FINAL RESEARCH PAPER

PROJECT TITLE: THE RELATIONSHIPS AMONG TRANSFORMATIONAL LEADERSHIP, SUSTAINABLE LEADERSHIP, LEAN MANUFACTURING PRACTICES, AND SUSTAINABILITY PERFORMANCE IN THAI MANUFACTURING INDUSTRY

DR. PIYACHAT BURAWAT

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รายงานวิจัยฉบับสมบูรณ์

โครงการ ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย

โดย ดร.ปิยฉัตร บูระวัฒน์

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PIYACHAT BURAWAT

FACULTY OF BUSINESS ADMINISTRATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI

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(The results presented in this report are those of the researcher which OHEC and TRF do not necessarily agree)

สัญญาเลขที่ MRG5980112

รายงานวิจัยฉบับสมบูรณ์

โครงการ ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืน ในอุตสาหกรรมการผลิตไทย

ผู้วิจัย
ปิยฉัตร บูระวัฒน์
สังกัด สาขาวิชาการจัดการ คณะบริหารธุรกิจ
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สนับสนุนโดยสำนักงานคณะกรรมการการอุดมศึกษา
และสำนักงานกองทุนสนับสนุนการวิจัย
(ความเห็นในรายงานนี้เป็นของผู้วิจัย สกอ. และ สกว. ไม่จำเป็นต้องเห็นด้วยเสมอไป)

Abstract

Project Code : MRG5980112

Project Title : The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry

Investigator : Piyachat Burawat, Rajamangala University of Technology Thanyaburi

Email Address : piyachat_b@rmutt.ac.th

Project Period : 1 year 6 month

This study proposes to examine the structural relationship model among transformational leadership, sustainable leadership, lean manufacturing practices, and sustainability performance. In addition, this study is aimed to explore the relationship between transformational leadership and sustainability performance through lean manufacturing, and to explore the relationship between sustainable leadership and sustainability performance through lean manufacturing. The research design is based on the mixed method, gathering data from middle and senior managers working in small and medium enterprises of Thai manufacturing industry.

Regarding the quantitative approach, the data were collected from 598 respondents by means of survey. Considering the initial model, the results reported that lean manufacturing has a partial mediated effect on the relationship between transformational leadership and sustainability performance, and between sustainable leadership and sustainability performance.

Regarding the structural relationship model, the results suggested that transformational leadership has an effect on lean manufacturing, and lean manufacturing has an effect on sustainability performance. Meanwhile, sustainable leadership has an effect on sustainability performance. Although the initial model revealed that there is the relationship between transformational leadership and

sustainability performance, there is the relationship between sustainable leadership and lean manufacturing. This is because sustainable leadership is an expansion theory from transformational leadership; thus, there is relationship between these two factors at high level, which brings about the suppressed regression effect. So, the structural relationship model was reported unrelated.

Qualitative approach was conducted by collecting data by means of in-depth interview with 40 participants who informed that lean practices were appropriate for automotive industry, though less attention and implementation in other industries. The company takes the most attention on customer involvement, with some attention on employee and supplier involvement, which is consistent with quantitative results. Accordingly, small and medium enterprises need to survive in fierce competition by creating value with differentiated strategy as well as cost leadership strategy. Due to limitations in all resources including human resources, which result in maximum resources utilization with lowest cost, managers tend to give advices and exchange ideas with their followers rather than inspire and give them opportunities to make decision. This confirms quantitative result in which the transformational leadership has partial effected with lean and sustainability performance.

Keywords: Transformational leadership, sustainable leadership, lean manufacturing, sustainability performance, manufacturing industry

บทคัดย่อ

รหัสโครงการ : MRG5980112

ชื่อโครงการ : ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย

ชื่อนักวิจัย และสถาบัน : ปิยฉัตร บูระวัฒน์ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

อีเมล์ : piyachat_b@rmutt.ac.th

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การศึกษานี้มีวัตถุประสงค์เพื่อทดสอบโครงสร้างความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืน นอกจากนี้การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลงและประสิทธิภาพที่ยั่งยืนโดยส่งความสัมพันธ์ผ่านระบบการผลิตแบบลีน และเพื่อศึกษาความสัมพันธ์ระหว่างภาวะผู้นำที่ยั่งยืนและและประสิทธิภาพที่ยั่งยืนโดยส่งความสัมพันธ์ผ่านระบบการผลิตแบบลีน ซึ่งใช้วิธีการศึกษาแบบผสมระหว่างวิธีการเชิงปริมาณและวิธีการเชิงคุณภาพ โดยทำการเก็บรวบรวมข้อมูลจากบริษัทขนาดกลางและเล็กที่ดำเนินธุรกิจในอุตสาหกรรมการผลิตในประเทศไทย

วิธีการเชิงปริมาณใช้การวิจัยเชิงสำรวจ โดยทำการเก็บรวบรวมข้อมูลจากพนักงานปัจจุบันซึ่งดำรงตำแหน่งผู้จัดการระดับกลางและระดับสูง จำนวน 598 คน ศึกษาด้วยการวิเคราะห์ข้อมูลประชากรด้วยสถิติเชิงพรรณนา การวิเคราะห์ความสัมพันธ์ระหว่างตัวแปรและความสัมพันธ์ระดับโครงสร้างด้วยเทคนิคการสร้างสมการโครงสร้าง และผลการศึกษาจากโมเดลขั้นแรก พบว่าระบบการผลิตแบบลีนมีอิทธิพลบางส่วนต่อความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลงและประสิทธิภาพที่ยั่งยืน และพบว่าระบบการผลิตแบบลีนมีอิทธิพลบางส่วนต่อความสัมพันธ์ระหว่างภาวะผู้นำที่ยั่งยืนและประสิทธิภาพที่ยั่งยืน

จากการวิเคราะห์ความสัมพันธ์ในระดับโครงสร้างด้วยเทคนิคการสร้างสมการโครงสร้าง พบว่ามีความสัมพันธ์เชิงบวกระหว่างภาวะผู้นำแบบการเปลี่ยนแปลงและระบบการผลิตแบบลีน พบว่ามีความความสัมพันธ์เชิงบวกระหว่างระบบการผลิตแบบลีนและประสิทธิภาพที่ยั่งยืน และพบว่ามีความสัมพันธ์เชิงบวกระหว่างภาวะผู้นำที่ยั่งยืนและประสิทธิภาพที่ยั่งยืน ถึงแม้ว่าในโมเดลขั้นแรกจะพบความสัมพันธ์ระหว่างภาวะผู้นำแบบการแลกเปลี่ยนและประสิทธิภาพที่ยั่งยืน และ

พบความสัมพันธ์ระหว่างภาวะผู้นำที่ยั่งยืนและระบบการผลิตแบบลีน แต่เมื่อพิจารณาความสัมพันธ์ระดับโครงสร้างของตัวแปรทั้งหมด พบว่าไม่มีความสัมพันธ์กัน เนื่องจากแนวคิดภาวะผู้นำที่ยั่งยืนเกิดจากการพัฒนาแนวคิดภาวะผู้นำแบบการแลกเปลี่ยน ทำให้มีความสัมพันธ์กันเองในระดับที่สูง ซึ่งเป็นตัวแปรกด ทำให้ไม่พบความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลงและประสิทธิภาพที่ยั่งยืน และความสัมพันธ์ระหว่างภาวะผู้นำที่ยั่งยืนและระบบการผลิตแบบลีน ซึ่งขัดแย้งกับผลการทดสอบในโมเดลขั้นแรก

ในด้านการศึกษาเชิงคุณภาพ ทำการเก็บข้อมูลด้วยวิธีการสัมภาษณ์เชิงลึกกับผู้จัดการในระดับกลางและระดับสูง จำนวน 40 คน ผลการศึกษาพบว่า ผู้มีส่วนร่วมให้ข้อมูลว่าระบบการผลิตแบบลีนเหมาะสำหรับอุตสาหกรรมรถยนต์และชิ้นส่วนรถยนต์ ทำให้ได้รับความสนใจและการประยุกต์ใช้ในระดับต่ำสำหรับอุตสาหกรรมการผลิตอื่น เมื่อพิจารณามิติของระบบการผลิตแบบลีน พบว่า ระบบการผลิตแบบลีนมิติด้านการมีส่วนร่วมจากลูกค้า เป็นมิติที่ได้รับความสนใจและการประยุกต์ใช้ระดับมากที่สุด รองลงมาคือมิติด้านการมีส่วนร่วมจากพนักงานและผู้จัดหาวัตถุดิบ เป็นมิติที่ได้รับความสนใจและการประยุกต์ใช้ในระดับปานกลาง ซึ่งผลที่ได้จากการสัมภาษณ์สนับสนุนผลการศึกษาที่ได้จากการศึกษาเชิงปริมาณ เนื่องจากกลุ่มตัวอย่างเป็นบริษัทขนาดกลางและเล็ก ทำให้ต้องสร้างความแตกต่างในขณะที่ต้องมีต้นทุนในระดับต่ำด้วย จึงจะสามารถอยู่รอดได้ในการแข่งขันในปัจจุบันที่มีความรุนแรง แต่เนื่องจากข้อจำกัดทางทรัพยากรทุกประเภท รวมถึงทรัพยากรมนุษย์ ทำให้ต้องใช้ทรัพยากรให้คุ้มค่ามากที่สุด ดังนั้น ผู้จัดการมีแนวโน้มที่จะให้คำปรึกษาและแลกเปลี่ยนความคิดกับพนักงานมากกว่าการกระตุ้นให้พนักงานเกิดความคิดสร้างสรรค์และการให้โอกาสในการตัดสินใจ ซึ่งผลที่ได้นี้สนับสนุนผลการศึกษาที่ได้จากการศึกษาเชิงปริมาณที่พบว่าภาวะผู้นำการเปลี่ยนแปลงส่งผลกระทบบางส่วนต่อระบบการผลิตแบบลีนและประสิทธิภาพที่ยั่งยืน

คำสำคัญ: ภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน ประสิทธิภาพที่ยั่งยืน อุตสาหกรรมการผลิต

Executive Summary

The aim of this study is to investigate the connections among transformational leadership, sustainable leadership, lean manufacturing, and sustainability in small and medium enterprises operating in Thai manufacturing industry. With the total of 598 samples, who worked for top executives and middle management managers (216 respondents from automotive industry, 382 respondents from nonautomotive industry), the data were gathered for quantitative approach. On the one hand, qualitative method was carried out by in-depth interview with 40 top executives and middle management managers (20 participants from automotive industry and 20 participants from nonautomotive industry).

The results fulfill the vague knowledge by confirming the relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance. In addition, this study augments the comprehension that lean manufacturing can be applied in any industry. Accomplished lean implementation requires serious and much attention from all members across company, suppliers, distributors, and customers. Successful lean managers need insight comprehension about lean concept and implementation before persuading their employees to do with higher willingness and cooperation. Referring to the scarcity of lean manufacturing success at recent time, it is possible to be a challenge for the coming research to discover antecedent, consequent, and intervention factors, which will result in superior understanding of the lean production notions and utilizations. Successful lean implementation will generate better financial outcomes and lower cost, thanks to the willingness of all employees and efficient processes, which lead to all of sustainable competitiveness, including operational, financial, social, and environmental performance.

According to the fact, the relationship between a variety of independent factors and lean manufacturing practice incline to be more robust for leadership style, followership style, size of company, competition level, and degree of technology and innovation. As a consequence, the research in the future would be to investigate the moderate and/or mediate influences of these factors on the relationship between independent variables and lean production. In addition, the future investigation might

examine the magnitude to which interventions could create a lean manufacturing practice for leading higher organizational performance. Finally, the successful lean production required cooperation across all members of supply chain, which takes time and requires longitudinal study.

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Piyachat Burawat

October, 2017

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CHAPTER 1

INTRODUCTION

The title of this research is "The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry". This chapter provides an overview of the research problem and the area of focus in investigating the research problem in the manufacturing and service industry in Thailand. This chapter also encompasses the situation and declaration of the problems, the significance, and the objectives of this study. The next part is about research questions, followed by research hypotheses. Afterwards, the conceptual framework/model is addressed. The next part is about explanations of jargons, and then the delimitation and limitation of the study. Finally, the benefits of the study segments are addressed.

1.1 Background and Importance of the Problem

At the present time, globalization makes communication free and borderless. Moreover, there has been a ferocious competition in both internal and worldwide markets because of a setting up of ASEAN Economic Community (AEC) in 2015. Therefore, organizations operating in manufacturing industry have to look for strategies that can enlarge productivity, minimize costs, raise quality, and diminish delivery lead time to customers, all of which involve the collaboration of all parties from management teams, employees, subcontractors, and suppliers. The greater number of producers have chosen continuous improvement programs as their primary strategic initiatives to increase quality, level of customer service, and overall total value to their customers.

Recently, continuous improvement strategies have originally evolved from the Toyota production system (TPS), the combination of the United States quality principles by Deming, Juran, and others (Womack & Jones, 1996; Lathin & Mitchell, 2001; Marynell, 2013). The resulting strategies incorporate top-down and bottom-up relationships for organizational changes that include such programs as six-sigma, lean manufacturing, total quality management, and theory of constraints (Marynell, 2013).

Currently, the most noted continuous improvement program that manufacturers select to achieve these strategic initiatives is lean manufacturing. However, it seems significant that only about 30% of companies with lean programs are successful (Pay, 2006). The Industry Week/MPI Census of Manufacturers reported a doubt that only 2% of companies with lean programs fully achieved their objectives whereas less than 24% of all companies presented that the firms significantly succeeded. The remains 74% of the companies accepted that they are not receiving satisfactory outcomes with lean programs implementation because they did not take good attention and overlooked to supply and encourage their implementation of lean practices (Pay 2006). In addition, firms that won great prizes from the Shingo Prize Association did not carry on and did not keep operating with lean program; thus they could not maintain sustainable results (Pay, 2006).

Considering studies on victorious lean executions, the important attributes for effectiveness depend upon the obligation of top management, the enabling of employees, evaluating activities for accomplishment, having an obviously explained improvement process plan, establishing obvious focus, direction, and targets (Forrester, 1995; Leitner, 2005; Smalley, 2005; Brown, Lamming, Bessant & Jones 2006; Liker& Meier, 2006; Longenecker, Moore, Petty, Palich & McKinney, 2006; Shukla, 2006;

Spector & West, 2006). These successful attributes associate with leadership's capacity and accountabilities for organizational change that are considered important within the fundamental concept of lean practices. The success of lean initiatives and development of a continuous improvement culture relies upon the leadership actions and executes within the firm (Heymans, 2002; Achanga, Shehab, Roy & Nelder, 2006; Found & Harvey, 2007).

The existing researches place an emphasis on the relation of leadership behaviors and practices that leads to achievement in lean implementations. Some studies even reflect on the propriety of extraordinary leadership characteristics and leadership styles for an accomplished lean implementation. Papers of leadership and leadership styles over the past years have bring about the enlargement of diverse models of leadership. Some of these models encompass situational leadership, contingency leadership, path-goal theory, transactional leadership, and transformational leadership. Each model embraces primary principals that associate with a leadership style(s) as it employs to explaining the underlying theory of each leadership model. If achievement in applying a lean practice is affected by the leadership style(s) as existing researches suggest, then possibly one leadership model offers the best representation appropriate for these program implementations. The research literature falls short of regarding that one leadership model might be more suitable for achievement within lean implementations. Consistent with Herkness (2005), it reveals that transformational leadership enhances transactional leadership by creating on the reciprocity between employers and employees. In summary, the findings of the study add to the existing empirical data, suggesting that the transformational leadership model is useful when trying to lead change. Although several studies focus on the effect of leadership on lean

practice, they pay attention only to one industry; the simultaneous study on overall industry is lacking. Therefore, this study extends current knowledge by examining the influence of transformational leadership on lean manufacturing practices in manufacturing industry.

