยรวม (Total Quality Management: TQM) ตามแบบองค์กรแห่งความเป็นเลิศ (Business Excellence Organisations) ในประเทศไทย

แบบสอบถามนี้เป็นส่วนหนึ่งของการศึกษาระดับปริญญาเอกในหัวข้อการวิจัย "ผลกระทบของแนวคิดแบบลีนในการสนับสนุนการพัฒนาคุณภาพในประเทศไทย"

ข้อมูลจากการตอบแบบสอบถามนี้จะถูกเก็บเป็นความลับและนำไปใช้เพื่อดำเนินการวิจัยเท่านั้น ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

In order to become a world-class organisation, a number of quality management approaches have been implemented to improve organisational performances. Particularly, Lean Thinking has been highlighted as one of the significant management approaches that focuses on the elimination of waste. Due to the success of reported improvement programmes, Lean Thinking has been applied in various organisations which include public and private sectors. However, there is still a question on how to implement Lean tools and techniques in a way suited to the particular needs of the business. This study therefore aims to generate a conceptual academic model which supports the analysis of how Lean Thinking was implemented alongside Total Quality Management in the Business Excellence organisations in Thailand.

This questionnaire is the part of the PhD study on "The Impact of Lean Approaches to Support Quality Developments in Thailand"

All confidential information will be kept securely and no company information will be used in any way likely to compromise confidentiality. Thank you for being part of this study.

Section 1. ข้อมูลทั่วไปขององค์กร (Details of the organisation)

Question 1.1

องค์กรของท่านดำเนินธุรกิจอยู่ในอุตสาหกรรมใด

(Which industry are you operating in?)

- ไฟเบอร์ (Fibre and product)
- เคมีภัณฑ์ (Chemicals and plastics)
- กระดาษ (Paper)
- รถยนต์ (Automobile)
- ซีเมนต์ (Cement)
- อุปกรณ์อิเล็กทรอนิกส์ (Electronics)
- พลังงาน (Energy)

- อาหาร (Food)
- อาหารสัตว์ (Animal Food)
- อื่นๆ (Other)

Question 1.1b

โปรดระบุ (Please specify)

Question 1.2

องค์กรของท่านจดทะเบียนก่อตั้งเป็นสัญชาติใด

(Which nationality does your organisation registered for?)

- ไทย 100% (100% Thai Owner)
- ต่างชาติ 100% (100% Foreign Owner)
- ร่วมทุน (Joint Venture)

Question 1.2b

โปรดระบุสัญชาติ (Please specify the nationality)

Question 1.3

ท่านรับผิดชอบหน้าที่ใดในองค์กร

(What is your responsibility in an organisation?)

- ผู้บริหารระดับสูง (Top Management)
- ผู้จัดการคุณภาพ (Quality Manager)
- ผู้จัดการฝ่าย/แผนก (Departmental Manager)
- อื่นๆ (Other)

Question 1.3b

โปรดระบุ (Please specify)

Section 2. เครื่องมือของแนวคิดแบบลีน (Lean Tools)

Question 2.1

จากประสบการณ์ของท่าน องค์กรควรจัดลำดับความเหมาะสมในการใช้งานเครื่องมือของแนวคิดแบบลีนหรือไม่

(Based on your experiences, do you think Lean tools should be prioritised in the implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.1c

กรุณาประเมินระดับความสำคัญในการจัดลำดับความเหมาะสมในการใช้งานเครื่องมือของแนวคิดแบบลีน

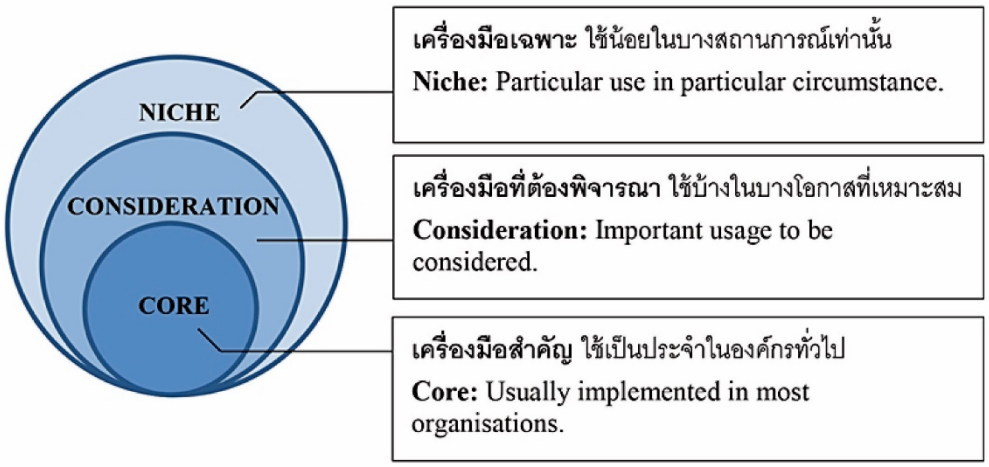
(Please weigh the importance of Lean tool prioritising in the implementation)

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%

Question 2.2

จากรูป ท่านเห็นด้วยหรือไม่ที่มีการจัดประเภทเครื่องมือของแนวคิดแบบลีนออกเป็นสามกลุ่ม คือ เครื่องมือที่สำคัญ (Core), เครื่องมือที่ต้องพิจารณา (Consideration) และเครื่องมือเฉพาะ (Niche) ดังรูป

(Based on the model, is it sensible to categorise Lean tools into three groups which are Core, Consideration and Niche?)



- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.3

จากตารางด้านล่าง ท่านเห็นด้วยหรือไม่ที่เครื่องมือของแนวคิดแบบลีน (Lean Tools) ถูกจัดออกเป็นสามกลุ่มคือ เครื่องมือสำคัญ, เครื่องมือที่ต้องพิจารณา และ เครื่องมือเฉพาะ

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(Based on the table below, do you agree on Lean toolboxes which are categorised into Core, Consideration and Niche groups?)

กลุ่มของเครื่องมือ (Category)	เครื่องมือของแนวคิดแบบลีนในอุตสาหกรรมการผลิต (Lean Tools in the manufacturing sector)
เครื่องมือเฉพาะ ใช้น้อยในบางสถานการณ์เท่านั้น NICHE: Particular use in particular circumstance.	Level Scheduling, Group Technology, Pull System
เครื่องมือที่ต้องพิจารณา ใช้บ้างในบางโอกาสที่เหมาะสม CONSIDERATION: Important usage to be considered.	Continuous Flow, Ergonomic Design, Autonomation, Value Analysis, Concurrent Engineering, Cellular Manufacturing, JIT, Close Supplier Ties, Takt Time, A3 Thinking, SMED
เครื่องมือสำคัญ ใช้เป็นประจำในองค์กรทั่วไป CORE: Usually implementation in most organisations.	PDCA, Five Ss, Kaizen, Root Cause Analysis, Standardisation, TPM, Gemba, Policy Deployment, Visual Management, Breakthrough Improvement, Poka-Yoke, Bottleneck Analysis, QFD, Brown Paper Analysis, VSM, Flexible Workforce

ตารางแสดงเครื่องมือของแนวคิดแบบลีน (Lean Tools) ในอุตสาหกรรมการผลิต

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 2.3b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.4

ท่านเห็นด้วยหรือไม่ว่าองค์กรในอุตสาหกรรมการการผลิต น่าจะมีการจัดลำดับการนำเครื่องมือของแนวคิดแบบลีนมาใช้ แตกต่างจากองค์กรในภาคการบริการ

(Based on your experiences, do you agree that your organisations as the manufacturing business might prioritise Lean

tools differently from those in the service sectors?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.4b

โปรดระบุเหตุผล (Please specify reasons)

Section 3. เงื่อนไขที่ใช้ตัดสินใจนำแนวคิดแบบลีนมาใช้ (Decision criteria in the implementation)

Question 3.1

จากประสบการณ์ ท่านเห็นด้วยหรือไม่ว่าองค์กรควรกำหนดเงื่อนไขที่สำคัญที่ใช้ในการตัดสินใจนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้

(Based on your experiences, is it important to propose key decision criteria that should be used when making a decision on Lean Thinking implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 3.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 3.2

จากรูป ท่านเห็นด้วยหรือไม่ว่า เงื่อนไขที่องค์กรใช้ในการตัดสินใจนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้ สามารถแบ่งได้เป็นสามกลุ่ม คือ ความพร้อมขององค์กร (organisation readiness), แผนกลยุทธ์ (strategic planning) และ คำแนะนำจากภายนอก (external suggestion)

(Based on the model, is it sensible to categorise decision criteria that should be used in making a decision on Lean Thinking implementation based on organisation readiness, strategic planning and external suggestion?)

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- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 3.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 3.3

กรุณาประเมินระดับความสำคัญของเหตุผลแต่ละข้อที่ใช้ในการตัดสินใจนำแนวคิดแบบลีนมาประยุกต์ใช้

(Please weigh the degree of **important** of the decision criteria in Lean Thinking implementation.)

ความพร้อมขององค์กร (Organisation readiness)	○	○	○	○	○	○	○	○	○	○	○
แผนกลยุทธ์ (Strategic planning)	○	○	○	○	○	○	○	○	○	○	○
คำแนะนำจากภายนอก (External suggestion)	○	○	○	○	○	○	○	○	○	○	○

Question 3.4

ท่านมีข้อเสนอแนะอื่นๆ ที่เกี่ยวข้องกับเหตุผลที่ใช้ในการตัดสินใจนำแนวคิดแบบลีนมาประยุกต์ใช้หรือไม่

(Do you have any suggestions on the Decision Criteria of Lean Thinking implementation?)

- มีข้อเสนอแนะ (Yes)
- ไม่มีข้อเสนอแนะ (No)

Question 3.4b

โปรดระบุ (Please specify)

Section 4. ปัจจัยสนับสนุนในการประยุกต์ใช้แนวคิดแบบลีน (Supporting factors in Lean Thinking implementation)

Question 4.1

จากประสบการณ์ ท่านเห็นด้วยหรือไม่ว่าองค์กรจำเป็นต้องพิจารณาปัจจัยต่างๆที่ช่วยสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on your experiences, do you agree that an organisation needs to consider a number of supporting factors in order to achieve in the implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

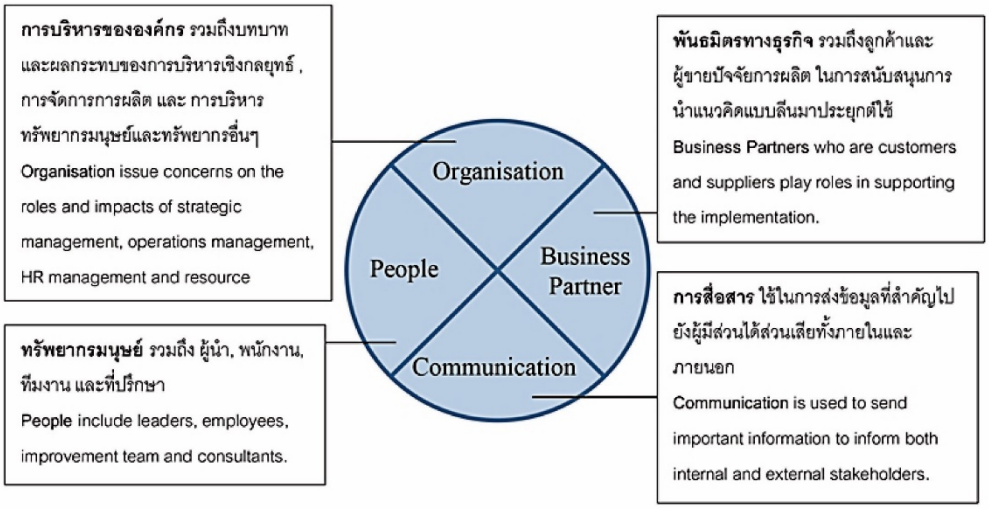
Question 4.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 4.2

จากรูป ท่านเห็นด้วยหรือไม่ว่า ทรัพยากรมนุษย์, การบริหารขององค์กร, การสื่อสาร และ พันธมิตรทางธุรกิจ มีบทบาทสำคัญในการสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on the model, do you agree that people, organisation, communication and business partner are significant aspects that support the achievement in Lean Thinking implementation?)



- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 4.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 4.3

Appendix E

กรุณาประเมินระดับความสำคัญของปัจจัยแต่ละข้อที่ช่วยสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Please weigh the degree of **importance** of the supporting factors in Lean Thinking implementation.)

ทรัพยากรมนุษย์ (People)	○	○	○	○	○	○	○	○	○	○	○
การบริหารองค์กร (Organisation)	○	○	○	○	○	○	○	○	○	○	○
การสื่อสาร (Communication)	○	○	○	○	○	○	○	○	○	○	○
พันธมิตรทางธุรกิจ (Business Partner)	○	○	○	○	○	○	○	○	○	○	○

Question 4.4

ท่านมีข้อเสนอแนะอื่นๆ ที่เกี่ยวข้องกับปัจจัยสนับสนุนในการนำแนวคิดแบบลีนมาประยุกต์ใช้หรือไม่

(Do you have any suggestions on the Supporting factors of Lean Thinking implementation?)

- ○ มีข้อเสนอแนะ (Yes)
- ○ ไม่มีข้อเสนอแนะ (No)