The novel leadership paradigm could be entitled sustainable leadership, separated into three core processes including learning through doing, having an obvious perception of individual intention and recognition of individual expectations and inspirations, and successful stress management and adequate self-care (Casserley & Crichley, 2010). Peterlin, Pearse & Dimovski (2015) stated that transformational leadership and sustainable leadership are similar to each other in main four ideas, i.e. their dedication to understanding all demands of stakeholders, intellectual stimulation of stakeholders, motivation by inspiration action, and individualized treatment of stakeholders (Bass, Avolio, Jung & Berson, 2003). Looking at the difference, transformational leadership focuses more on individual charisma or idealized influence in persuading existing employees (House, Spangler & Woycke, 1991) whereas sustainable leadership focuses on striving the sustainable value at the personal, organizational, social and ecological levels for both existing and upcoming cohorts (Peterlin et al, 2015). Gurr (2007) stated that sustainability is at the first phase of being recommended on the magnitude of introduction-evaluation-consolidation of the notion into a big theory, and further explained that it is still not at the extent of a mature theoretical notion. Since sustainable leadership is insufficient in academic field, the theoretical premise has not been completely developed. In addition, according to my knowledge, it is the first time that the relationship between sustainable leadership and lean manufacturing as well as the effect of lean manufacturing on the relationship

between sustainable leadership and sustainability performance has been explained, which are the incremental contributions to academic research.

The critical factor of the competition is labor productivity. Furthermore, it can also enlarge sustainability revenue. Company with higher costs will result in lower competitiveness which bring about loss and withdrawal from the business. Labor productivity in Thailand increases by 2% per year, which is extremely poor compared to other nations, for instance, China increases by 10% and Vietnam increases by 4% (Tansakul & Sutthiwatanaruputh, 2014). Regarding the unit labor costs of Thailand, these enlarged by 3% while Indonesia's dropped by 12% (Tansakul & Sutthiwatanaruputh, 2014). Both lower productivity level and higher unit labor costs level resulted in diminishing the competitiveness of Thailand.

Meanwhile, inventory is one of the most costly assets of various firms, indicating as much as half of total invested capital. Employers have long conceded that good inventory management is essential. Moreover, an organization can decrease costs by diminishing inventory. As another option, manufacturing may break and customers become disappointed when a product is unavailable. (Heizer & Render, 2014).

As Thai manufacturing companies are confronting with low level of productivity (Tansakul & Sutthiwatanaruputh, 2014), higher labor cost (Tansakul & Sutthiwatanaruputh, 2014), high level of inventory (Burawat & Kuntonbutr, 2015; Burawat, 2016) as well as advances in technology, science, and innovation (UNCTAD, 2015), business leaders and managers need to explore strategies that can increase value to their goods, and decrease losses as much as possible (Barney & Hesterly, 2010). Since Toyota applied lean manufacturing successfully, it has gained much attention within two decades. Overall, the reviews of related publications present that lean

production implementation is repeatedly related to operational performance improvement. The most normally mentioned advantages associated with lean implementation are advancement in employee productivity and quality of products, along with decreasing in manufacturing costs, cycle time, and customer lead time (Sakakibara, Flynn, Schroeder, & Morris, 1997; White, Pearson, & Wilson, 1999; Puvanasvaran, Megat, Tang, Muhamad & Hamouda, 2008; Marynell, 2013, Chanegrih & Creusier, 2016). However, some studies found that some dimensions of lean manufacturing are related to firm performance (Taj & Morosan; 2011; Hong, Yang & Dobrzykowski, 2014; Sharma, Dixit &Qadri, 2015). Moreover, some studies found that there is no relationship between lean manufacturing and performance (Kaplan & Norton; 1992; Swink, Narasimhan, & Kim, 2005; Hibadullah, Fuzi, Chiek Desa, & Zamri, 2013). Although, some studies assert the relationship between lean practice and financial performance (Fullerton & Wempe, 2009; Yang, Hong, & Modi, 2011, Chanegrih & Creusier, 2016), some studies reject this relationship (Kaplan & Norton, 1992; Fullerton, McWatters, & Fawson, 2003; Cannon, 2008; Jayaram, Vickery, & Droge, 2008). Meanwhile, only some studies such as Fullerton and Wempe (2009) found that there is an effect of lean production on financial performance through operational performance.

Regarding the above concepts, the associations among leadership style, lean manufacturing, and performance are ambiguous. Thus, this paper proposes to examine the simultaneous connections among transformational leadership, sustainable leadership, lean manufacturing practices, and sustainability performance in Thai manufacturing industry. In addition, this study proposes to explore the relationship between transformational leadership and sustainability performance through lean

manufacturing, and to explore the relationship between sustainable leadership and sustainability performance through lean manufacturing. The findings of this study provide enlightenment information in an efficient form for a company's operational system, which bring about sustainable development despite immediate or harsh changes environment in the worldwide competition.

1.2 Purpose of the Study

The purposes of the study are to examine (1) the relationship between transformational leadership and lean manufacturing, (2) the relationship between transformational leadership and sustainability performance, (3) the relationship between sustainable leadership and lean manufacturing, (4) the relationship between sustainable leadership and sustainability performance, (5) the relationship between lean manufacturing and sustainability performance, (6) the relationship between transformational leadership and sustainability performance through lean manufacturing, (7) the relationship between sustainable leadership and sustainability performance through lean manufacturing, (8) the moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance, (9) the moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance, (10) the moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance, and (11) the moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

1.3 Research Question and Hypothesis

This study contains eleven research questions: (1) Is there a relationship between transformational leadership and lean manufacturing?, (2) Is there a relationship between transformational leadership and sustainability performance?, (3) Is there a relationship between sustainable leadership and lean manufacturing?, (4) Is there a relationship between sustainable leadership and sustainability performance?, (5) Is there a relationship between lean manufacturing and sustainability performance?, (6) Is there a relationship between transformational leadership and sustainability performance through lean manufacturing?, (7) Is there the relationship between sustainable leadership and sustainability performance through lean manufacturing?, (8) Is there the moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance?, (9) Is there the moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance?, (10) Is there the moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance?, and (11) Is there the moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance?.

This study contains eleven research hypotheses:

H1: There is a positive relationship between transformational leadership and lean manufacturing.

H2: There is a positive relationship between transformational leadership and sustainability performance.

H3: There is a positive relationship between sustainable leadership and lean manufacturing.

H4: There is a positive relationship between sustainable leadership and sustainability performance.

H5: There is a positive relationship between lean manufacturing and sustainability performance.

H6: There is a relationship between transformational leadership and sustainability performance through lean manufacturing.

H7: There is a relationship between sustainable leadership and sustainability performance through lean manufacturing.

H8: There is a moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance.

H9: There is a moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance.

H10: There is a moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

H11: There is a moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

1.4 Conceptual Framework

The conceptual framework of this study is illustrated in figure 1.1-1.3.

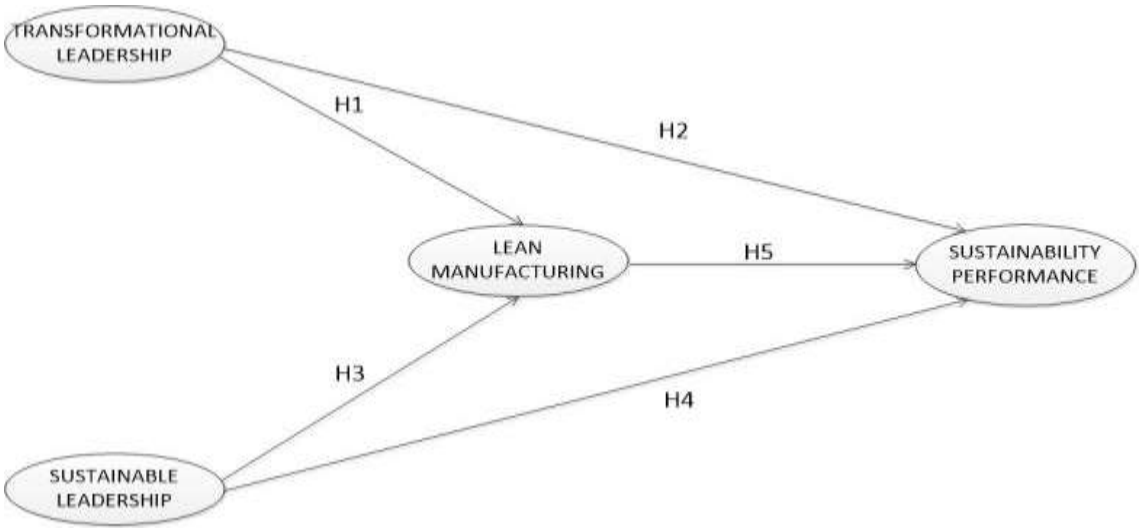

Figure 1.1 The proposed theoretical model

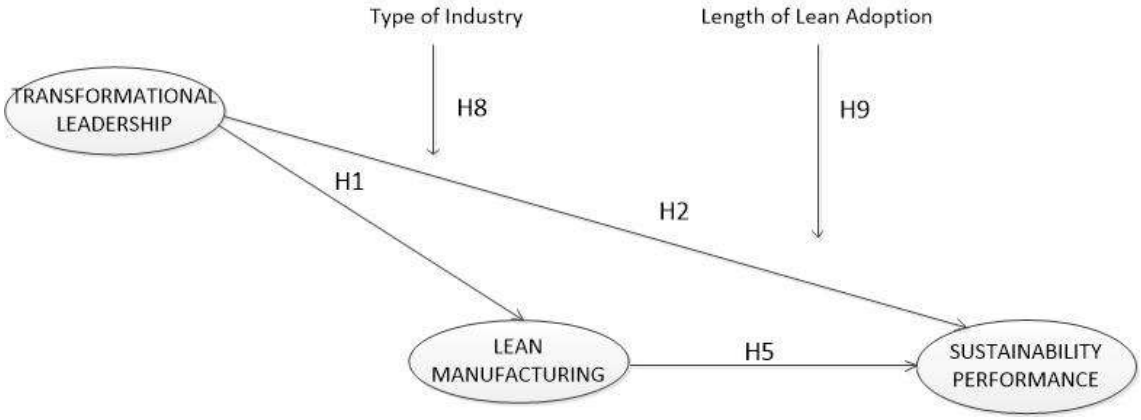

Figure 1.2 The proposed theoretical model to test moderate effect on the relationships among transformational leadership, lean manufacturing, and sustainability performance

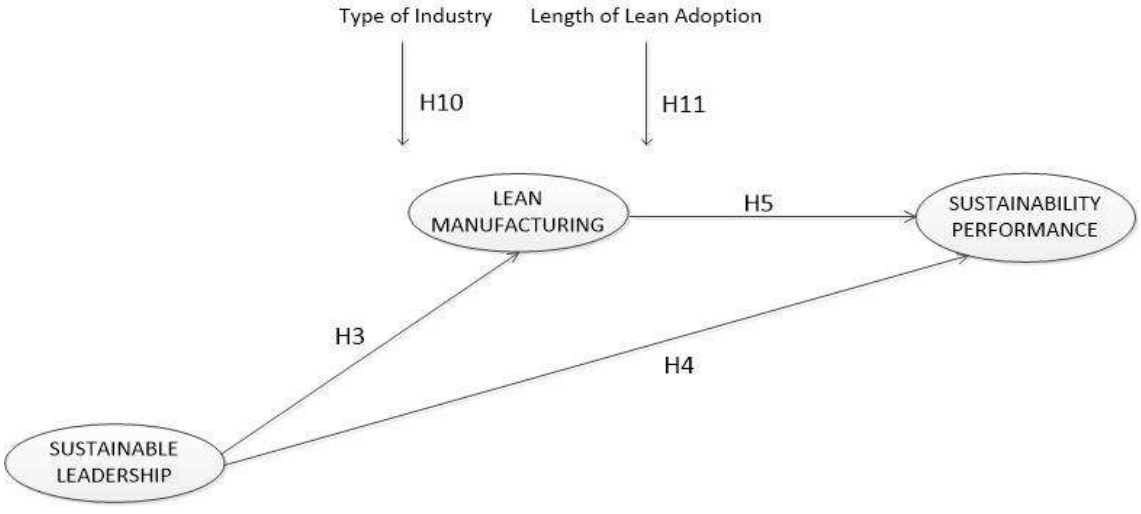

Figure 1.3 The proposed theoretical model to test moderate effect on the relationships among sustainable leadership, lean manufacturing, and sustainability performance

1.5 Scope of the Study

The GDP structure of the country in 2015 as categorized by major economic activity shows that the service sector made the most significant contribution to the economic system at 40.0% of the total GDP. As concerns the GDP structure of SMEs in 2015, the service sector was still the most important economic activity, followed by trade and maintenance, and the manufacturing sector, accounting for 41.4%, 29.4% and 22.1% respectively. GDP of manufacturing sector for 2015 categorized by size of enterprise this number, the GDP value of SMEs accounted for 1,225,919 million baht or 33.7% (Office of SMEs Promotion, 2016).

The manufacturing industry is essential to Thailand's economic. The main part of manufacturing industry consisted of automotive and automotive part, electric and electronics, chemical, petroleum and petrochemical, iron, plastic, textile and garment shoes and leather, tire and rubber, food and beverage, paper and publication, wood and furniture, and cement industry (Office of the national economic and social development board, 2015). Regarding above notion, thus, the sample population consisted of top and middle managers of small and medium enterprises operating in Thai manufacturing industry, which have been engaged in lean implementation.

The study was designed by mixed methqodology. Regarding quantitative study, a survey was done with 598 respondents. Regarding the qualitative aspect, the in-depth interview was conducted with 40 participations. The term of this study was 18 months from May 2016 to October 2017.

1.6 Definition of Terms

Northouse (2001) defined transformational leadership as the leaders who engage with followers in a cooperative attempt to increase their motivation and morality level. Intention of transformational leadership is to increase the sense of employers' comprehending of what is essential, and inclines to move employees to go beyond their own self-interest in admiration of what is crucial to their company (Bass & Avolio, 1994). Transformational leadership notions proposed the significance of visionary goals, ideological values, intellectual stimulation, symbolic behaviors, and intellectual stimulation (Bennis & Nanus, 1985; Bass & Avolio, 1990; Bennis & Townsend, 1995; Yukl, 2002).

Avary and Bergsteiner (2010) have proposed the sustainable leadership (SL), which is the balancing of human, returns and the earth to advocate organizational longevity through evidence-based management practices in the process embracing a holistic approach toward organizational sustainability. Suriyan kietkaew and Avery (2014) suggest that sustainable leadership is systematic, holistic and incorporates much of what the other individual perspectives cover. The sustainable leadership practices encompass multi-dimension management systems, concepts, foundations, processes, and values that research shows can create long-term organizational performance and resilience or endurance.

Lean manufacturing intends at waste elimination in every production area, including product design, customer relations, factory management, and supplier relations (Karlsson & Ahlstorm, 1996). The aim of lean manufacturing is to spend low level of employee effort, time, space and inventory, to become high-quality products

with maximum responsiveness of customer demand, while producing quality products in the most efficient and economical manner (Motwani, 2003).

Schaltegger and Wagner (2006) define sustainability performance as the performance of a company in all dimensions and for all driver of corporate sustainability. It extends beyond the boundaries of a single company and typically addresses the performance of both upstream suppliers and downstream customers in the value chain (Fiksel, Mcdaniel & Mendenhall, 1999).

Schaltegger and Wagner (2006) define sustainability performance as the performance of a company in all dimensions and for all driver of corporate sustainability. It extends beyond the boundaries of a single company and typically addresses the performance of both upstream suppliers and downstream customers in the value chain (Fiksel et al., 1999). Global Reporting Initiative (GRI) index (Adams,Muir & Hoque, 2014) suggested that sustainability performance is the mixture of annual/financial reports with sustainability reporting.

Manufacturing is the value added production of merchandise for use or sale using labor and machines, tools, chemical and biological processing, or formulation. The term may refer to a range of human activity, from handicraft to high tech, but is most commonly applied to industrial production, in which raw materials are transformed into finished goods on a large scale. Such finished goods may be used for manufacturing other more complex products, such as aircraft, household appliances or automobiles, or sold to wholesalers, who in turn sell them to retailers, who then sell them to end users and consumers (Wikipedia, 2016).

1.7 Delimitation and Limitation of the Study

Several potential limitations were expected in this study. Firstly, the effect of external factors may involve transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance, such as political issues, macroeconomics, microeconomics, and economic crisis. Secondly, as the study applied self-report and cross-sectional data, the summarizations could not only make causal extrapolations but also increase some concerns about common bias. Thus, a study in long term is preferred to offer greater conclusive summarization. Thirdly, the results would explain the small and medium manufacturing firms' situations and activities which may not be compatible with the service companies as well as large companies. Finally, the results would describe situations and activities of firms operating in Thailand, which may not be compatible with international and multinational corporations.

1.8 Benefits of the Study

Some benefits of the study were addressed as followed.

1.8.1 To increase more knowledge in transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance.

1.8.2 The companies who strongly understand and implement transformational leadership, sustainable leadership, and lean manufacturing can improve their productivity, customer satisfaction, good image, cost savings, and profitability, which will lead to sustainable competitiveness advantage.

1.8.3 Currently, Thai companies are facing major challenge, i.e. limited and expensive resources. So, these Thai companies can apply lean production concept in order to reduce material costs, set up time, and delivery lead time.

CHAPTER 2

REVIEW OF THE LITERATURE

Chapter two starts with an introduction to the definition and the notion of leadership model. The second part is the concept of the transformational leadership. The next section is about the concept of sustainable leadership, followed by the review of lean manufacturing. The fifth section is the reviews of sustainability performance. The last section will mention the review of the manufacturing industry which is the interesting areas of this study.

2.1 Leadership Model

Enormous leadership models have been emerged, studied, reviewed, commented, and criticized over the past 5 decades with the effort to explain the conceptual models of leadership (Northouse, 2004). The existing researches can be classified into the following four manners, i.e. trait theory, behavioral theory, contingency theory, and transformational leadership (Herkness, 2005). The studies of leadership notions in the early 20th century emphasized the personal characteristics of the leaders in order to describe their successfulness (Stogdill & Coons, 1957; Mann, Gibbard, & Hartman, 1967; Stogdill, 1974). Following researchers realized the imperative for an extensive perspective to leadership successfulness and originated studying behaviors of leaders. The leadership behavioral model attempts to comprehend the connection between leader behaviors and followers reactions. Other academicians attempted to elaborate further leadership theory in order to clarify the role that diverse environments have on the leadership situation. This research vein is recognized as

contingency approach or contingency theory. More present papers have interest in the successfulness of leaders who behave in an inspirational and visionary capacity. This viewpoint of leadership concepts is called as transformational leadership (Burns, 1978; Bryman, 1992; Bass, 1998). Present study reveals that transformational leaders can enhance the overall successfulness and organizational innovations competing in present's worldwide context and, therefore, are ideally appropriated to lead organizational change (Northouse, 2001). Below are the brief overviews of the four theoretical perspectives to leadership.

Considering trait theory, in the early 20th century, notable academicians emphasized on trying to explore the characteristics that distinguished leaders from non-leaders. At that moment, leadership principles generally emphasized on what characteristics or traits made a proficient leader more than how to bring about efficiently. Trait theories are based on the belief that there are obvious extraordinary characteristics or traits usual to proficient leaders. Preceding researchers (Stogdill & Coons, 1957; Mann et al., 1967; Stogdill, 1974) endeavor to clarify individual characteristics that separate leaders and non-leaders. The foundation is that leaders who have absolute individual traits will be capable to bring about other manifold circumstances. Gardner (1990) suggested the 13 characteristics of proficient leaders consisting of enthusiasm to obtain task, responsibility aptitude, perceiving of employees and their requirements, able to connect with all of stakeholders, physical energy and healthiness, require for accomplishment, able to persuade people, faithfulness, decisiveness, courage, assertiveness, self-confidence, and flexibility. Nevertheless, Sadler (1988) critiqued that a weakness of this viewpoint is that it does not take into attentiveness the specific circumstance encountered by the leader. Various industries

may have specific leadership demands; for instance, resulting in a research institution compared to resulting in a business organization may desire quite a diverse set of expertise for proficient leadership to take place.

The second manner of leadership model is behavior theory. In the middle of the 20th century, leadership theory changed from personality characteristics to how leaders act toward servants. Fundamental in this concept is that leadership can cultivate through training. This theory takes different formats of actions and amalgamates them into grouped manners.

Blake and Mouton's (1964) Managerial Grid and McGregor's (1960) delineation of leaders as theory X or theory Y, are two of the most popular behavior theory models. According to McGregor (1960), theory X leaders have an idea that followers require ordering and supervising due to employees short of direction, obligation, and responsibility. In contrast, theory Y leaders perceive followers as chargeable, assume followers thrive in a situation that permits for self-expression, and have an idea that followers can straighten their individual goals with those of the company in the veracious environment.

The research in this area studied by the University of Michigan, categorized behaviors of leader as either employee centered or production centered. Employee-centered leaders are interested in the followers' welfare, while production-centered leaders are interested in goal accomplishment. Their study has presented that employee-centered leaders are often related to job satisfaction and productivity. Blake and Mouton (1964) applied the leadership aspects analyzed in the University of Michigan learns to expand the managerial grid model. This model applies five styles of leadership behavior based on people concerns and result concerns included impoverished, country club,

produce or perish, middle of the road, and team. Research revealed that managers who received high on both production and people facets concurrently had high level of performance score. This is known as team style. An important purpose of team style is to create a sensing of obligation, commitment and interrelatedness among the team followers.

The third manner of leadership model is contingency theory. Contingency theory is the root of foundation for proficient leadership to emerge; the leadership style of leaders must suit the situation or context they are in. Northouse (2001) suggested that "Proficient leadership is dependent on proper a style of leadership to the correct setting" (p. 75). Fiedler's contingency theory is an essential model in this area (Fiedler, 1967; Fiedler & Garcia, 1987). Fiedler postulated that predicaments created the requirement for managers to adjust their leadership style ground on the three situational factors, i.e. leader-follower relations, task structure, and position power. Thereby, the task motivation, and relationship motivation leadership styles are inherent in the contingency model. Fiedler's least preferred coworker (LPC) survey is applied to evaluate leaders' style grounded on relationship motivation and task motivation variables. Contingency theory consumes these styles and situational factors as a framework for creating a model that can be applied to align leaders to their specific organizational leadership situation. By applying this model, the leader may be able to adapt either his leadership style or situation to enlarge leadership successfulness.

Hersey-Blanchard situational leadership model is another well-known leadership model in this area (Hersey & Blanchard, 1969, 1982; Blanchard, Zigarmi, & Zigarmi, 1985). The Hersey and Blanchard theoretical model is grounded on two factors, which are the number of direction, and number of support a leader must supply

depended on the circumstance and the employee maturity level being led. Referring to Hersey and Blanchard, like Fiedler's contingency model, the model investigates leadership within the context of the situation.

In conclusion, contingency theory indicates a spacious perspective to the leadership issues by evaluating leaders within the work situation of the leader. This viewpoint has created a numerous number of researches and has indicated its value as an antecedent of proficient leadership (Northouse, 2001).

The third manner of leadership model is transformational leadership style. Transformational leadership's theoretical foundation emerges throughout the last several decades from various studies. The research emphasized on charismatic leadership (Weber, Henderson, & Parsons, 1947; Conger & Kanungo, 1988; Conger, 1989), which laid the foundation for Burns's (1978), Bass's (1985), and Bass and Avolio's (1990) researches on transformational leadership.

The sources of charismatic leadership theory can be discovered to the well-known sociologist, Max Weber. Initially traced from Christian theology, Weber et al. (1974) described that the charisma concept views that certain personals are provided with divine, supernatural, super-human, or least exceptional powers and qualities that other people do not possess. Spontaneous in this theory is the notion that charismatic authority comes from the faith of employees in the gifted charismatic leader. Employees perceived the charismatic leader as being specific and greater than life. Northouse (2001) stated that "The 'charisma concept' was first applied to explain an extraordinary gift that selected personals occupy, and that offered them the efficacy to perform exclusive things" (p. 133).

Weber's prior work supplied a conceptual framework for comprehending social authority. Weber et al. (1947) have an idea that charismatic leaders can be built by diverse situations or conditions including specific efficacies, offering a revolutionary perspective, a fatal crisis, indicated effectiveness, and employees' connection to the charismatic leader. Based on these situations, Weber et al. (1947) endeavored to describe from a sociological approach how leaders reach ability and impact in society and, therefore, offered a theoretical framework for following leadership academicians.

Dissimilarity to charismatic leadership theory of Weber, which emphasized on the leader's characteristics, House's (1977) theoretical model is grounded mainly on behaviors of leaders. While proceeding the study on the psychological ground for transformational leadership, he assumed that charisma is at the principal of transformational leadership. House's model proposes the key behaviors of charismatic leaders including dominance, a vigorous requirement to have an effect on others, self-confidence, and a robust perceive of one's own moral values. House also indicated that charismatic leaders have the traits and deportments including behaving as a role model, authorizing others within the company, having high anticipation, an obvious vision communication, and taking risks (House, 1977; House, Delbecq & Taris, 1997).

In accordance with House (1997), charisma can be viewed as the leader's efficacy to have an effect on others' opinions, morals, values, and efficiencies based on their own opinions, morals, values, and efficiencies. The following studies have presented that having a vigorous moral opinion system is viewed as inspiring to employees as is a leader who presents confidence. Bass augmented on House's theory by conducting research on the situations in which a charismatic leader would prosperity (Yukl, 2002). Due to Bass, charismatic leaders often emerge when an enterprise is in a

critical period or is receiving a significant change and may or may not be liked. Bass theorized that understanding of followers of what a charismatic leader is describes who they trust are charismatic leaders (Yukl, 2002).

Conger and Kanungo enlarged charismatic leadership theory of Bass's follower perception (Yukl, 2002). They speculated that charisma is an attribution occurrence as realized by the employees (Conger & Kanungo, 1988). Accordingly, it is the employees who ascribe to their leader's role as a charismatic leader. Conger and Kanungo's theory also takes into account the situation in which the charismatic leader looks for himself; therefore, charismatic leaders may have ranging levels of charisma relying on the circumstance (Conger & Kanungo, 1998; Yukl, 2002). In accordance with Yukl (2002), Conger and Kanungo's theory of charismatic leadership, described by the reaction between behaviors of leader and perceptions of followers, offered a conceptual framework for study into transformational leadership.

2.2 Transformational Leadership

Over the last 30 years, transformational leadership has developed as an exceedingly essential model for researcher who focused on organizational leadership (Northouse, 2001). Recently, the transformational leadership model can be considered as a system that can change companies and followers by comprehending their motives, requirements, and nurturing them as personals.

Transformational leadership as a theoretical model came into reputation with James McGregor Burns's (1978) book, Leadership. Burns portrayed that transformational leadership arises when one or more individuals engage with others in such an approach that managers and employees bring up one another to greater morality

and motivation level. Absolutely, the linkage can be moralistic. However, transforming leadership eventually turns into moral in that it increases the extent of human behavior and ethical intention of both leader and the led, and therefore it has a transforming influence on both. (p. 20).

Bass (1985) described four characterized transformational factors including idealized influence and charisma (robust role models with high ethics), inspirational motivation (shared vision and high team spirit), intellectual stimulation (stresses problem solving and inventiveness), and individualized consideration (encouraging environmental and use of deputation). This leadership style differs from the main part of the leadership styles that are transactional in nature. Transactional leadership depends on the exchange of rewards with followers in order to push organizational objectives.

Meanwhile, Northouse (2001) described that transformational leaders have an explicit vision of the upcoming situation of their company. Transformational leaders are also observed to be social architects who are competent to communicate and transform organizations' values. In addition, Northouse (2001) defined transformational leadership as the managers who engage with employees in a collaborative attempt to increase their morality and motivation level. The purpose of transformational leadership is to increase the awareness of employees' comprehending of what is crucial, and inclines to motivate followers to outstrip their own self-interest in favor of what is essential to their company (Bass & Avolio, 1994). Transformational leadership theories suggested the significance of visionary goals, ideological values, intellectual stimulation, symbolic behaviors, and intellectual stimulation (Bennis & Nanus, 1985; Bass & Avolio, 1990; Bennis & Townsend, 1995; Yukl, 2002).

In line with charismatic leadership theories, Burns's research focused on the interactions between leaders and followers and their influence on each other. Burns (1978) made a distinction between transformational leadership and transactional leadership behaviors. Transactional leadership involves an exchange between the leader and follower based on the self-interest primarily of the follower. Contingent reinforcements (such as rewards) and negative feedback (such as disciplinary actions) are used to meet commitments to organizational goals. Transactional leadership as a traditional hierarchical model of leadership has been similarly identified by numerous leadership theorists (Bass & Avolio, 1994; Bennis & Nanus, 1985; Bennis & Townsend, 1995). In contrast, transformational leaders are competent to boost performance of follower relied on the leader's advanced values and ideals. Burns's transformational leadership theory is distinguished from charismatic leadership theory in two domains. First, Burns's theory affirms the efficacy of leaders to change followers' motives and values through mentoring and teaching. Second, the author hypothesized that change to social systems happens in the environment of a equilibrium between a leader's inspiration for change and resultant follower have an effect on leader actions (Bass, 1985).

Developing from the study of House (1977) and Burns (1978), Bass (1985) elaborated the theoretical notion of transformational leadership. Bass's prior research emphasized on exclusive leaders' deportments, and how these leaders are proficient to increase performance of follower to new highest point. Bass's perspective distinguished from Burns's theory in that it stands more focus on followers' requirements.

Bass's theoretical viewpoint is grounded on interviews and information collected from industry top managements and important leaders (Bass, 1985). The

interviews emphasized on demonstrating the deportments of excellent leaders whom they have worked with and learned from. Bass assumes that transformational leaders indicate and apply high extents of charisma, intellectual stimulation, and individualized consideration. In accordance with Bass (1985), the combination of these three factors can raise followers' endeavors to accomplish desired purposes and efficiency as well as buliding an environment that permits for proactive thinking (Yukl, 2002).

According to the Bass and Avolio's (1990, 1994), transformational leadership can be viewed as a multidimensional leadership continuum consisting of transactional and transformational leadership styles. These theorists believe that transformational leaders can act both in a transformational and in a transactional manner depending on their respective style and context.

According to Bass (1998), transactional leadership occurs when leaders use discipline or rewards based on the follower's performance to goals. This can take two forms including positive contingent reward, or a somewhat negative approach using management by exception (active or passive). Overall, transactional leaders focus mainly on follower compliance. In transactional leadership they identified three distinct leadership styles including contingent reward, management by exception—passive and management by exception—active.

The contingent reward dimension is an example of the classic transactional leadership style, which is characterized by leaders setting clear goals and rewarding followers for their accomplishment through a variety of ways. In effect, a contract between leaders and followers occurs when rewards are given for successful completion of the goals. According to this model, leaders can drive desired behaviors through this process of contingent rewards (Northouse, 2001). Considering a management by

exception-passive (MBE-P), leader typically reacts only when exceptional circumstances arise, such as missed deadlines or goals. These leaders avoid unnecessary change, and tend to criticize employees based on the fact rather than proactively communicating expectations. Meanwhile, a management by exception-active (MBE-A) leader uses a variety of control systems to monitor actively employee performance to goals. MBE-A leaders react quickly to the mistakes of followers and use corrective action to bring followers behavior back in line with goals. The research indicates that this style results in only moderate success, unless followers perceive that MBE-A leaders are striving to communicate goals and expectations more clearly.

Transformational leaders, by going beyond transactional exchanges or agreements with followers, achieve superior results. By using the four dimensions of transformational leadership, the research has shown that these leaders are able to increase proactively situational awareness of what is good for the organization, work group, and individual. Transformational leadership in the Bass and Avolio (1990) model consists of four leadership styles, i.e. idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.