Question 4.4b

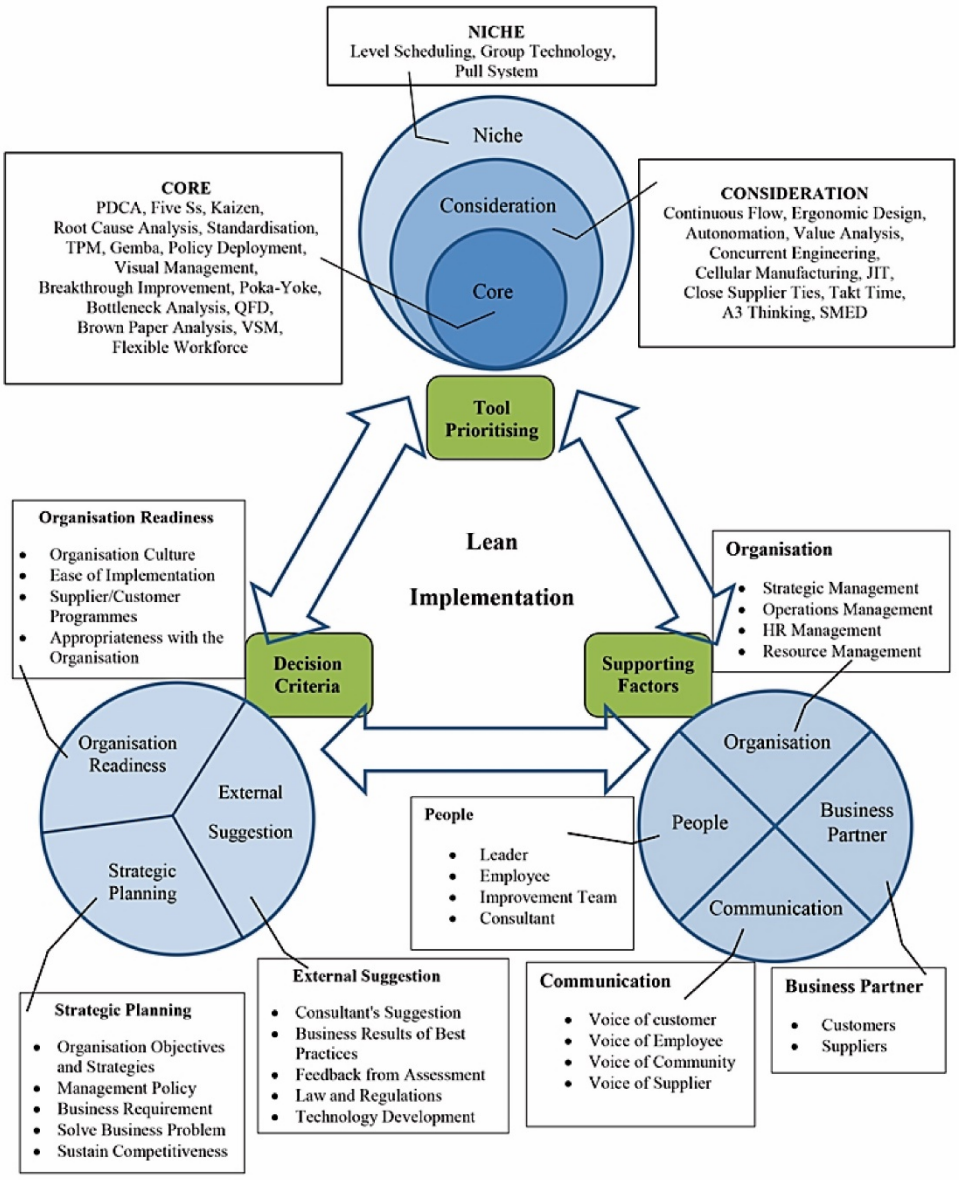
โปรดระบุ (Please specify)

Section 5. ข้อเสนอแนะในการปรับปรุงกรอบแนวคิดแบบลีน (Suggestions for developing the proposed model on Lean Thinking implementation)

Question 5.1

กรุณาประเมินระดับความครบถ้วนสมบูรณ์ขององค์ประกอบของแนวคิดแบบลีนในกรอบความคิดที่พัฒนาขึ้น

(Based on the model, please weigh the degree of comprehensiveness of Lean elements in the developed model.)



Lean Thinking Elements and Interaction Model in the Manufacturing Sector

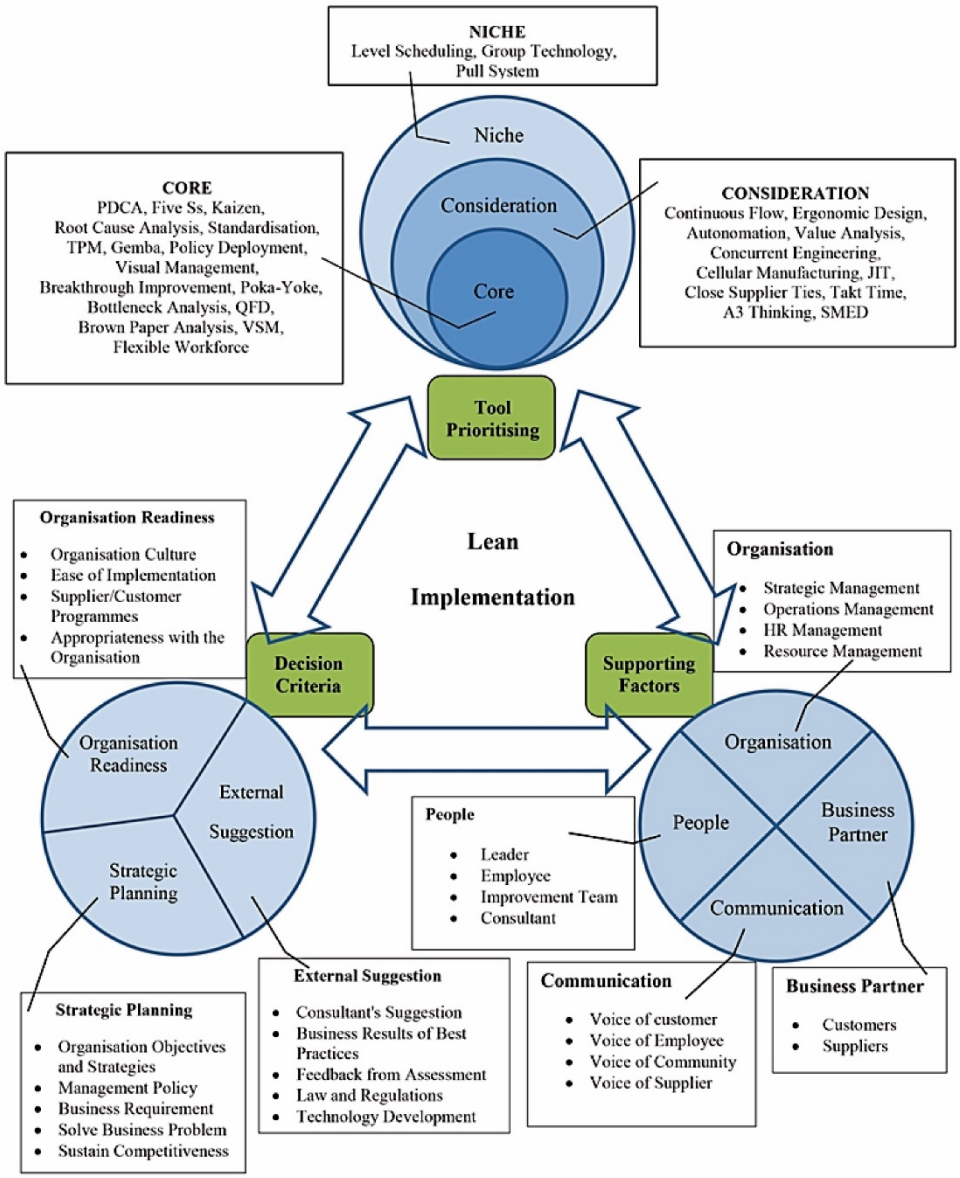
การจัดลำดับความสำคัญของเครื่องมือตามแนวคิดแบบลีน (Tool Prioritising)	○	○	○	○	○	○	○	○	○	○	○
เงื่อนไขที่ใช้ในการตัดสินใจ (Decision Criteria)	○	○	○	○	○	○	○	○	○	○	○
ปัจจัยสนับสนุน (Supporting Factors)	○	○	○	○	○	○	○	○	○	○	○

Question 5.2

Appendix E

กรุณาประเมินระดับความเหมาะสมของโครงสร้างของกรอบความคิดที่พัฒนาขึ้น

(Please weigh the degree of appropriateness of the structure of the developed model.)



Lean Thinking Elements and Interaction Model in the Manufacturing Sector

ชัดเจนและง่ายในการทำความเข้าใจ (Clarity: easy to understand)

ความสอดคล้องขององค์ประกอบของแนวคิดแบบลีน

(Relatedness of Lean elements)

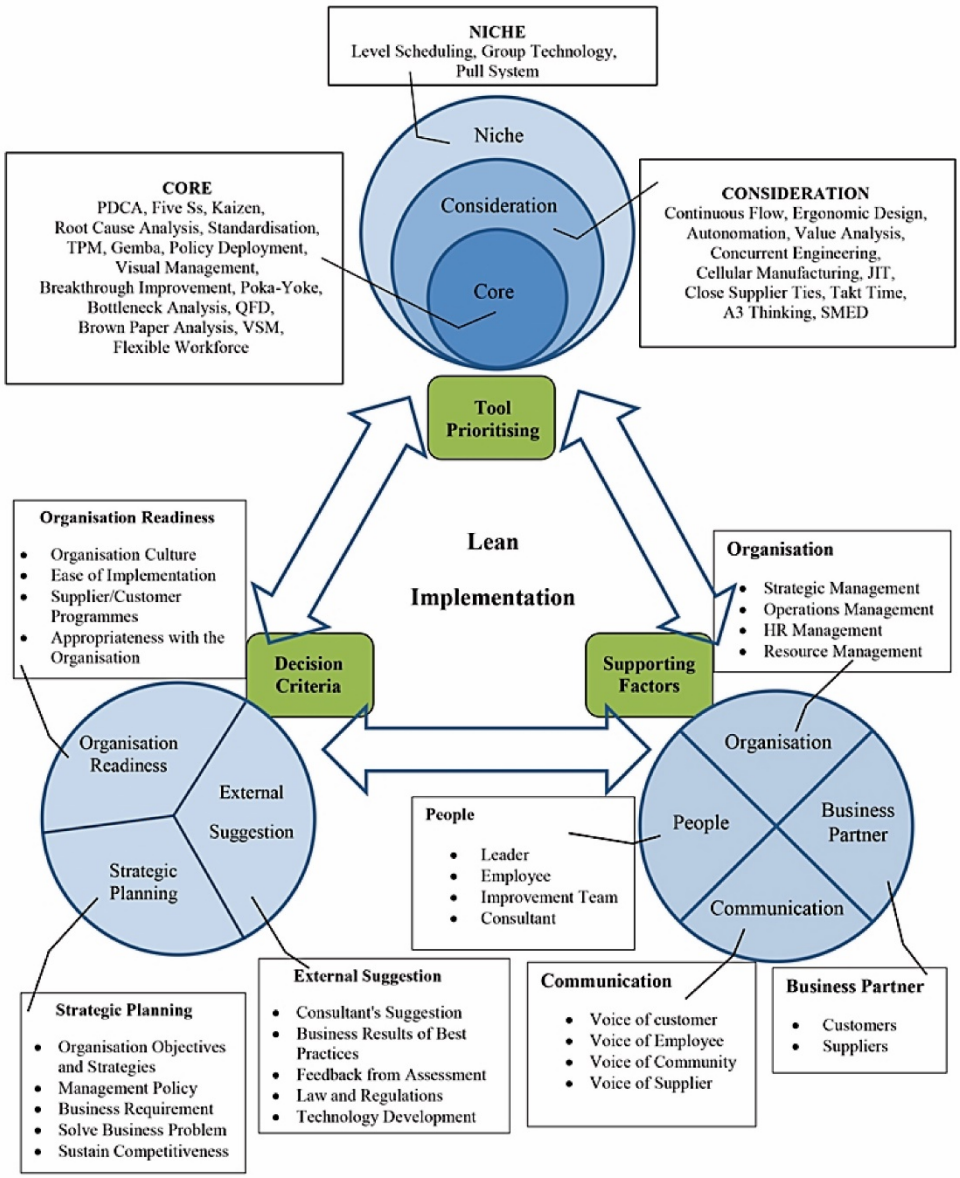
ความถูกต้องของกรอบแนวคิด (Accurateness of the proposed model)

Question 5.3

กรุณาประเมินระดับประโยชน์และความเป็นไปได้ในการนำกรอบความคิดที่พัฒนาขึ้นนี้ไปประยุกต์ใช้ในสถานการณ์จริง

(Please weigh the degree of usefulness and applicability of the developed model in the real situation.)

Appendix E



Lean Thinking Elements and Interaction Model in the Manufacturing Sector

กรอบแนวคิดนี้สามารถท่านจัดลำดับความสำคัญในการทำงานได้ (This model would help you to prioritise your works.) ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

กรอบแนวคิดนี้ช่วยให้ท่านทราบว่าในการนำแนวคิดแบบลีนมาประยุกต์นั้น องค์กรจำเป็นต้องพิจารณาองค์ประกอบใดบ้าง (This model informs you of important elements that should be considered in the implementation.) ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

กรอบแนวคิดนี้สามารถนำไปประยุกต์ใช้ได้ในสถานการณ์จริง (This model can be applied in the real situation.)

ท่านเห็นว่ากรอบแนวคิดนี้มีประโยชน์และสามารถใช้เป็นแนวทางในการนำแนวคิดแบบลีนมาประยุกต์ใช้ (Overall, your view of the usefulness of this model as a guideline in Lean Thinking implementation.)

Question 5.4

ท่านคิดว่าจุดเด่นของกรอบแนวคิดนี้คืออะไร

(What are strengths of the proposed model?)

Question 5.5

ท่านคิดว่าจุดด้อยของกรอบแนวคิดนี้คืออะไร

(What are weaknesses of this model?)

Question 5.6

ท่านเห็นด้วยหรือไม่ว่ากรอบแนวคิดนี้ควรใส่องค์ประกอบอื่นๆเพิ่มเข้ามาเพื่อทำให้กรอบแนวคิดนี้สมบูรณ์มากยิ่งขึ้น

(Based on the proposed model, are there other aspects that should be added to present a more complete picture of Lean implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 5.6b

โปรดระบุ (Please specify)

Question 5.7

ท่านมีข้อเสนอแนะอื่นๆเพิ่มเติมหรือไม่

(Do you have any suggestions for improving the proposed model?)

- มี (Yes)
- ไม่มี (No)

Question 5.7b

โปรดระบุ (Please specify)

ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

Thank you for taking this questionnaire.

Appendix F : Survey Questionnaire for the Service Practitioners in the Model Refinement

The Impact of Lean Approaches to Support Quality Development in Thailand (For Practitioners in the Service Sector)

องค์กรจำนวนมากนำแนวคิดทางการบริหารเชิงคุณภาพมาประยุกต์ใช้ เพื่อปรับปรุงการดำเนินงานขององค์กร โดยเฉพาะอย่างยิ่ง แนวคิดแบบลีน (Lean Thinking) ซึ่งเป็นแนวคิดที่มุ่งเน้นการลดกิจกรรมที่ไม่สร้างมูลค่าเพิ่ม (Non-value-added Activities/Wastes) โดยองค์กรจำนวนมากทั้งภาครัฐและภาคเอกชนได้มีการนำแนวคิดดังกล่าวนี้ไปประยุกต์ใช้มากมาย เนื่องจากมีหลักฐานที่ชัดเจนว่าแนวคิดแบบลีน (Lean Thinking) สามารถช่วยให้องค์กรหลายแห่งประสบความสำเร็จในการปรับปรุงการดำเนินงาน อย่างไรก็ตามยังคงมีข้อสงสัยว่าองค์กรควรจะมีการนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้อย่างไรจึงจะเหมาะสมกับความต้องการที่เฉพาะเจาะจงของแต่ละธุรกิจ ดังนั้นงานวิจัยนี้จึงมุ่งมั่นที่จะพัฒนากรอบความคิดในการนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้ร่วมกับการบริหารคุณภาพโดยรวม (Total Quality Management: TQM) ตามแบบองค์กรแห่งความเป็นเลิศ (Business Excellence Organisations) ในประเทศไทย