Considering idealized influence dimension, this leadership dimension is characterized by leaders who are perceived as a positive role model and who demonstrate extraordinary capabilities. These leaders are often considered charismatic, have high morality and integrity, and are trustworthy. Because of these characteristics, followers tend to want to emulate the leader. Leaders demonstrating idealized influence tend not to use organizational positional power to achieve desired performance results. The second leadership style is inspirational motivation dimension. Leaders who exhibit inspirational motivation have characteristics that are perceived by followers as being

extremely moral in nature. Inspirational leaders use emotional appeal, meaning, and challenge to create and encourage organizational change. The inspirational leader uses these characteristics to motivate people to achieve superior results. The latter style is intellectual stimulation dimension. Avolio and Bass (2004) characterized this dimension as, "These leaders stimulate their followers' effort to be innovative and creative by questioning assumptions, reframing problems, and approaching old situations in new ways. There is no ridicule or public criticism of individual members' mistakes" (p. 98). Finally, regarding individualized consideration dimension, these leaders pay attention to each individual's need for achievement and growth by acting as a coach or mentor. Followers are developed to successively higher levels of potential. New learning opportunities are created along with a supportive climate in which to grow (Avolio and Bass, 2004).

Bass's theoretical perspective is frequently mentioned to as the comprehensive scope of leadership model (Bass, 1998). Central to this model is the notion of expansion. Expansion is the hypothesis that transformational leadership expands transactional leadership by creating the exchanges between leaders and followers. Bass applied this augmentation concept to vary from Burns's idea that transformational and transactional leadership are on opposite facets of the leadership continuum. Bass (1998) suggested that "the best leaders are both transactional and transformational" (p. 16). Correspondingly, Avolio (1999) proposed that "transformational leadership expands or enlarges transactional in its influences on follower satisfaction, motivation, and performance" (p. 55). Bass, mentioning to the full-range model, stated that most leaders use each style to some degree. The comprehensive scope leadership theory, applying the model of augmentation (to expand to the transactional leadership facet), is believed to

supply a greater extent of job satisfaction and organizational performance. Research findings have revealed that this augmentation model has some empirical validity level (Bycio, Hackett, & Allen, 1995; Hater & Bass, 1988; Waldman, Bass, & Yammarino, 1990).

In conclusion, transformational leadership theory creates on characteristics or traits, deportment, and contingency theories to offer what various believe to be the novel or new leadership model. The theory is emphasized on indicating why exact leaders are proficient to motivate followers to perform exclusive duties. Northouse (2001) proposed that leaders need to comprehend and adjust to the followers' requirements and motivations. Transformational leaders are acknowledged as change representatives who are well role models, who can build and express an explicit vision for a company, who authorize followers to accomplish at greater standards, who behave in approaches that make others want to believe them, and who offer meaning to organizational existence (p. 158).

Transformational leadership fundamentally emphasizes on changing and transforming followers and companies (Northouse, 2001). Being part of what Bryman (1992) called the modern leadership model, the author has an idea that transformational leadership is highly interrelated and ideally proper to assist transform companies and personals during lean-system deployments.

2.3 Sustainable Leadership

The recently developed theory in leadership could be entitled sustainable leadership. Gurr (2007) proposes that sustainable leadership is at the beginning stage of being established on the scale of introduction-evaluation-consolidation of the notion

into a big theory and further explains that it is not still at the extent of fully developed theoretical notion. As a beginning stage, it is therefore valuable to selectively contrast sustainable leadership to other leadership principles and perspectives. Sustainable leadership has some characteristics that coincide with other leadership theories, but it also has its own peculiar components.

McCann and Holt (2011) define that the sustainability is concerning with creating current and future profits for an organization while improving the lives of all concerned. Meanwhile, Kiewiet and Vos (2007) state that the topic of sustainable leadership is found in the business definitions of sustainability and becoming more influential in business today. The triple bottom line (TBL) perspective is the prevailing idea when considering the notion of sustainability and sustainable leadership. Elkington (1998) defines the triple bottom line (TBL) as the three P's: people, profits, and planet. This concept focuses leadership in organizations on balancing people, profits, and planet for a sustainable future.

The Brundland Commission Report, who is credited with introducing the sustainability concept, defines sustainable leadership as meeting the needs of the present generation without compromising the ability of future generations to meet their needs (WCED, 1987). In addition, Dervitsitotis (2003) proposes that the sustainable leadership strategy rely heavily on developing an organization that can learn better, faster, and become more flexible and adaptable than its rivals. Meanwhile, Rodriguez et al. further describe that sustainable leadership is the ultimate goal on an organization to create value for shareholders and society as a whole, by satisfying leadership and engaging in behaviors for the right reasons while aiming to achieve a sustainable competitive advantage.

Casserley and Crichley (2010) propose that sustainable leadership made distinctive by three main processes including learning through doing, having an explicit feeling of individual goal and consciousness of individual motivations and assumptions, and proficient management of states and adequate self-care. The authors further proposed that sustainable leadership composes of four detached levels. The first of these is an individual level. The sustainable leader requires to nature individual physical and psychological health in order to be effective. A leader has a higher capacity to assess problems with explanation of mind and to value the participation of workmates in finding these solutions. The process is sustained by reflexivity, or the self-awareness needed for making different direction, came from reflection both in action and on action. The second level is the organizational level. The company must advocate and provide for sustainability such as determining the company's greater goals, shaping actions and values to be aware that goals, valuing workers, understanding their specific participation, empowering them to have a duty in determining, and shaping the objectives of the company, and advocating them to be aware of their own efficiency. The third level is the sociological level. At this level, companies know their affect upon the broad community and take positions to make this positive relationship. For example, internships for regional students, philanthropic providing to assist fund community projects, supply of proficiency to help projects at local schools, and yearly organizational trip to the seaside or beach for workers and their relatives. The final level is ecological sustainability. Ecological leadership engages increasing recognition of how an organization or industry has an impact on, not just with the community, but with the globe, for example, decreasing the carbon footprint, changing heating and cooling

methods, wind power, solar energy, and waste-wood furnaces (Casserley & Crichley, 2010).

Corresponding to Casserley and Crichley's (2010), the first level of sustainable leadership is a personal level; therefore, several approaches develop organizational sustainability at the strategic micro-level of leadership (Suriyankietkaew & Avery, 2014). First, the notion bases on concepts of stakeholder relationship management and the triple bottom line approach (Freeman, 1984; Maak & Pless, 2006; Porter & Kremer, 2011). Second, the concept comes from ethical leadership (Brown, Trevino& Harrison, 2005; Resick, Hangers, Dickson & Mitchelson, 2006), which associates with the significance of getting involve with business standards of ethical. The sufficiency economy philosophy (SEP) in Thailand with its set of underpinning sustainable development business philosophies has emerged. The sufficiency economy philosophy reflects the Buddhist idea of the middle path (Puntasen et al., 2003; Kantabutra & Avery, 2010). The final notion is derived from global research. Avery and Bergsteiner (2010) have proposed the sustainable leadership (SL), which is the balancing of people, profits and the planet to encourage continuance of an organization through practices based on evidence management in the process embracing a holistic approach toward organizational sustainability.

Suriyan kietkaew and Avery (2014) suggest that sustainable leadership is systematic, holistic and incorporates much of what the other personal perspectives cover. The sustainable leadership practices cover multi-aspect management systems, principles, processes, and values that research shows can create long-term organizational performance and resilience or endurance. In addition, it advocates taking a long-term approach towards organizational decision making and considering

sustainability beyond the atomistic and more limited, concepts of triple bottom line, corporate social responsibility and corporate responsibility. A holistic perspective is valuable because much of the current study inclines to be broke up and made simple, rather than investigating the interconnected structure, systematic, inherent characteristics of leadership deportments in practices (Boal & Hooijberge, 2001).

Moving on to the comparing of the sustainable leadership characteristics with other theories of leadership, there are both similar and different components. Peterlin et al. (2015) concluded that transformational and sustainable leadership are indistinguishable in main four ideas consisting of their dedication to understanding all demands of stakeholders, intellectual stimulation of stakeholders, motivation by inspiration action, and individualized treatment of stakeholders (Bass et al., 2003). Looking at the difference, transformational leadership focuses more on individual charisma or idealized influence in having impact on existing followers (House et al., 1991) whereas sustainable leadership focuses on motivating the sustainability value at the personal, organizational, social and ecological level for both existing and future cohort (Peterlin et al., 2015).

Avery and Bergsteiner (2011) conclude that sustainable leadership is similar to servant leadership because it emphasizes more on the requirements of others than on the leader's requirements. However, sustainable leadership is differentiated from servant leadership in the feeling that it focuses on the future requirements of numerous stakeholders, not only the current requirements of existing followers.

Sustainable leadership is dependent upon the concept of ethical leadership (Brown et al., 2005), but augments its scope of utilization by confirming that it is ethical that we take into consideration the requirements of a broad scope of stakeholders',

including coming cohorts and the natural environment. Olivier (2012) exposes a number of critical leadership challenges, and describes sustainability as one of the main contemporary social, economic and ecological challenges of the kind of ethical leader that Aristotle called the "good man", who looks for the welfare of his subjects as he is charged with the chasing of justice, in order to preserve the generally well-being of the community. In essence, in contrast to other leadership concepts that derived from the transformational leadership paradigm, sustainable leadership is differentiated by seeking the sustainability value at the personal, organizational, social and ecological level for both existing and next cohorts.

Having compared sustainable leadership to other leadership perspectives, it can now be described more precisely and its explaining characteristics are focused on. The Institute for Sustainable Leadership (2015) describe sustainable leadership in a business environment as those behaviors, practices and systems that build long-lasting value for all stakeholders of companies, including employees, investors, the environment, the community, other species, and next cohorts (Edge equilibrium, 2015). Hargreaves (2007) suggested an explanation of sustainable leadership in an educational setting as leadership that expands in-depth learning in a method that does not risk but creates positive influences for all stakeholders, both in current and future. In combination, these explanations focus that sustainable leadership (1) is exercised in linkage to a broad scope of stakeholders; (2) dominates a preoccupation with the present state of concerns by developing a long term perspective; (3) exercises leadership not only through behavior but also through other organizational systemic components; and (4) explains value in words of a higher normal good.

Sustainable leadership takes into deliberation a broad scope of complex interrelations among personals, the business community, international markets and the ecosystem, with the main purpose that a company attains welfare by regarding social values, obtaining success in longevity by making decision based on strategic value and preserving the natural environment, by which integrate from all members.

2.4 Lean Manufacturing

Lean manufacturing or production is an operation improvement strategy used to improve the manufacture and delivery of a product (to a customer's expectation) by means of a purpose-designed facility and process, utilizing an interconnected array of supply chains. It is a program that can be adopted by both mature and new manufacturing entities (Womack & Jones, 1996). Mature manufacturing entities represent facilities producing a particular product that have a low rate of product and process innovation. To stay competitive, mature manufacturers have to focus on cost reduction, improved productivity through better capacity utilization, incremental improvement and the adoption of more efficient technologies. In contrast, new manufacturing entities, on the other hand, lack market share and product demand; therefore, fewer workers are needed (Jeserich, Mason, & Toft, 2005). Focusing on process development, solving complex technical problems, rapid time to market, fast ramp-up and design for manufacturability are the main factors that curtail the number of employees' new manufacturing entities (Hayes, Pisano, Upton & Wheelwright, 2005).

Lean production or lean manufacturing, frequently conceived as Toyota production system (TPS) in scholarly publications, began in Toyota Motor Manufacturing Company after the 2nd World War when almost all Japanese companies

which include Toyota Manufacturing Company were encountered with the challenge of tackling production resources with restricted assets and facilities (Liker, 1998; Pavnaskar, Gersheenson & Jambekar, 2003). This challenge inspired managers worked for Toyota to initiate a variety of TPS's elements purposed at eliminating waste. Therefore, lean manufacturing is about manufacturing the same product quantity with lower resources (working hours, working area, machine hours, material, instruments, and equipment). Recently, lean practice has advocated Toyota accomplish the difference of being the best manufacturer in the world who produce car (Stewart & Raman, 2007). Still, the interest taken in lean by the western manufacturing community was limited until the performance gaps between Toyota and other carmakers were highlighted by the book The Machine that Changed the World, which also coined the term lean production (or lean manufacturing) (Womack, Jones, & Roos, 1990). The exploration of the enterprise model, the infrastructure and practices that support lean production, promoted explicitly a thesis of transference and the ability of non-automotive and non-Japanese emulation based upon the premise that manufacturing problems and technologies were universal problems facing management (Womack et al., 1990). Lean utilization is not narrow to only the automotive industry, but it has also obtained acceptance in a comprehensive scope of manufacturing industries conducting under non-unionized or a an unionized situation in the United State (Shah & Ward, 2003) or somewhere else (Cua, McKone & Schroeder, 2001; Anand & Kodali, 2008), and is being implemented in large as well as little companies (White et al., 1999).

Lean production is considered by the academic community fundamentally at three levels. At the first level, which is the theoretical one, lean manufacturing is referring to getting rid of waste from the manufacturing system (Ohno, 1988; Shingo,

1989; Womack et al., 1990; Womack & Jones, 1996) and but be able to make the excellent quality products that fulfills the end consumers. As Shingo (1989) aptly noticed, 80 percent of lean practice is involved waste reducing and the system balancing. Waste, frequently entitled muda, in Japanese, encompassed seven general waste types, i.e. over production that is more than needed or before it is needed, unneeded movements or motions by employees, surplus finished goods and material being processed, unneeded movements of products and materials, rejections/rework, wasted time waiting, and extra processing more work or higher quality than require (Cachon & Terwiesch, 2009). Evidently, decreasing of these wastes seems easy and uncomplicated, but their identification is frequently problematic in nearly all companies.

Figure 2.1 Eight wastes in production

Source: Organizational Excellence. (2015).

At the second level, some academics interpret lean manufacturing as a rule driven system (Spear & Bowen, 1999). Spear and Bowen (1999) conducted research from 40 factories over a four-year period in Europe, United State, and Japan, and found that some factories were manufacturing according to lean program but the others were

not. The authors summarized that Toyota applies three rules for designing manufacturing system and another rule for systematic problem solving. Rule 1 proposes that all activities required to be identified in terms of content, succession, timing, and results. Rule 2 states that every purchaser and supplier relationship desires to be direct and unsuspicious. Rule 3 encourages direct and easy procedures for every product and service. Rule 4 encourages little development done scientifically under the suggestion of an instructor at the minimum feasible level.

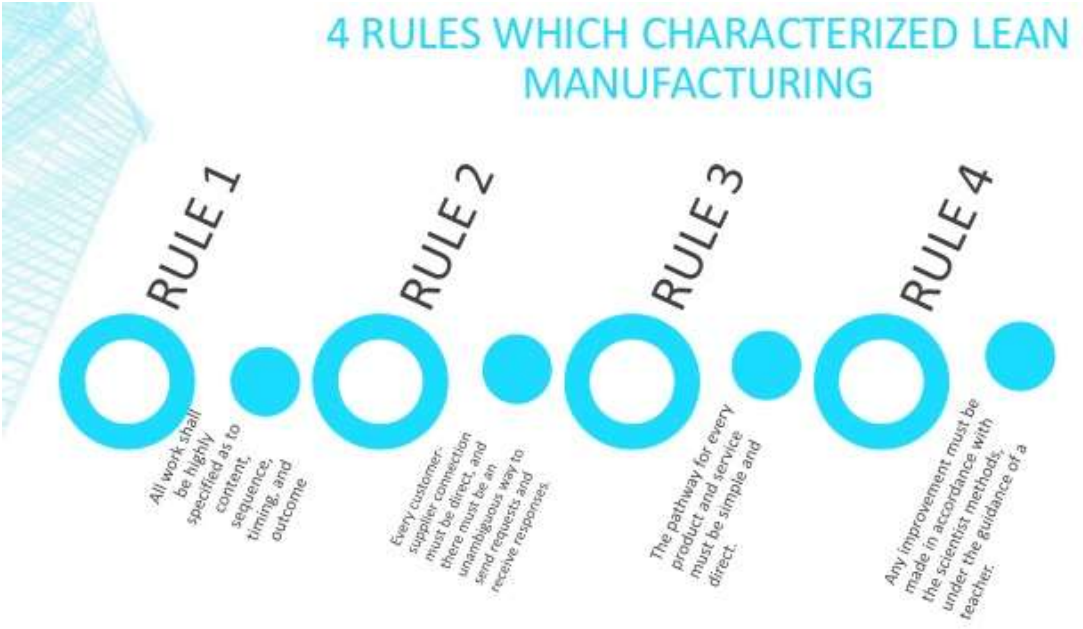

Figure 2.2 Four rules which characterized lean manufacturing

Source: Hernandez (2017).