แบบสอบถามนี้เป็นส่วนหนึ่งของการศึกษาระดับปริญญาเอกในหัวข้อการวิจัย "ผลกระทบของแนวคิดแบบลีนในการสนับสนุนการพัฒนาคุณภาพในประเทศไทย"

ข้อมูลจากการตอบแบบสอบถามนี้จะถูกเก็บเป็นความลับและนำไปใช้เพื่อดำเนินการวิจัยเท่านั้น ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

In order to become a world-class organisation, a number of quality management approaches have been implemented to improve organisational performances. Particularly, Lean Thinking has been highlighted as one of the significant management approaches that focuses on the elimination of waste. Due to the success of reported improvement programmes, Lean Thinking has been applied in various organisations which include public and private sectors. However, there is still a question on how to implement Lean tools and techniques in a way suited to the particular needs of the business. This study therefore aims to generate a conceptual academic model which supports the analysis of how Lean Thinking was implemented alongside Total Quality Management in the Business Excellence organisations in Thailand.

This questionnaire is the part of the PhD study on "The Impact of Lean Approaches to Support Quality Developments in Thailand"

All confidential information will be kept securely and no company information will be used in any way likely to compromise confidentiality. Thank you for being part of this study.

Section 1. ข้อมูลทั่วไปขององค์กร (Details of the organisation)

Question 1.1

องค์กรของท่านดำเนินธุรกิจอยู่ในอุตสาหกรรมใด

(Which industry are you operating in?)

- รถยนต์ (Automobile)
- พลังงาน (Energy)
- อุปกรณ์อิเล็กทรอนิกส์ (Electronics)
- โรงพยาบาล (Hospital)
- การศึกษา (Education)
- ค้าปลีก (Retailing)
- โทรคมนาคม (Telecommunication)

- รับชำระเงิน (Payment Service Provider)
- อื่นๆ (Other)

Question 1.1b

โปรดระบุ (Please specify)

Question 1.2

องค์กรของท่านจดทะเบียนก่อตั้งเป็นสัญชาติใด

(Which nationality does your organisation registered for?)

- ไทย 100% (100% Thai Owner)
- ต่างชาติ 100% (100% Foreign Owner)
- ร่วมทุน (Joint Venture)

Question 1.2b

โปรดระบุสัญชาติ (Please specify the nationality)

Question 1.3

ท่านรับผิดชอบหน้าที่ใดในองค์กร

(What is your responsibility in an organisation?)

- ผู้บริหารระดับสูง (Top Management)
- ผู้จัดการคุณภาพ (Quality Manager)
- ผู้จัดการฝ่าย/แผนก (Departmental Manager)
- อื่นๆ (Other)

Question 1.3b

โปรดระบุ (Please specify)

Section 2. เครื่องมือของแนวคิดแบบลีน (Lean Tools)

Question 2.1

จากประสบการณ์ของท่าน องค์กรควรจัดลำดับความเหมาะสมในการใช้งานเครื่องมือของแนวคิดแบบลีนหรือไม่

(Based on your experiences, do you think Lean tools should be prioritised in the implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.1c

กรุณาประเมินระดับความสำคัญในการจัดลำดับความเหมาะสมในการใช้งานเครื่องมือของแนวคิดแบบลีน

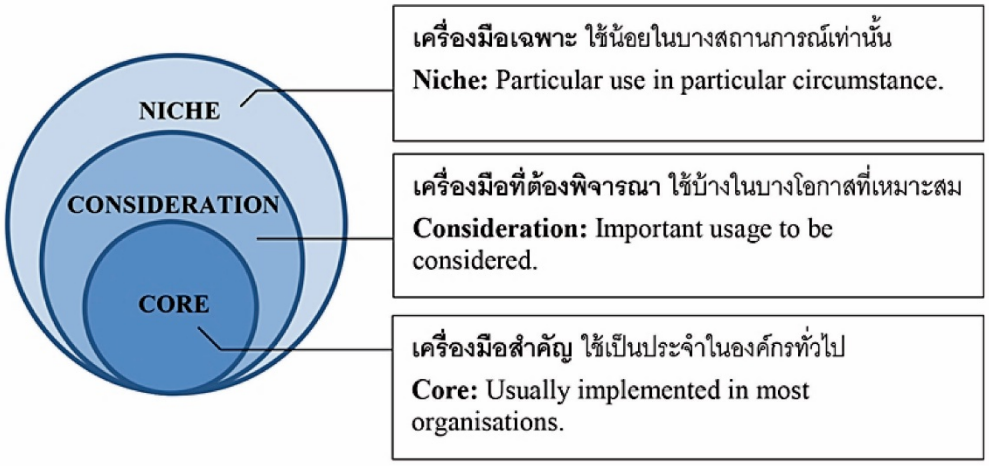
(Please weigh the importance of Lean tool prioritising in the implementation)

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%

Question 2.2

จากรูป ท่านเห็นด้วยหรือไม่ที่มีการจัดประเภทเครื่องมือของแนวคิดแบบลีนออกเป็นสามกลุ่ม คือ เครื่องมือที่สำคัญ (Core), เครื่องมือที่ต้องพิจารณา (Consideration) และเครื่องมือเฉพาะ (Niche) ดังรูป

(Based on the model, is it sensible to categorise Lean tools into three groups which are Core, Consideration and Niche?)



- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.3

จากตารางด้านล่าง ท่านเห็นด้วยหรือไม่ที่เครื่องมือของแนวคิดแบบลีน (Lean Tools) ถูกจัดออกเป็นสามกลุ่มคือ เครื่องมือสำคัญ, เครื่องมือที่ต้องพิจารณา และ เครื่องมือเฉพาะ

(Based on the table below, do you agree on Lean toolboxes which are categorised into Core, Consideration and

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Niche groups?)

กลุ่มของเครื่องมือ (Category)	เครื่องมือของแนวคิดแบบลีนในอุตสาหกรรมการบริการ (Lean Tools in the service sector)
เครื่องมือเฉพาะ ใช้น้อยในบางสถานการณ์เท่านั้น NICHE: Particular use in particular circumstance.	VSM, Level Scheduling, Pull System, Autonomation, Group Technology, JIT, Close Supplier Ties, Takt Time, A3 Thinking, Cellular Manufacturing, SMED
เครื่องมือที่ต้องพิจารณา ใช้บ้างในบางโอกาสที่เหมาะสม CONSIDERATION: Important usage to be considered.	Visual Management, Poka-Yoke, Continuous Flow, Breakthrough Improvement, Value Analysis, Brown Paper Analysis, Bottleneck Analysis, QFD, Flexible Workforce, Ergonomic Design, Concurrent Engineering
เครื่องมือสำคัญ ใช้เป็นประจำในองค์กรทั่วไป CORE: Usually implementation in most organisations.	PDCA, Root Cause Analysis, Five Ss, Kaizen, Policy Deployment, Standardisation, Gemba, TPM

ตารางแสดงเครื่องมือของแนวคิดแบบลีน (Lean Tools) ในอุตสาหกรรมการบริการ

- ○ เห็นด้วย (Yes)
- ○ ไม่เห็นด้วย (No)
- ○

Question 2.3b

โปรดระบุเหตุผล (Please specify reasons)

Question 2.4

ท่านเห็นด้วยหรือไม่ว่าองค์กรในอุตสาหกรรมการการบริการ น่าจะมีการจัดลำดับการนำเครื่องมือของแนวคิดแบบลีนมาใช้ **แตกต่างจากองค์กรในภาคการผลิต**

(Based on your experiences, do you agree that your organisations as the service business might prioritise Lean tools differently from those in the manufacturing sectors?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 2.4b

โปรดระบุเหตุผล (Please specify reasons)

Section 3. เงื่อนไขที่ใช้ตัดสินใจนำแนวคิดแบบลีนมาใช้ (Decision criteria in the implementation)

Question 3.1

จากประสบการณ์ ท่านเห็นด้วยหรือไม่ว่าองค์กรควรกำหนดเงื่อนไขที่สำคัญที่ใช้ในการตัดสินใจนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้

(Based on your experiences, is it important to propose key decision criteria that should be used when making a decision on Lean Thinking implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 3.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 3.2

จากรูป ท่านเห็นด้วยหรือไม่ว่า เงื่อนไขที่องค์กรใช้ในการตัดสินใจนำแนวคิดแบบลีน (Lean Thinking) มาประยุกต์ใช้ สามารถแบ่งได้เป็นสามกลุ่ม คือ ความพร้อมขององค์กร (organisation readiness), แผนกลยุทธ์ (strategic planning) และ คำแนะนำจากภายนอก (external suggestion)

(Based on the model, is it sensible to categorise decision criteria that should be used in making a decision on Lean Thinking implementation based on organisation readiness, strategic planning and external suggestion?)

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- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 3.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 3.3

กรุณาประเมินระดับความสำคัญของเหตุผลแต่ละข้อที่ใช้ในการตัดสินใจนำแนวคิดแบบลีนมาประยุกต์ใช้

(Please weigh the degree of **important** of the decision criteria in Lean Thinking implementation.)

ความพร้อมขององค์กร (Organisation readiness)	○	○	○	○	○	○	○	○	○	○	○
แผนกลยุทธ์ (Strategic planning)	○	○	○	○	○	○	○	○	○	○	○
คำแนะนำจากภายนอก (External suggestion)	○	○	○	○	○	○	○	○	○	○	○

Question 3.4

ท่านมีข้อเสนอแนะอื่นๆ ที่เกี่ยวข้องกับเหตุผลที่ใช้ในการตัดสินใจนำแนวคิดแบบลีนมาประยุกต์ใช้หรือไม่

(Do you have any suggestions on the Decision Criteria of Lean Thinking implementation?)

- มีข้อเสนอแนะ (Yes)
- ไม่มีข้อเสนอแนะ (No)

Question 3.4b

โปรดระบุ (Please specify)

Section 4. ปัจจัยสนับสนุนในการประยุกต์ใช้แนวคิดแบบลีน (Supporting factors in Lean Thinking implementation)

Question 4.1

จากประสบการณ์ ท่านเห็นด้วยหรือไม่ว่าองค์กรจำเป็นต้องพิจารณาปัจจัยต่างๆที่ช่วยสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on your experiences, do you agree that an organisation needs to consider a number of supporting factors in order to achieve in the implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

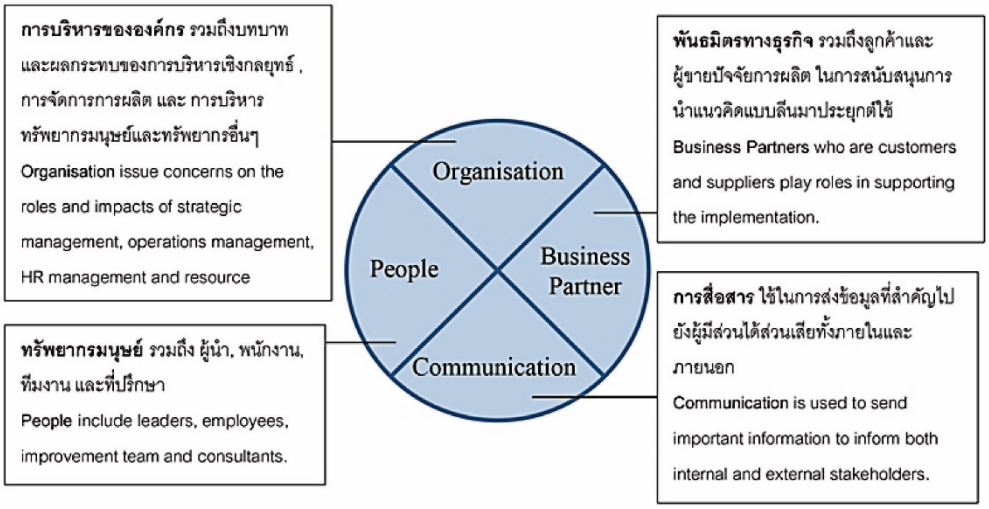
Question 4.1b

โปรดระบุเหตุผล (Please specify reasons)

Question 4.2

จากรูป ท่านเห็นด้วยหรือไม่ว่า ทรัพยากรมนุษย์, การบริหารขององค์กร, การสื่อสาร และ พันธมิตรทางธุรกิจ มีบทบาทสำคัญในการสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Based on the model, do you agree that people, organisation, communication and business partner are significant aspects that support the achievement in Lean Thinking implementation?)



- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)

Question 4.2b

โปรดระบุเหตุผล (Please specify reasons)

Question 4.3

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กรุณาประเมินระดับความสำคัญของปัจจัยแต่ละข้อที่ช่วยสนับสนุนให้องค์กรประสบความสำเร็จในการนำแนวคิดแบบลีนมาประยุกต์ใช้

(Please weigh the degree of **importance** of the supporting factors in Lean Thinking implementation.)

ทรัพยากรมนุษย์ (People)	○	○	○	○	○	○	○	○	○	○	○
การบริหารองค์กร (Organisation)	○	○	○	○	○	○	○	○	○	○	○
การสื่อสาร (Communication)	○	○	○	○	○	○	○	○	○	○	○
พันธมิตรทางธุรกิจ (Business Partner)	○	○	○	○	○	○	○	○	○	○	○

Question 4.4

ท่านมีข้อเสนอแนะอื่นๆ ที่เกี่ยวข้องกับปัจจัยสนับสนุนในการนำแนวคิดแบบลีนมาประยุกต์ใช้หรือไม่

(Do you have any suggestions on the Supporting factors of Lean Thinking implementation?)