At the third level, lean manufacturing is considered as tools and techniques congregation (Hines,Rich & Esain, 1999; Pavnaskar et al., 2003; Shah & Ward, 2003; Li, Subba Rao, Ragu-Nathan & Ragu-Nathan, 2005; Seth & Gupta, 2005; Lasa, Laburu & Vila, 2008; Basu, 2009) purposed at reducing waste. Shah and Ward (2003) examined the implementation of 22 lean practices and classified them into four bunches consisting of just-in-time (JIT), total productive management (TPM), total quality

management (TQM), and human resource management (HRM), in various industries in America, and noticed that 23 percent differentiation in operational performance resulted from to the applies of lean package. They also remarked that a vigorous effect of size of company on lean utilization and a lower effect of age of company and unionization. Shah and Ward (2007) in a following study contended that lean manufacturing is a multi-manner construct and the authors create ten different manners/aspects to classified lean manufacturing system, i.e. (1) supplier feedback, meaning the company has close communicate with suppliers and provides quality and delivery feedback to supplier, (2) just in time delivery by suppliers, or major suppliers delivering on a time basis, (3) supplier development, associating with the company keeping corporate-level contact on essential problems with suppliers. Suppliers become committed to annual cost reduction, product quality enhancement and delivery improvement, (4) customer involvement, meaning that the company has close communicate with customers, (5) pull system, associating with manufacturing in which the producer makes products only according to the quantity desired by the ultimate customer, (6) continuous flow, or machine being categorized to proceed a continuous flow of products' families. The manufacturing speed is directly related to the customer requirement rate, (7) set up time reduction, meaning that the company has a short time to go from producing one product to another, (8) total productive/preventive maintenance, or regular schedules for equipment maintenance, (9) statistical process control, or most equipment/processes on the working area being control by statistical process, and (10) employee involvement, meaning that operational workers are essential teams to solve production problems and they force programs of suggestions.

Research has been investigated to discover the fatal achievement factors of lean production so as to attempt to complete the gap between lean effectiveness and underachiever. Within the research examinations discovering the fatal factors related to lean manufacturing success, one general factor continued to present as the most critical success factors are leadership and commitment of top management (Forrester, 1995; Soriano-Meier & Forrester, 2002; Leitner, 2005; Liker& Meier, 2006; Longenecker et al., 2006; Shukla, 2006; Spector & West, 2006). Present working paper has started to emphasize on the influence of leadership upon success of lean implementation. The research literature falls short of viewing that one leadership model might be greater suitable for lean implementations effectiveness. Consistent with Herkness (2005), the research revealed that transformational leadership expands transactional leadership by creating on the interactions between managers and employees and it further suggested that the transformational leadership model is useful when trying to lead change. Therefore, this study intends to study the influence of transformational leadership on lean manufacturing practices.

2.5 Sustainability Performance

According to the increasing inattentiveness of variety of stakeholders' group in corporate activities in recent competitive circumstance, there has been a sudden increase of literatures in the field of corporate sustainability performance evaluation from both practitioners and scholar researchers. Organizations are struggling to accomplish longevity advantage by embracing sustainability activities as key of organizational strategy (Chabowski, Mena & Gonzalez-Padron, 2011; Cruz, Pedrozo & Estivalete, 2006). In actuality, commitment to sustainability matters has turn into an affair of

strategic significance in present competitive situation. It is anticipated from business firms to be a superior population (Orsato, 2006). Growing wave of incorporation of sustainability in organizational strategy formulation bring about the requirement of its performance evaluation. The expansion of successful, longevity organizational sustainability strategy and its performance assessment has tempted the interest of researchers for the last 20 years. Within this investigation vein, the organizational sustainability performance have an influence on evaluation on organizational performance is very essential. In accordance with Neely, Mills, Platts, Gregory and Richards (1994), successfulness measurement of any strategy and its influence on overall company is an essential matter that all companies require to evaluate after application of any modern strategy. In the period of positive increasing of organizational sustainability performance, organizational performance follows the same path or, vice versa, requires a good quantity of study. Organizational sustainability performance mostly emphasizes on the economic, social, and environmental performance of sustainable development (Takala & Pallab, 2000).

Schaltegger and Wagner (2006) define sustainability performance as the performance of a company in all dimensions and for all driver of corporate sustainability. It enlarges further on the scopes of a single firm and usually explains the value chain performance of both downstream customers and upstream suppliers (Fiksel et al., 1999).

The comprehensive utilized sustainability assesses only have an environmental parameter, for instance amount of substances spread and facilities spent, which are not sustainability evaluates; as they only have a cover to one side of the equation (DeSimone & Popoff, 2003). Fiksel et al., (1999) argue that sustainability performance

measurement must be viewed as a systematic business procedure in order to be integrated efficaciously into organizational strategic planning and day-to-day operations. It tackles with the economic, social, environmental facets (Elkington, 1998) of the organizations in common, and of organizational sustainability performance in specific (Epstein & Roy, 2003; Schaltegger, Burritt & Petersen, 2003;Schaltegger & Wagner, 2006; Johnson 2007; Epstein, 2008).

Sustainability performance reflects one goal end of the move of organizations in the organizational responsibilities continuum (Bhimani & Soonawalla, 2005; Schaltegger & Wagner, 2006; Johnson, 2007) from organizational conformance, guaranteeing, agreement and delineating with provided standards to organizational performance in association to stakeholder anticipations (Epstein, 2008). Even though performance assessment has a long history (Neely, 1998), prior empirical study into social and environmental (performance) management and accounting was partially cited in the 1970s business ethics disputation (Schaltegger & Wagner, 2006). Business strategists, in the last 30 years, have expanded broad internal management systems and evaluations. A scope of methods and initiatives were emerged in the last 20 years to assess diverse performance of companies, including concepts of sustainability evaluation, sustainability reporting, sustainability accounting initiative and other economic assessments.

Where sustainability performance assesses are revealed by private sector companies, there is a tendency to arrange these with the Global Reporting Initiative (GRI) index (Adams et al., 2014) with a combination of stand-alone sustainability records and mixed yearly financial accounts with sustainability accounting. In 2006, 83 percent of Australian top 500 organizations reported stand-alone sustainability records

(KPMG, 2007, p. 9) but more presently an increasing amount of organizations is providing their sustainability performance with the Measurement of sustainability performance financial to demonstrate, or at least provides the impression that sustainability is integrated in decision-making, a notion turning into familiar as integrated accounting (Economist Intelligence Unit, 2010, p. 16). For organizations whose objective is considered (at least by them) as being outstandingly one of economic result might be higher easily excused for individually reporting voluntary sustainability evaluates. Bellringer,Ball & Craig (2011) found that an important reason for the deficient reporting was that the organizational sustainability information was reported mostly for internal stakeholders.

The Society for Knowledge Economics (2013) proposed the Australian guiding principles on extended performance management. The guiding principles agree with the concept of Elkington (1998) that new accounts of performance such as social responsibility reports, triple bottom line (TBL) reports and intellectual capital reports (referred to in the guidelines as extended performance accounts) make visible knowledge intensive organizational resources giving a broader and more balanced perspective of organizational wealth and shed light on an organization's ability to create wealth in the future.

Hangstefer (2000) proposes that the starting point for a momentum factor measurement is revenue margin, which focuses upon a quantitative look at market position strength. Revenue margin is defined as the profit from a company's revenue generation system as the only source for a company's operating profit. Within a single indicator, it integrates a composite of the company's operating profit from changes in revenue level, pricing, cost and productivity. It is the trends in revenue margin that are

the most telling financial measure for indicating a company's overall market position strength. In summary, the concept of sustainability of performance in the literature is primarily addressed from two primary perspectives: financial measures of ongoing performance and social/environmental measures of organizational impact on the future viability other organizations or operations. However, the literature conceptually supports an extension of the concept of sustainability of performance to include social/environmental sustainability when the return on effort can be realized. This extension is what is being promoted in this research project. Realizing this value in a relatively short period of time is particularly useful to technology innovator firms because of the turbulent business environments in which they operate.

This is corresponding with Bansal (2005), who stated that economic viability is evaluated by indices such as increasing in earnings per share and profits, forward-looking market assesses of longevity futures such as market-to book ratio, and other assesses such as cash-flow, which is essential to sustain a company, and capital investment, which is important for creation value in long term. Environmental honesty and social responsiveness evaluates include indices such as energy reduction qualifications and water spend, carbon releasing, dangerous by-waste and products, and a company's adherence to reasonable trade principles, regard for personal rights, increasing in product safety, reach of gender equality in payment and promotion opportunities, decreasing in health and safety violations, and other social factors. Assesses such as these guage the measurement to which companies are indicating sustainability, and the measurement to which prospect development and creation value in the long term might be confident. However, as recognized, sustainable companies do

not concentrate extremely on only one dimension; rather, they struggle to present performance across social, environmental, and economic facets (Bansal, 2005)

In conclusion, sustainability performance embraces performance in relation with: natural facilities preservation and level of emissions; other environmental activities and initiatives; dimension of employment; occupational health and safety; community associations; stakeholder participation; economic influences on the company other than those financial assesses applied in the financial reports. Early study presents an insufficient reporting for environmental and social performance. Although there has been a sudden increase of working papers in the field of organizational sustainability performance measurement from both practitioners and scholar researchers, there is no concurred global guideline or standard. Generally, there are some measures generally applied or mentioned by organizations in choosing sustainability performance evaluates.

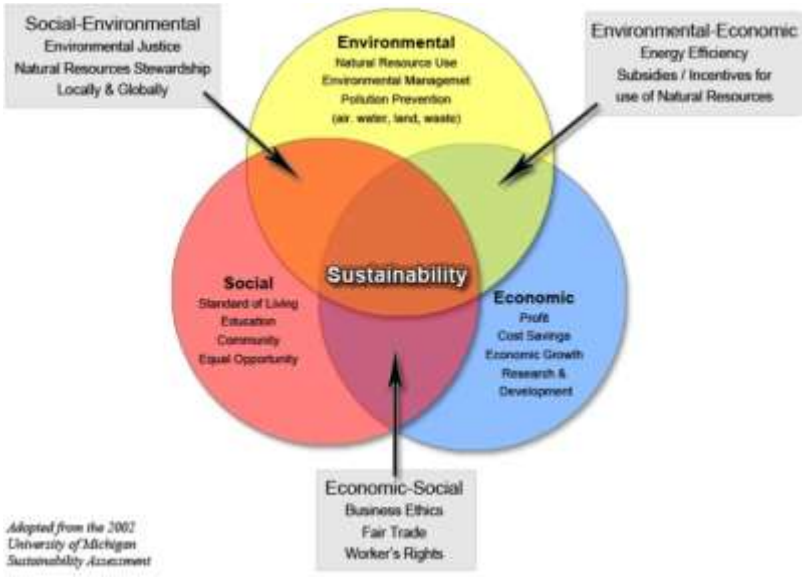

Figure 2.3 The three spheres of sustainability

Source: O'Meara(2013).

2.5.1 Environmental performance

The first area of sustainability to be considered is environmental sustainability. Concerns about environmental sustainability have a long history. The evidence would appear to suggest that environmental considerations are now one of the leading strategies being used by organizations (Kristensen, Juhl & Ostergaard, 2001) to enhance their image, reduce costs and create a competitive advantage. Yet, this has been given insufficient consideration in the academic literature. Yudelson (2009) stated that sustainability has consequences for every area of human endeavor including the design, construction and operation of shopping centers and retail stores. There are four main reasons for this interest in sustainability; reduce energy costs for ongoing operations; mitigate risk of future regulation of carbon emissions; take advantage of opportunities that will arise due to commitment to green issues; and well design sustainability initiatives that often have a really attractive return on investment (Yudelson, 2009).

Environmental performance indices as the consciousness of environmental preservation grow after a sequence of environmental accidents and ecological disasters in the 1970s and 1980s. Environmental reporting turned into a part of various sustainability records. Recently, environmental reports are mandated in numerous nations, including the United States. The federal legislation offers the Environmental Protection Agency (EPA) with the authority to eliminate waste sites and charge the eliminated costs to members who it expects to be chargeable for the pollution. In various manufacturing, the cost to restore or eliminate existing toxic sites can be essential. Ranganathan (1999) proposed four important components to assess environmental performance: resources utilization, energy expending, non-product output and pollutant emissions. Meanwhile, the GRI G3 guidelines indicate eight

evaluations for environmental performance including (1) materials; (2) energy; (3) water; (4) biodiversity; (5) emission, effluents, and waste; (6) products and services; (7) compliance; and (8) transport (GRI, 2006).

2.5.2 Social performance

Customers are also increasingly concerned with ethical and environmental issues which affect their purchasing decisions (Laroche, Bergeron & Barbaro-Forleo, 2001; Trudel & Cotte, 2009). Corporations, alone, cannot resolve the sustainability challenges facing the world and therefore there is a need for social partners or stakeholders to be involved too. Durieu (2003, p. 7) maintained that organizations can greatly influence changes in production processes and consumption patterns and are positioned to exert pressure on producers in favor of more sustainable consumer choices.

Social performance indicators are the endeavor to addition traditional financial disclosures by assessing the social impact of organizational operations. Matthews (1997) found that influences of product and environment were the two most targeted areas for the providers of social accounting. Ranganathan (1999) indicates four essential components for social performance including (1) employment; (2) community connections; (3) ethical sourcing; and (4) social impact of products. GRI Guidelines of 2006 (G3) records four indices for social performance comprised (1) labor practices, (2) personal rights, (3) society, and (4) product responsibility. Each social performance index has sub-dimensions. For labor programs, the five sub-aspects are labor/management relationship, employment, training and education, occupational health and safety, and diversity and equivalent chance. For personal rights, the six sub-aspects are procurement and investment practice, non-discrimination, autonomy of

relationship, employ child/young employee, security practice, and rights of local people. For society, the four sub-facets are corruption, community, public policy, and anti-competitive behavior. For product responsibility, the four sub-manners are marketing communications product and service labeling, customer health and safety, and customer privacy.

2.5.3 Economic performance

Economic performance in sustainability disclosures is often vague with the financial performance in reporting accountings. The financial performance evaluates an organization's profitability and prospect development. On the one hand, economic performance in sustainability records assesses an organization's impacts on its stakeholders' economic situations and on the economic systems at region, country, and/or global levels (GRI, 2006). According to such confusion, economic performance was often overlooked and ignored. This aspect of performance increased in reputation in the 1990s due to requirement by customers for sustainability disclosures. It was purposed to evaluate capital flows among various stakeholders and the economic effects of the company on the society (GRI, 2006). GRI Guidelines (G3) indicates three economic performance indices: (1) economic performance; (2) market existence; and (3) indirect economic effects.

Regarding the microeconomic theory, the performance of manufacturing or economic is separated into two classifications, which are performance of technical and resource allocation. Technical performance associated with a potential to produce greatest number of products from the expenditure of the smallest amount of resources. Meanwhile, the resource allocation efficiency refers to a greatest of making in which the organizations are contented with the meeting of goals and resources.

Specifically, the resource allocation efficiency can be described as the yield acquired from spending the minimal cost.