- ○ มีข้อเสนอแนะ (Yes)
- ○ ไม่มีข้อเสนอแนะ (No)

Question 4.4b

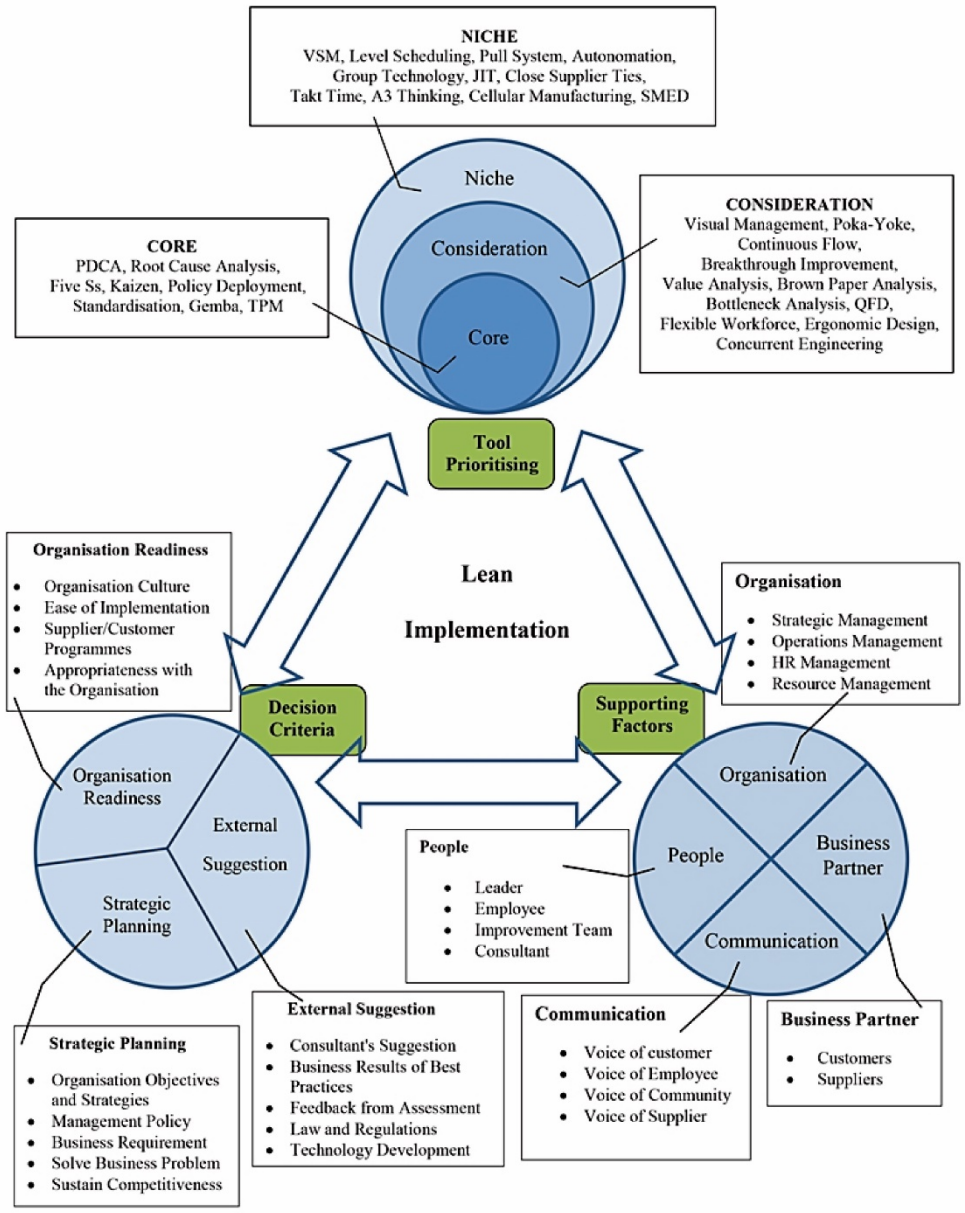
โปรดระบุ (Please specify)

Section 5. ข้อเสนอแนะในการปรับปรุงกรอบแนวคิดแบบลีน (Suggestions for developing the proposed model on Lean Thinking implementation)

Question 5.1

กรุณาประเมินระดับความครบถ้วนสมบูรณ์ขององค์ประกอบของแนวคิดแบบลีนในกรอบความคิดที่พัฒนาขึ้น

(Based on the model, please weigh the degree of comprehensiveness of Lean elements in the developed model.)



Lean Thinking Elements and Interaction Model in the Service Sector

การจัดลำดับความสำคัญของเครื่องมือตามแนวคิดแบบลีน (Tool Prioritising)	○	○	○	○	○	○	○	○	○	○	○
เงื่อนไขที่ใช้ในการตัดสินใจ (Decision Criteria)	○	○	○	○	○	○	○	○	○	○	○
ปัจจัยสนับสนุน (Supporting Factors)	○	○	○	○	○	○	○	○	○	○	○

Question 5.2

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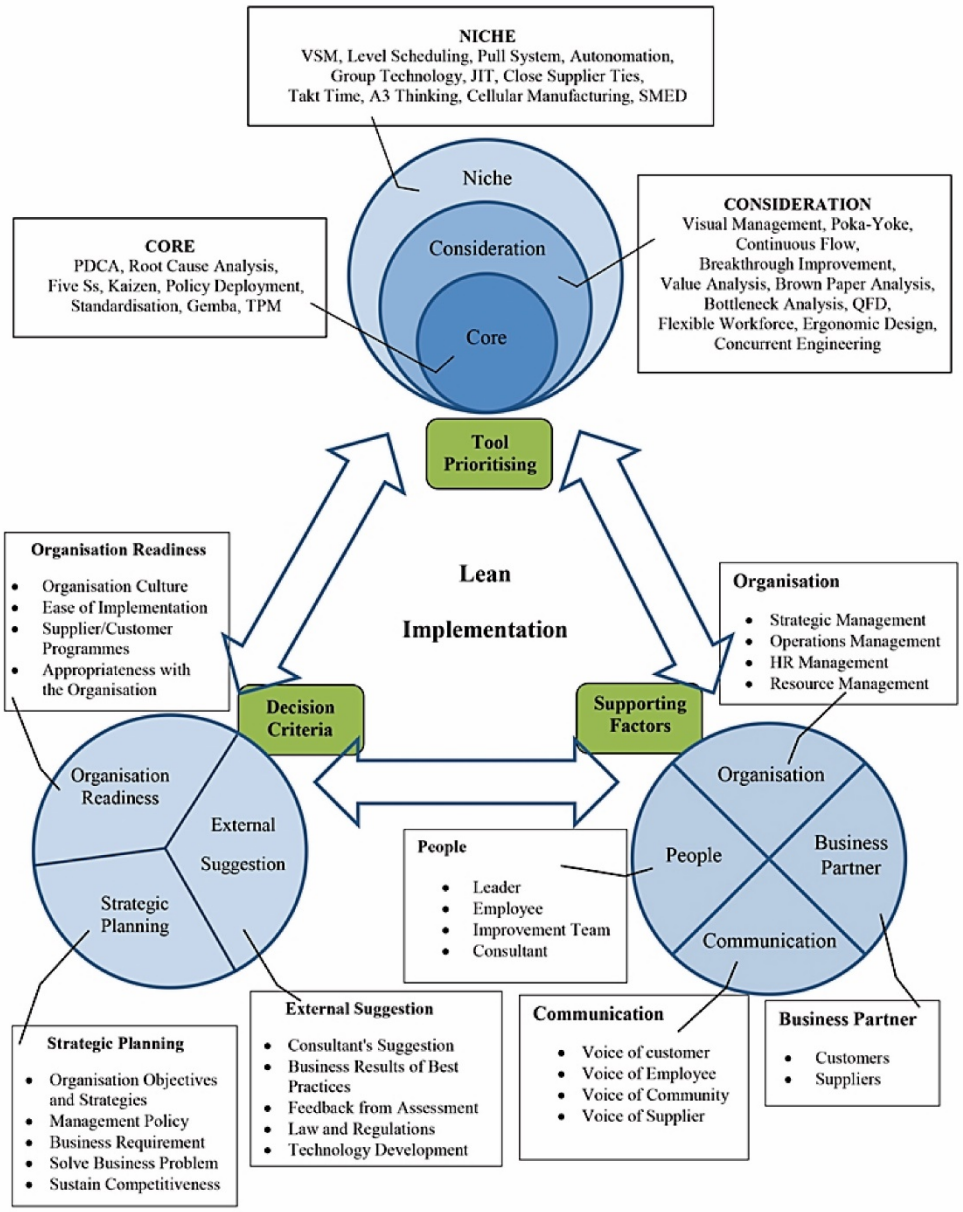
กรุณาประเมินระดับความเหมาะสมของโครงสร้างของกรอบความคิดที่พัฒนาขึ้น

(Please weigh the degree of appropriateness of the structure of the developed model.)