Conventionally, an organizational performance has been noticed and evaluated in accounting terms (Conant, Mokwa and Varadarajan, 1990; Jennings & Seaman, 1994). Nevertheless, publications concerned with assessment of business performance (Kaplan & Norton, 1996; Lynch & Cross, 1991; Otley, 1999) recommended that managers inclined towards locating relatively slight significance on measurement of traditional financial performance such as net profits, return on assets, or return on investment. It is compatible with Barros and Santos (2006), who suggested that organizational performance is a result from the resources spending ability and top management cares for overall outcome of both financial and non-financial performance. Generally, the term performance brings about the outstanding position of assessments such as cost, profit, and market share (Laitinen, 2002). Sink and Tuttle (1989) confirmed that performance should not be handled hardly as a financial viewpoint. Furthermore, Li et al. (2009) recommended that performance can be measured by non-financial performance such as satisfaction, efficiency, growth, and loyalty.

The organizational performance considered as an important connection between the strategies, execution, application and measurement operations (Emmanuel, Otley & Merchant, 1990; Haktanir & Harris, 2005). This is consistent with Melia and Robinson (2010), who suggested that assessing the organizational performance is associated with the strategy of the company. Thus, companies required to set obvious objectives and rules to increase efficiency and move towards the accomplishment of the objectives. Moreover, numerous companies have an idea that that the performance measurement can be evaluated grounded on the application of any

strategies. The performance reporting will take place at all organizational levels alike to financial reporting (Neely, Adams & Kennerley, 2002).

Companies, particularly in the private parts, must manage with strong rivalry and the necessary to grow and survive. While the extraneous business environment consisted of competitive forces, intraneous competency depends on finite facilities. Presently, business managers and academicians have interest in examining the connection between competitive priorities and organizational performance. Operational evaluates which are commonly applied as organizational performance assesses include quality, productivity, timeliness, cost, and accuracy (White et al., 1999; Ahmad & Schroeder, 2003; Hallgren, 2007; Kathuria, Rajesh, Natarajan & Kunal, 2010).

2.6 Manufacturing Industry

Manufacturing is related to the production of merchandise for sale or use by employing workers, equipment, machines, tools, biological and chemical processing, or formulation. The term may indicate to a distance of activity of people, from handiwork to high technology, but it is most generally used to industrial production, in which raw materials are changed into completed products on a huge quantity. Completed products may be applied for manufacturing other more complicated goods, for example; household appliances, aircraft, or automobiles, or sold to wholesalers, who in turn sell them to retailers, who then sell products to purchasers and end users (Wikipedia, 2016).

Manufacturing takes turns under all kinds of economic systems. In a free market economy, manufacturing is normally directed toward the mass production of goods for sale to purchasers at a profit. In a collectivist economy, manufacturing is more frequently directed by the state to provide a centrally planned economy. In mixed

market economies, manufacturing emerges under some levels of government regulation. Modern manufacturing comprises all intermediate processes needed for the production and integration of a product's components. Several industries, such as steel manufacturers and semiconductor spend the term fabrication instead.

2.6.1 Manufacturing industry categories

The aspect of manufacture and trade is based on the fabrication, processing, or arrangement of goods from raw materials and merchandises. The Standard Industrial Classification classifies the industry into 20 standard industrial categories (Sustainable Development Indicator Group, 1996) as followed:

2.6.1.1 Apparel industry

2.6.1.2 Chemical and allied industry

2.6.1.3 Electronic and electrical equipment industry

2.6.1.4 Fabricated metal industry

2.6.1.5 Food and related industry

2.6.1.6 Furniture and fixtures industry

2.6.1.7 Industrial and commercial machinery industry

2.6.1.8 Leather industry

2.6.1.9 Lumber and wood industry

2.6.1.10 Measuring, analyzing and controlling instrument industry

2.6.1.11 Paper and allied industry

2.6.1.12 Petroleum refining and related industry

2.6.1.13 Primary metal industry

2.6.1.14 Printing, publishing, and allied industry

2.6.1.15 Rubber and miscellaneous plastic industry

2.6.1.16 Stone, clay, glass, and concrete industry

2.6.1.17 Textile mill industry

2.6.1.18 Tobacco industry

2.6.1.19 Transportation equipment industry

2.6.1.20 Miscellaneous manufacturing industries refer to all organizations mainly associated with producing goods not assorted in any other manufacturing category. This comprises firms associated with the manufacturing of products such as musical instruments, jewelry, sporting products, toys, etc.

2.6.2 Supporting factors of Thai manufacturing industry

2.6.2.1 Increase in government expending and capital invested has been pushed by a shortage financial plan for year 2016 in the quantity of 390,000 million baht. The undersupply quantity, increasing from 250,000 million baht in fiscal year 2015, will benefit the tendency and advancement of investment in infrastructure projects.

2.6.2.2 Besides pushing factor from the economy stimulus measures (phase 3) throughout the second half of 2015, the government has declared a main economic stimulus for evaluation as well, comprising 6 scales as follows: 1) evaluation to boost the welfare of citizens who have poor revenue, and assessment to provoke small business investment of government on all parts of the nation, 2) fiscal calculation to encourage small and medium-sized enterprises (SMEs) in an instantaneous manner, 3) financial and fiscal computation to motivate the economy on the asset and property investment, 4) tax evaluation to advance domestic investment, 5) evaluation to escalate the BOI investment, and 6) evaluation to reinforce rubber and tire farmers. Even though

the drive by budget and credit was adopted throughout the year 2015, the drive by tax evaluation is still in use constantly as long as the year 2016.

2.6.2.3 Moderate rehabilitation of the economy around the world and trade internally products prices are contributing factor to enlarge the export values in 2016 to increase gradually, and encourage the economic growth more.

2.6.2.4 A diminishing of Thai baht will encourage incomes and liquidity in Thai baht of enterprises consistently.

2.6.2.5 Prices of agricultural products improve gradually.

2.6.2.6 Inclination of oil prices has consistently risen gradually and remained at a low price. This advocates the actual population purchasing power and advocates the monetary policy conduct to encourage the economic retrieval consistently.

2.6.2.7 An increasing of tourism industry in 2016 is anticipated that the number of travelers which journey to Thailand will reach to approximately 32.5 million, up by 7.5% from 2015, and leads to incomes from the tourism about 1.65 trillion baht, an expansion of 9.3% when compared with the year 2015.

2.6.3 Risk factors of Thai manufacturing industry

2.6.3.1 A sluggish of the China's economy and its weakened economic fundamental. China still has a risk of slowdown quicker than supposition. The nation with drop off economic fundamental, exclusively the nations with high overseas debt and confidence in exports of initial products and the depreciating money, has risks of the economic crisis consistently. Such situations could result in the retrieval of the worldwide economy and commodity values in the global markets fall behind as anticipation.

2.6.3.2 The reducing of main currencies of partners and competitive nations. Specifically, Chinese Yuan Renminbi is likely to enfeeble because of the economic and financial free trade policy. A reduce in global funds and a requirement of liquidity cause the nations to require an intervention in order to make the currency more steady with more limitations.

2.6.3.3 The influences of shortage of water are also higher possible to be harsh persistently relying on the quantity of water obtainable in main huge 4 dams (Bhumibol Dam, Sirikit Dam, KwaeNoiBamrung Dan Dam, PasakJolasid Dam).

2.6.4 Industrial manufacturing trends in 2017

The sting of 2001 and 2008 is still too distressing for some industrial manufacturing organizations to forget. Back then, worldwide economic enlargement tempted manufacturing producers to outlay in modern technologies and machine designed to get better manufactory effectiveness for both themselves and their purchasers. When markets immediately collapsed, the company paid an extreme price for having expended at the top of the cycle. The payoff took years to realize, if it presented at all. This recollection colors the provisional steps that several industrial producing organizations are taking today. Certainly, economic expansion, although emerging, is not especially vigorous. It is anybody's guess whether China is heading for a soft landing or a renewed takeoff. The prospects for Euro zone and the futures for Brazil, India, and Russia are not possible to read. It is attractive to believe that a boardroom version of the defense avoiding possible big losses by taking small opportunities may be the best strategy. Yet, that summarization is a fictitious option. Production industry may be confronting some headwinds, but it is undeniable in the midst of a technological renaissance that is changing the look, systems, and processes of

the new plant. Notwithstanding the risks and present history, industrial production organizations cannot carry to neglect these progresses. By involving them now, they can get better efficiency and effectiveness in their own factories, contend versus competitors, and keeping an edge with ultimate consumers who are searching for their own obtains from innovation. Rather than fearing the past, industrial manufacturing managers should be asking these crucial questions. At a time of quick change and limited upside, technology investments will have the largest positive influence on business, return on investment, value potential, and risk of investing in these technologies (Pillsbury & Bono, 2016).

2.6.4.1 Technology driving the change. Given today's leading-edge efficacy, it is appropriate to envision and prepare for a data-driven factory of the future where all internal and external activities are linked through the same information platform. Customers, designers, and workers will share information on everything from initial notions, to installation, to performance feedback throughout the life cycle. Workers will access materials on demand, collaborate with robots to use them safely and ergonomically, and believe in virtual work instructions demonstrated at the point of use. Assembly lines will output highly personalized products, sometimes in a lot size of one, which contains zero defects. But what breakthrough equipment, ideas, and processes will have the largest impact on factory surroundings? The following four technology sorts are already driving much of the change (Pillsbury & Bono, 2016).

2.6.4.1.1 Internet of Things (IoT).

The connected factory is a concept that has been created for the recent few years. Progressively, it refers to increasing the power of the Web to connect equipment, computers, sensors, and employees in order to capacitate

modern degrees of information observing, collection, producing, examination, and analysis. These gadgets give higher infallibility and can translate gathered data into enlightenment that, for instance, assists to define the volume of voltage consumption to make a product or to greater comprehend how pressure, temperature, and humidity affect performance. Stanley, Black and Decker has modified the Internet of things in a factory operate in Mexico to observe the real time of manufacturing lines status through smart phones and Wi-Fi RFID tags. Consequently, overall equipment effectiveness (OEE) has enhanced by 24 percent, working hours by 10 percent, and rate of selling by 10 percent.

However for industrial production organizations, the upcoming generation of the Internet of things (IoT) technology should shift fine apart from actual-time observing to link information platforms that grasp data and proceed analytics to carry superior-quality, better permanent and dependable goods. An imply of this can be viewed in wind turbines produced by General Electric. This equipment comprises some 20,000 sensors that generate 400 data points per second. Immediately, continuous analysis of this data authorizes GE and its consumers to maximize turbine performance and proactively make decisions about maintenance and parts replacement. Before investing in the Internet of things (IoT), however, industrial producing organizations must define accurately what data is most precious to gather, as well as gauge the efficacy of the analytical structures that will be applied to evaluate the data. Moreover, equipment in the future will need a future combine of employees, which should comprise workers who can design and create the Internet of things (IoT) goods together with data scientists who can analyze quantity produced.

2.6.4.1.2 Robotics

Over the recent decade, China appears as an automated producing powerhouse, as expanded labor costs and booming industry drove enormous enlargement in industrial robotics. Since 2013, the quantity of shipments of multipurpose industrial robots in China approximately doubled to a forecasted 75,000 in 2015, with that volume forecasted to twice the usual size yet again to 150,000 by 2018, due to the International Federation of Robotics. But although a Chinese organization presently broke ground on the globe's first completely automated plant, in Dongguan, the prevailing application of robotics and unmanned control technologies may not address all productivity concerns. As expected, some producers believe that larger automation is destructive, leading to few innovations because only human can create concepts to enrich processes and goods. As a result, robotic execution is exploring on a dissimilar path in the United State and other fully developed economies. In various cases, robots are applied to equipment more than substitute employees. This notion, perceived as "cobotics," teams up workers and equipment in order to produce complicated items of the assembly process quicker, easier, and safer. Cobotics is quickly getting momentum, and successful executions to date have concentrated mostly on particular ergonomically challenging duties within the automotive and aerospace industries. However these implications will increase as automation creator introduce more complex sensors and more adjustable, extremely functional robotic equipment that will let human and equipment interact skillfully on the plant floor.

2.6.4.1.3 Augmented reality

The latest progresses in computer vision, computer science, information technology, and engineering have capacitated producers

to transfer real-time information and guidance at the consumption point. Practitioners easily follow the graphics, text, audio, and other virtual improvements superimposed onto goggles or true assemblies as they perform complicated duties on the plant floor. This equipment can concurrently evaluate the precision and timing of these jobs, and inform the workers of quality risks. Some industrial operating organizations are applying this technology to offer hand-free training, capacitate quicker replies gather requests, track inventory, improve safety, and give an actual view of producing operations. In more than a few examples, these increased services could be sold as add-ons to the tools itself, making a new income stream for industrial producing companies. Among the likely utilizations is an assembly-line instructional manner in which video clips or text instructions walk operators through sophisticated processes step-by-step. Mistakes occurring from exhaust or on-the-job pressure are removed. Other feasibility relates to applying data and physical evidence retrieved by enlarged reality on the plant floor to design novel tools that presents the deficiencies of current day gadgets on the assembly line.

2.6.4.1.4 3D printing

Also known as additive manufacturing, 3D printing technology makes solid objects from digital designs by creating up multiple layers of resin, plastic, or other materials in an accurately determined shape. Prior adopters among industrial producing organizations are applying 3D printing to produce items in small lots for product prototypes, to decrease design-to-production cycle time, and to substantially change the economics of manufacturing. For instance, BAE Systems turned to 3D printing when it could no longer secure an important injection-molded plastic part for a regional jetliner. The organization conserved greater than 60

percent on the cost of the part, avoided retooling costs, and diminished manufacturing lead time by two months. 3D printing is still in its infancy, and the technology is recently restricted in the performance specifications of the products it can make. However organizations must start planning for the integration of this current technology. As a first step, industrial operating firms should use 3D printing technology to develop the product and prototyping process, where its rapidity and flexibility can stimulate innovation and decrease time-to-market. The second step could be to apply 3D printing to create extremely specialized, low-volume parts that are parts or subassemblies of completed goods, or to build equipment for the molding, casting, or forming of goods.

2.6.4.2 New risk and reward equation. Industrial producing managers should discuss investments in appearing technologies through three paths of analysis (Pillsbury & Bono, 2016).

2.6.4.2.1 Define the exclusive spaces to develop the company, or what performance goal a technology investment is trying to obtain. How will the investment effect cost, quality, labor, or other strategic concerns? How will the modern technology assist distinguish the value offer to purchasers? Will it generate capacity or create productivity in the limited components of the operations? Will the technology give improved adaptability to assist manipulate with inexactitude?.

2.6.4.2.2 Comprehend how the novel technologies will capacitate that degree of effectiveness and weigh the value of reaching that effectiveness against the technology cost. What degree of output should the facility be efficient to generate today, and how much development can be anticipated over time as the technology continues to create? Who are the present industry precursors in each

technology category, and what tangible impact is their technology having? What is the clock speed of the technology, and how practicable is it that it will create to reliably transfer on the performance purposes?

2.6.4.2.3 Understand the technology executions in operational and organizational level and understand how it places with the company of the future vision. How does it assist or provoke employees or the culture? How should teaming and incentives models evolve to maximize modern technology? How scalable is the technology? How well does it combine into a firm's technology backbone and whole footprint? Even though the appearing technologies are possibility transformative, they are unfolding against a backdrop of dubiousness among industrial producing organizations. In the fourth-quarter 2015, PwC Manufacturing Barometer™, which surveyed United State-based industrial producing managers, revealed that only 27 percent of CEOs working in industrial production indicated good side about the worldwide economy. Industrial producers' forecasted mean income development, in addition, decreased to 1.8 percent in 2015, from 5.2 percent in the previous year, due to this account. Worse yet, just 31 percent of organizations are producing close absolute capacity in the fourth quarter, a decrease of 26 percentage points in the past year. Still, this data should be seen as the springboard for calculated action. Speedy manufactory innovation is differentiating the risk/reward equation. A sheepish repercussions to appearing inactive economic status can rapidly place companies in risk behind rivals and incapable to address purchaser requirements even with markets enhancement in the next years. Making strategic investments is crucial for improvement, specifically in fast-evolving industries. Given that technology in manufacturing industry is creating quicker than ever before, several of the technologies being introduced nowadays will be normal

within 5 or 10 years. Industrial products managers must convey with an eye toward that substantiality, and not solely the present bottom line.