Lean Thinking Elements and Interaction Model in the Service Sector

ชัดเจนและง่ายในการทำความเข้าใจ (Clarity: easy to understand)

ความสอดคล้องขององค์ประกอบของแนวคิดแบบลีน

(Relatedness of Lean elements)

ความถูกต้องของกรอบแนวคิด (Accurateness of the proposed model)

Question 5.3

กรุณาประเมินระดับประโยชน์และความเป็นไปได้ในการนำกรอบความคิดที่พัฒนาขึ้นนี้ไปประยุกต์ใช้ในสถานการณ์จริง

(Please weigh the degree of usefulness and applicability of the developed model in the real situation.)

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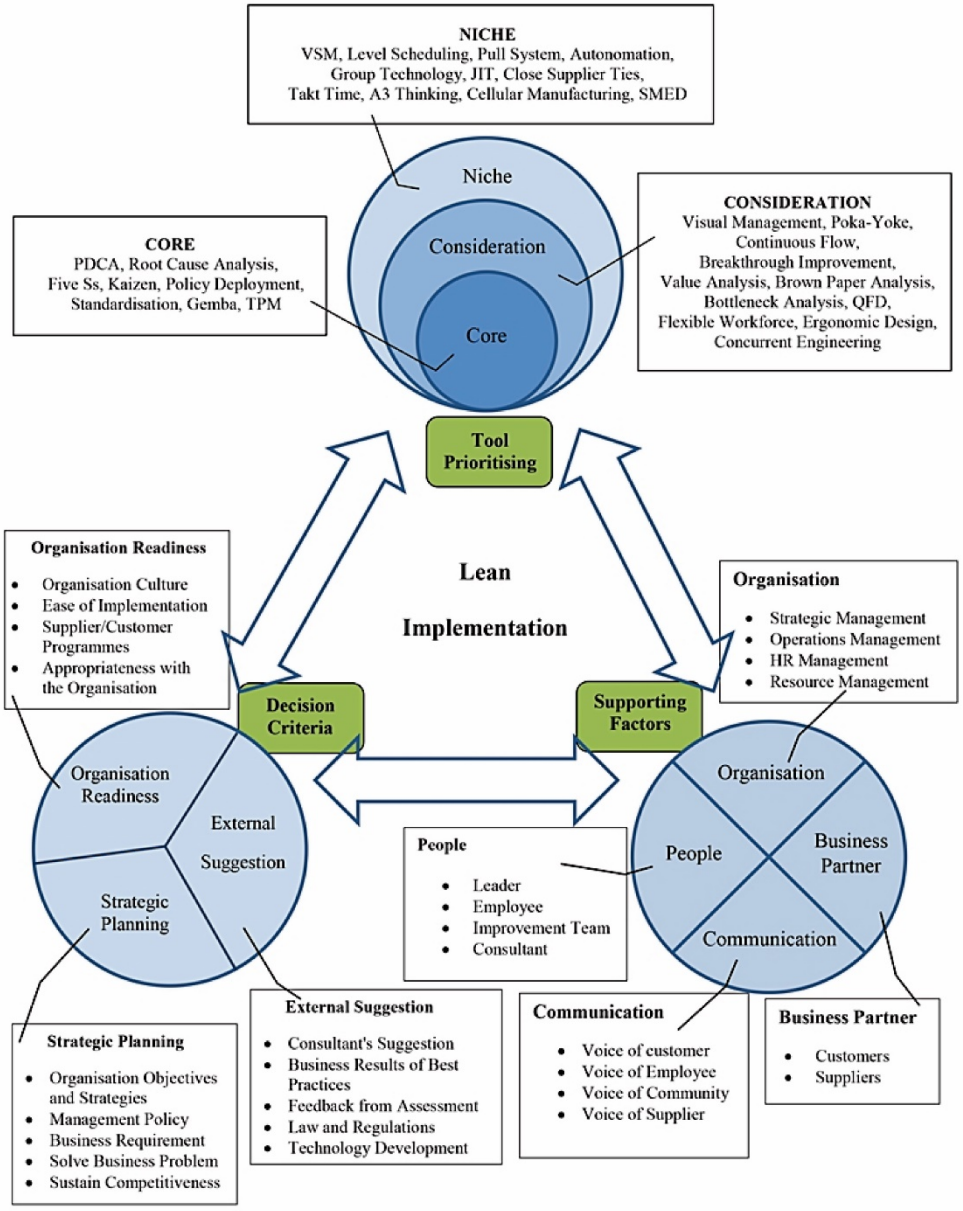

Lean Thinking Elements and Interaction Model in the Service Sector

กรอบแนวคิดนี้สามารถท่านจัดลำดับความสำคัญในการทำงานได้ (This model would help you to prioritise your works.) ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

กรอบแนวคิดนี้ช่วยให้ท่านทราบว่าในการนำแนวคิดแบบลีนมาประยุกต์นั้น องค์กรจำเป็นต้องพิจารณาองค์ประกอบใดบ้าง (This model informs you of important elements that should be considered in the implementation.) ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○

กรอบแนวคิดนี้สามารถนำไปประยุกต์ใช้ได้ในสถานการณ์จริง (This model can be applied in the real situation.)

ท่านเห็นว่ากรอบแนวคิดนี้มีประโยชน์และสามารถใช้เป็นแนวทางในการนำแนวคิดแบบลีนมาประยุกต์ใช้ (Overall, your view of the usefulness of this model as a guideline in Lean Thinking implementation.)

Question 5.4

ท่านคิดว่าจุดเด่นของกรอบแนวคิดนี้คืออะไร

(What are strengths of the proposed model?)

Question 5.5

ท่านคิดว่าจุดด้อยของกรอบแนวคิดนี้คืออะไร

(What are weaknesses of this model?)

Question 5.6

ท่านเห็นด้วยหรือไม่ว่ากรอบแนวคิดนี้ควรใส่องค์ประกอบอื่นๆเพิ่มเข้ามาเพื่อทำให้กรอบแนวคิดนี้สมบูรณ์มากยิ่งขึ้น

(Based on the proposed model, are there other aspects that should be added to present a more complete picture of Lean implementation?)

- เห็นด้วย (Yes)
- ไม่เห็นด้วย (No)
-

Question 5.6b

โปรดระบุ (Please specify)

Question 5.7

ท่านมีข้อเสนอแนะอื่นๆเพิ่มเติมหรือไม่

(Do you have any suggestions for improving the proposed model?)

- มี (Yes)
- ไม่มี (No)

Question 5.7b

โปรดระบุ (Please specify)

ขอขอบพระคุณเป็นอย่างสูงในความอนุเคราะห์ตอบแบบสอบถามนี้

Thank you for taking this questionnaire.