2.7 Chapter Summary

Chapter two reviews the publications from both perspective of scholar researchers and practitioners respecting the concept of leadership model, transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance. The last section will mention the review of the manufacturing industry which is the interesting areas of this study. The next chapter will discuss on the research methodology consisting of hypotheses development, theoretical framework, assessment tools, populations, samples, data gathering, and data analysis.

CHAPTER 3

RESEARCH METHODOLOGY

This study applied a mixed method procedure to investigate the qualitative and quantitative study by applying the simple random sampling and snowball sampling technique which have investigated the relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance. The research methodology consists of the purpose of the study, model/theoretical framework and hypothesis, population and sample, instruments, data gathering, data analysis, and time table. The chapter will conclude with a conclusion of interrelated points and an overview of the following chapter.

3.1 Purpose of the Study

The purposes of the study are to examine (1) the relationship between transformational leadership and lean manufacturing, (2) the relationship between transformational leadership and sustainability performance, (3) the relationship between sustainable leadership and lean manufacturing, (4) the relationship between sustainable leadership and sustainability performance, (5) the relationship between lean manufacturing and sustainability performance, (6) the relationship between transformational leadership and sustainability performance through lean manufacturing, (7) the relationship between sustainable leadership and sustainability performance through lean manufacturing, (8) the moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance, (9) the moderate effect of length of lean adoption on the relationships

among transformational leadership, lean manufacturing, and sustainability performance, (10) the moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance, and (11) the moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

3.2 Model/Theoretical Framework and Hypothesis

The theoretical framework displayed in figure 3.1-3.3 was converted into eleven hypotheses.

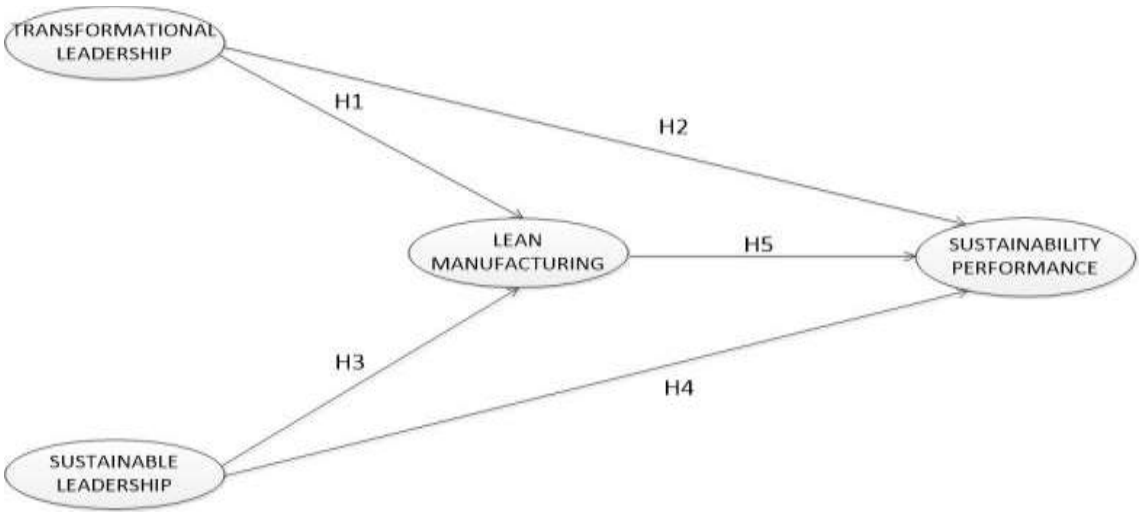

Figure 3.1 The proposed theoretical model

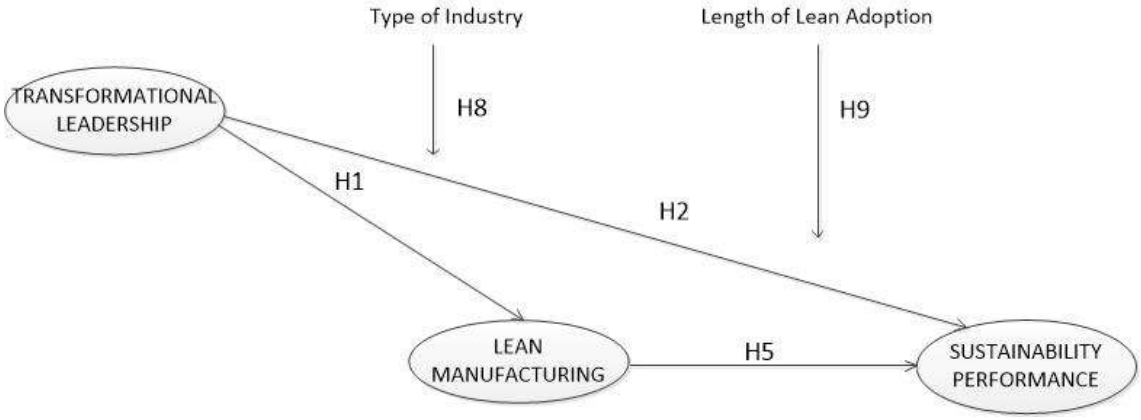

Figure 3.2 The proposed theoretical model to test moderate effect on the relationships among transformational leadership, lean manufacturing, and sustainability performance

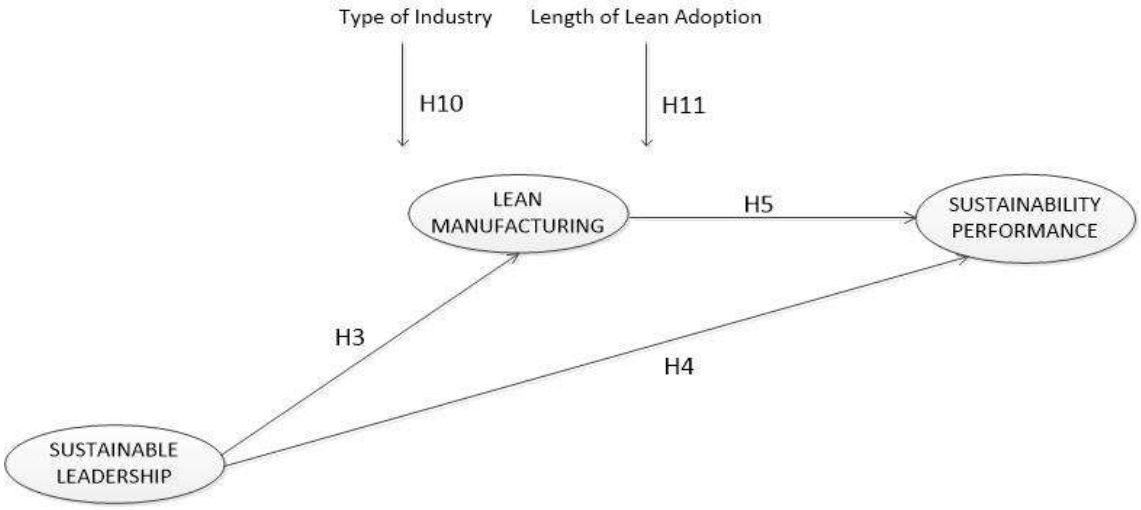

Figure 3.3 The proposed theoretical model to test moderate effect on the relationships among sustainable leadership, lean manufacturing, and sustainability performance

Sim et al. (2008) carried out a research based on a production factory inside a Fortune 500 companies operating in the Eastern U.S. The study reported that one of the main rationales for not accomplishing outcomes within the continuous improvement practice at this place was a scarce of dedicated leadership. Meanwhile, the research conducted by Leitner (2005) emphasized on the 20-year process at Boeing on application continuous improvement initiatives. Boeing had an idea that the important effective of their lean practice was extremely because of the leaders' characteristics and traits. Moreover, the organization mentioned that managers who will participate in lean program necessary to be strategically positioned within the company. Leadership must offer the encouragement of the lean practice by being engaged themselves as well as participating the labor force. This complied with Cheerawit, Napompech & Panjakhajornsak (2014), who collected data from manager in automotive industry in Thailand and asserted that leadership enhanced success of lean manufacturing practices.

Heymans (2002) reported on his own individual experiences working with producers across the U.S. to concentrate on critical behaviors of leadership that are

frequently absent within the managers or leaders of organizations he has facilitated. He analyzed that leadership practices and behaviors have important effect upon lean programs. He suggested a content of five crucial leadership deportments that advocate success of lean application, i.e. having an explicit vision and application plan, applying visual management techniques and authorize workers, setting objectives for development, taking actual action to initiate change, and setting and maintaining reliability standards. Meanwhile, Achanga et al. (2006) carried out study with 10 organizations in the Eastern Britain, all of which had utilized lean production. The study examination revealed four major factors which are regarded crucial for application of lean practice, i.e. management and leadership, skills and expertise, finance, and the organizational culture. Considering four factors, the research findings summarized that management commitment and leadership were the most essential factors in indicating effective of an implementation of lean program. Moreover, Woehl (2011) conducted research from semiconductor industry in America and found that leadership style correlated with degree of lean production success at 0.001 significant level.

The research publication falls scarce of regarding that one leadership concept might be more proper for effective lean applications. This is consistent with Herkness (2005), who revealed that transformational leadership expansions transactional leadership by creating on the exchanges between managers and employees. In summary, the findings of the study add to the existing empirical data suggesting that the transformational leadership model is useful when trying to lead change.

Meanwhile, Poksinska et al. (2013) found that the manager's role changed radically with the implementation of lean production. The focus in managerial tasks changed from managing processes to developing and coaching people. Supporting

structures were developed to empower employees and give them more responsibility for daily management activities. These supporting structures included visual control, goal deployment, short daily meetings, two-way communication flow, and a system of continuous improvement. Many leadership behaviors exhibited by lean managers can be classified as transformational leadership behaviors. However, the need for transformational leadership behaviors was smaller if the supporting management structure was strong.

Although most studies confirmed the relationship between leadership and lean manufacturing practice, some studies found opposite results. For example, Marynell (2013) studied top executives from 200 organizations who had been participated in an utilization of lean production from 2 to 5 years. The results revealed that all 3 aspects of leadership including transactional leadership, transformational leadership, and path-goal theory were not correlated with better performance lead to on-time delivery, lower and rapid inventory turns, and lower defects of critical products/components. This corresponds to Langlois (2015), who used an Internet-based survey to obtain responses from 86 company leaders within LinkedIn lean groups who have attempted to implement lean practices. It was found that there was a weak significant negative association between transformational leadership style and lean maturity, $r(86) = -0.240$; $p < 0.05$. So, the company leaders should be aware that the one-size-fits-all approach to leadership style might not always result in positive outcomes when implementing and sustaining lean manufacturing practices. Meanwhile, Holm (2010) studied on different leadership styles affecting success in implementing lean. The author suggested that authentic leadership which is an enlargement of transformational leadership and shared

or team leadership is complementary and integral parts of leadership for effective lean manufacturing.

Based on the above concept, the relationship between transformational leadership and lean manufacturing practices are ambiguous; so the below hypothesis was thus investigated.

H1: There is a positive relationship between transformational leadership and lean manufacturing.

Considering the relationship between leadership and performance, Ogbonna and Harris (2000) studied from 342 UK companies and it was found that participative, supportive, and instrumental leadership related to operational performance. Meanwhile, Elenkov (2002), investigating Russian companies, found that transformational leadership related to operational efficiency by reducing costs and enhancing quality of work. In addition, Dionne, Yammarino, Atwater & Spangler (2004) reported that transformational leadership consisted of inspiration, focus on employee, freedom to work, empowerment, attentiveness, and good coaching. These can motivate employees to work with more efficiency and quality. Moreover, Tombaugh (2005) supported that leader's manner of optimistic view, confidence, empathy, intelligence, trust, respect, and good knowledge in their work positively related to operational performance. Achanga et al. (2006) studied UK companies and found that one critical factor for lean implementation within SMEs is leadership. This complies with Cheerawit et al. (2014), who asserted that leadership enhanced firm performance.

Chi, Yeh and Yu (2008) studied the effects of transformation leadership, organizational culture, job satisfaction on the organizational performance in the non-profit organizations. The results revealed that transformation leadership, organizational

culture and job satisfaction had a significant effect on organizational performance. Another field experiment conducted with Israeli platoon leaders demonstrated that transformational leadership could be developed for positive impact on unit performance 6 months after the close of training (Dvir, Eden, Avolio & Shamir, 2002).

Lowe et al. (1996) conducted meta-analyses and confirmed the positive relationship between transformational leadership and performance reported in the literature. Similarly, Gang, Oh, Courtright and Colbert (2011) conducted meta-analyses from 117 independent samples over 113 primary studies, and the study showed that transformational leadership was positively related to individual-level follower performance across criterion types, with a stronger relationship for contextual performance than for task performance across most study settings. In addition, transformational leadership was positively related to performance at the team and organization levels.

Zhang, Peterson and Reina (2013) studied 101 subsidiary top management teams (TMTs) and showed that subsidiary CEO transformational leadership, which was focused evenly on every TMT member, increased team effectiveness and firm performance. In addition, Tonvongval (2013) examined the organizational development intervention (ODI) impact on transformational leadership development of 42 Branch Managers on employee engagement elements: job satisfaction and extra effort and organization performance on improvement of sales revenue, staff attrition and customer complaints. It suggested that transformational leaders promote higher performance in organizational units. Subsequently, Howell and Avolio (1993) found that the level of support for innovation climate moderated the relationship between transformational leadership and consolidated business unit performance of 78 managers in a Canadian

financial institution. Moreover, García-Morales, Matías-Reche and Verdú-Jover (2011) analyzed the influences of transformational leadership on organizational performance through the dynamic capabilities of organizational learning and innovation. The results revealed that (1) transformational leadership influences organizational performance positively through organizational learning and innovation; (2) organizational learning influences organizational performance positively, both directly and indirectly through organizational innovation; (3) organizational innovation influences organizational performance positively.

Arham (2014) investigated the impact of leadership behaviors on the performance of services SMEs in Malaysia from 193 owners and top managers. The results showed that there were significant relationships between different leadership behaviors and organizational performance of services SMEs, and transformational leadership contributed more significantly to the performance of SMEs than transactional leadership behavior. Meanwhile, Kheirandish (2014) investigated the relationship between transformational leadership and teacher's performance improvement. The finding results showed that there was a positive relationship between transformational leadership and teacher's performance improvement. The results also presented that in order to improve teacher's performance by transformational leadership approach, managers should be a role model for teachers, set clear vision for them, help them for questioning the existent situation and consider them individually.

Moving on to the study in Thailand, the number showed that there are many papers interested in the relationship between transformational leadership and performance. For example, Sookaneknun and Ussahawanitchakit (2012) revealed that, out of the four dimensions of transformational leadership, there was only one, the

idealized influence, which had an effect on organizational innovation capability. However, when all four dimensions were integrated as transformational leadership, it had a positive influence on organizational innovation capability. Secondly, organizational innovation capability had a positive effect on firm performance. In addition, Rattanaborworn et al. (2015) collected data from a survey of 152 instant foods and convenience foods businesses in Thailand, which provided the interesting points of leadership. The results revealed that transformational leadership in some dimensions have a positive influence on transformational leadership's consequences. Also, organizational innovation and organizational efficiency have a positive influence on firm performance. Moreover, Chokchai worarat and Jarinto (2014) relied on the data collected from 338 managers in Group awarded TQA/TQC (Thailand Quality Award/Thailand Quality Class) and Survival industries group according to the classification of the NESDB (Office of the National Economics and Social Development Board). The results light out that the transformational leadership is positively influenced with organization performance especially finance area. In the same line, transformational leadership is found to be not only positively affected by organization commitment but also affected by empowerment factor. The finding also shows the indirect effect between transformational leadership and organization performance via mediating factors.

Tonvongval (2013) examines the organizational development intervention (ODI) impact on transformational leadership development of 42 branch managers on employee engagement elements: job satisfaction and extra effort and organization performance on improvement of sales revenue, staff attrition and customer complaints. The results indicate statistically significant of both employee job satisfaction and extra

effort as a result of the intervention. It was also found that there is statistically significant improvement of organization performance between pre-and post-OD intervention as opposed to the negative findings in the control group.

Wongyanon, Wijaya, Mardiyono and Soeaidy (2015) conducted survey from 820 respondents in case of Thai local organization located in Pattaya, Laemchabang, and Chonburi province. The authors demonstrated that transformational, transactional and laissez-faire leadership styles have a significant and positive influence to the organizational performance. The findings revealed individual consideration leadership style in transformational exhibited in two locations, while others displayed only one location. Those include charisma, inspiration motivation and intellectual stimulation in transformational leadership, contingent reward and management by exception-active in transactional leadership and laissez-faire leadership style.

Although, most studies confirmed that there is relationship between transformational leadership and performance, some studies revealed the opposite results. For example, Chitwood (2010) conducted research from 41 executives working for university in America and found that there is no relationship between leadership style and operational performance. Regarding the above concept and some vague, this study intends to confirm the relationship between transformational leadership and sustainability performance by empirical study; so the below hypothesis was thus conducted.

H2: There is a positive relationship between transformational leadership and sustainability performance.

Najem, Dhakal & Bennett (2012) conducted a literature review and verified that companies cannot succeed in lean manufacturing unless they have a healthy culture,

skilled workers, the buy-in from the top management and a strong leadership. Similarly, Roth (2006) suggested that research literature on change management and lean case studies showed that without top management buy-in, organizations cannot create a system of continuous improvement then cannot sustain change efforts. Meanwhile, Dombrowski and Mielke (2014) proposed that lean production systems have become a state of the art in manufacturing enterprises. However, there are few companies succeeding, and sustaining lean implementation seems to have a different type of continuous improvement process. The author further indicated that continuous improvement process is linked to a different leadership approach. However, many references confirm that a different way of leadership is necessary but few studies gave practical advice.

In prior publications on lean, leadership, and in specific active leadership, has been delineated as a capable of lean application (Radnor, 2010; Suarez-Barraza & Ramis-Pujol, 2010). In addition, Achanga et al. (2006) investigated essential success determinants for implementation of lean production in small and medium enterprises (SMEs) and concluded that in order to succeed in lean manufacturing, the organizations should harbor strong leadership characteristics proficient of demonstrating outstanding project management styles including obvious vision and strategic initiatives, a good educational level and the willing to encourage initiatives of productivity improvement. Mann (2009) reported that senior managers frequently have an important responsibility in acting as role models when implementing lean. Moreover, Spear (2004) emphasizes that in a lean system, the leader helps employees in constructing work as a sets of investigations to endorse continuous learning. A lean leader thus teaches workers very actively and hands-on in searching the correct answer.

Suarez-Barraza and Ramis-Pujol (2010) mentioned that leadership enables or inhibits of success of lean implementation in almost every scholar and practitioner article published in the area. However, there are indications to recommend that some efforts of lean implementation disappointed even with commitment of top management. The authors further argue that there is no actual attempts developed to determine what actively leadership actually is.

Based on the above concept, there is lack of empirical study on the relationship between sustainable leadership and lean manufacturing practices. Accordingly, there is ambiguity on what is the suitable leadership style on lean manufacturing successful. Therefore, this paper intends to study the sustainable leadership; so the below hypothesis was thus examined.

H3: There is a positive relationship between sustainable leadership and lean manufacturing.

When discussing the perspective to strategic decision making that is supported by sustainable leadership, Gurr (2007) comments that it focuses on various competing important factors that capable long term improvement. Sustainable leadership takes into deliberation a comprehensive scope of complex interconnections among personals, the business community, worldwide demands and the natural environment, with the essential objective that a company accomplishes well-being by concerning social values, obtaining success in long-term based on strategic decision-making value and preservation the ecosystem, of which we all form an integral part. Secondly, in strategic decision making, sustainable leadership behaves responsibly. Avery and Bergsteiner (2011) confirmed that sustainable leadership creates communities, encourages cooperation among stakeholders and fosters value in long-term. The relevance of

sustainable leadership for chargeable strategic decision making in sustainable companies is obvious in the method it directs the sustainable leaders attentions with regard to four fields of deliberation when making decisions. It requires that top executives adopts a macro view of the company (Avery & Bergsteiner, 2011) due to sustainability associates with a variety dimensions of development and performance (Casserley & Critchley, 2010): (1) on a individual level: keeping physical health and individual psychological; (2) at the business level: keeping a workplace surrounding that permits workers to improve manifold knowledge with the goal of accomplishing the company's purposes, which are linked up with the goals of stakeholders; (3) at the social level: socially-responsible handling in the broader community; and (4) on the ecological level: preservation and sustainable environmental change.

Rhineland organizations anticipate not only to sustain and increase their economic, social and environmental capital bases but also to actively contribute to sustainability in the public boundary, for instance, by collaborating to political discourse and focusing to social requirements. More presently, Avery and Bergsteiner (2010) suggested the Honeybee leadership concept associating with a humanistic and resilient viewpoint to collaborative sustainability that generates on the sustainable Rhineland leadership executes that Avery (2005) and others have analyzed. Avery and Bergsteiner (2011) reveal an evidence-based view of how 23 leadership practices that interact to build Honeybee leadership encourage results that move apart from the triple bottom line including environmental sustainability, collaborative social responsibility and financial effectiveness.

Metsämuuronen, Kuosa and Laukkanen (2012) conducted in-depth interview from two cases of current future-oriented executions in the educational governance in

Finland and concluded that sustainable leadership can be viewed as a long sets of various future-oriented decisions and executions, for instance uniforming the system, providing extremely desiring education to their people, strategic decisions regarding the information society, as well as some other great political decisions regarding education. In addition, Hayward (2011) proposed that in the research publication of leadership, concentration has been focus on the role of leadership improving in assisting companies prevail over the crises, emphasizing on long-term profits more than short-term benefits.

Kantabutra and Avery (2013) conducted practices from Thailand's biggest corporation, Siam Cement Group (SCG) and revealed that all six series of executions, which absolutely differfrom the widespread business model of maximization short-term profitability but corresponding with the 23 sustainable leadership executions, were found to use in varying degrees to SCG. A total of 19 applied strongly, with three others moderately strong, given that sustainable leadership foundations are related to advocate brand and prominence, employee and customer satisfaction, and financial successfulness. The authors further suggested that even a publicly-listed organization can counteract pressures to correspond to business-as-usual executions and adopt the long-term, socially responsible principles of Honeybee sustainable leadership. In brief, Honeybee practices demonstrably drive organizations towards excellent business operations and superior performance; consequently supporting to the sustainability of an organization (Albert, 1992; Avery and Bergsteiner, 2010).

In the Thai healthcare organization study, evidence was found for compliance with 15 of Avery's 19 sustainable leadership elements, but to varying degrees. The elements were grouped into six core sets of practices: adopting a long-term perspective, staff development, organizational culture, innovation, social responsibility, and ethical

behavior. One element was found to be not applicable, and no evidence was found for conformity with Rhineland principles on the remaining three sustainable practices. The paper concludes that Avery's 19 Rhineland practices provide a useful framework for evaluating the corporate sustainability of this Thai enterprise. The author confirmed that healthcare enterprises in Thailand and possibly in other Asian countries that wish to sustain their organizational success could adopt Avery's 19 sustainable leadership grid elements to examine their leadership practices, and adjust them to become more sustainable.

Meanwhile, Kantabutra and Saratun (2013) adopted a multi-data gathering means, researchers supplied case study data with participant observations, and reference to documentation and information provided by or published about the university. Semi-structured interviews were conducted with various stakeholders in Thailand's oldest university. Six main series of executions correspond with 21 sustainable leadership practices are indicated: an interest on a long-term viewpoint, employee improvement, a vigorous innovation, organizational culture, social and environmental responsibility and ethical actions. According to sustainable leadership concepts related to advocate brand and prominence, employee and customer satisfaction, and financial effectiveness, the sustainable leadership grid offers educational leaders with a productive checklist for this objective. The paper contains the first investigation of sustainable leadership in the area of higher education. It presents that even a public service business can apply the long-term, socially responsible concepts of sustainable leadership.

Although most studies confirmed that sustainable leadership led to sustainability performance, some studies revealed the opposite results. For example, McCann and Sweet (2012) collected data from leaders in mortgage loan originator

organizations. The survey revealed that high levels of both ethical and sustainable leadership were yielded. However, correlations between the perceived leadership survey and sustainable leadership questionnaire did not prove to be dependent or closely correlate. So it is vague to identify that sustainable leadership lead to sustainability performance. Moreover, Suriyan kietkaew (2013) proposed that the literature on leadership paradigms, organizational performance and corporate sustainability, and key mediating variables, particularly shared vision and values, self-leadership, an organizational team orientation and consensual decision-making, affecting their relationships should be reviewed. In addition, the relevance of sustainable leadership principles to enterprises in less developed economies remains to be investigated. This study attempts to uncover this unknown. Regarding the above notion, the below hypothesis was thus investigated.

H4: There is a positive relationship between sustainable leadership and sustainability performance.

Considering the relationship between lean manufacturing and performance, Ravet (2012) conducted a literature review and concluded that lean manufacturing has long been linked to improved operational performance. And there is evidence that these process improvement philosophies and their associated tools improve environmental performance as well (Curkovic, Melnyk, Hanfield & Calantone, 2000; King & Lenox, 2001).

Laohavichien and Wanarat (2013) investigated the relationship between lean manufacturing and organizational performance, of which the data were derived from 119 Thai manufacturing firms. The results show that lean practices have a direct and significant impact on organizational and innovation performance. This is in compliance

with Ruangchoengchum (2015), who revealed that there is significance in performance related to lean manufacturing that affects net profit of SMEs in the manufacturing sector in Thailand. Moreover, the interview and survey of Kiatcharoenpol, Laosirihongthong, Chaiyawong & Glincha-em (2015) with lean experts experienced in Thai SMEs consultant confirmed that lean practices lead to high level of organizational performance.

Pradabwong, Braziotis and Pawar (2012) conduct interview with 10 industrial companies practicing lean manufacturing. The results shows that most lean practitioners understand the principal of lean manufacturing. There are three different types of performance measurement that apply for this 10 companies which cost per unit, total sale, and part per million (PPM). The big barrier is the culture change since it requires the entire company participation. The companies participating in this study confirmed that they were satisfied with the result of lean manufacturing though some companies have not completely adopted the lean approach. Furthermore, it is necessary for the top management to provide a clear policies as well as plan and direction. If lean implementation is to be successful, the communication and human resource department are also the main keys.

Shah and Ward (2003) studied from 1,757 executive and managers in manufacturing companies in America and indicated that lean production consisted of 4 dimensions including just in time (JIT), total preventive maintenance (TPM), total quality management (TQM), and human resource management (HRM). The results further reported that all 4 dimensions related to operational performance results in unit costs reduction, defect/rework improvement, manufacturing costs reduction, cycle time reduction, first pass yield improvement, delivery time reduction, and increase of

productivity. In addition, Fullerton and Wempe (2009) conducted research from 121 executives in manufacturing companies in America and revealed that lean manufacturing led to the setting up of time reduction, improving quality, reducing inventory, reducing cycle time, improving on time delivery, reducing defect rate, increasing productivity, and increasing supplier efficiency. Moreover, Rahman, Laosirihongthong and Sohal (2010) studied from 187 senior executives working for Thai manufacturing firms and indicated that 3 dimensions of lean system, i.e. just in time, defect reduction, and flow management, related with operational efficiency, which was measured from delivery faster than rivals, costs lower than rivals, overall efficiency greater than rivals, and customer satisfaction higher than rivals.

Hallgren and Olhanger (2009) investigated from 211 organizations in 7 countries and reveled that lean manufacturing system influenced on all operational performances at 0.001 significant level. In addition, Alsmadi, Almani and Jerisat (2012) studied from 278 companies, both manufacturing and service industry, and the results reported that six dimensions of lean system, i.e. customer involvement, just in time from supplier, pull system, continuous flow, statistical process control, and employee involvement, associated with operational performance. Moreover, Arawati and Mohd (2012) conducted research from 200 managers related with lean application in Malaysian manufacturers; the results found that lean production increases firm performance, improves product quality, reduces set up time, and reduces delivery lead time.

Hallgren and Olhager (2009) conducted research from 211 companies which applied lean system and found that lean production system enhanced operational performance, reduced cost, improved productivity, increased flexibility, and led to quick

and accuracy response. In addition, Wee and Wu (2009) conducted a case study by applying lean manufacturing in Ford Motor Company in Taiwan. The results showed that lean manufacturing practices correlated with higher operational efficiency, lower cost, better product quality, low set up and cycle time as well as on time delivery and increase of customer satisfaction.

Moori, Pescarmona and Kimura (2013) conducted research from 68 executives in Brazil and indicated that there is a positive correlation between lean manufacturing and financial effectiveness, resulting in return on asset, return on investment, profit before tax and interest, profit from operation, and incremental sale volume. This corresponds to Agus and Iteng (2013), who studied 205 executives from Malaysia and revealed that there is a positive correlation between lean manufacturing and financial effectiveness result in return on sale, and return on investment.

Although, some studies found that some dimensions of lean manufacturing related to firm performance. However, other studies found that there is no relationship between lean manufacturing and performance (Kaplan & Norton; 1992; Hibadullah et al., 2013). Jayaram et al. (2008) studied in the automotive supplier industry in North America and reported that there is no relationship between lean manufacturing practice and overall firm performance. Meanwhile, Oslen (2004) studied the relationship between lean manufacturing, operational performance, and financial performance from 48 companies which operated in computer, electronics and electronic parts, measurement equipment, and medical equipment industry. The results found that the operational performance did not differ significantly when comparing the companies that use and do not use lean system. However, the companies that apply lean system have higher performance in return on equity than the companies that do not apply lean

system. In addition, Fullerton and Wempe (2009) reported that there is a relationship between operational performance and financial performance. The results further revealed that there is no relationship between lean manufacturing and financial performance. Researchers further concluded that there is a connection between lean manufacturing and financial effectiveness through operational performance. Regarding the above concept, this study intend to confirmed the relationship by empirical study; so the below hypotheses were thus conducted.

H5: There is a positive relationship between lean manufacturing and sustainability performance.

Moving on to the relationship between transformational leadership and sustainability performance through lean manufacturing, Cheerawit et al. (2014) conducted research from 540 managers in Thailand's automotive part industry. The results found that there is a relationship between leadership and firm performance through lean manufacturing practices. This is corresponding to Masood (2015), who conducted survey from five different manufacturing organizations and revealed that for successful implementation of lean concept and to enjoy the benefits of lean system, deployment of transformational leaders can play a key role for achieving lean status. The author further concluded that transformational leaders employed lean manufacturing at the shop floor were facing little or no hurdle in implementing lean concept and their productivity and profitability was better than where non transformational leaders were employed.

Nordin et al. (2012) stated that lean manufacturing is a proven approach for success in manufacturing industry. However, several organizations failed in their attempt to implement lean manufacturing system. The transition to lean manufacturing

requires radical change which involves a total reshaping of purpose, system and culture of the organization. The results reported that leadership and direction, and change agent system found to be the most critical factors in managing change to lean manufacturing. Furthermore, the smooth transition also requires effective communication, workers' empowerment and lean review system. Failure in recognizing the required organizational change factors to be adapted in lean transition may hinder the long-term benefits of the company.

Achanga et al. (2006) conducted a study on the critical success factors for lean implementation within SMEs and found that strong leadership behaviors are vital to successfully application the principle of lean practices within the small and medium enterprises (SMEs). The three other important factors include the finance capabilities, skills and expertise and the organizational culture. Solid leadership behaviors would facilitate the integration of all infrastructures within the organization and instill the vision and strategy of the organization.

Bäckström and Ingelsson (2015) conducted a survey at a Swedish municipality from 841 co-workers who answered the questionnaire which had been designed and pre-tested to measure the presence of a number of lean values and lean leadership as well as self-reported perceived health. The results show a moderately positive relationship between lean values, lean leadership and co-workers' perceptions of their health. Customer focus presents the highest mean value, the lowest standard deviation and the highest correlation with co-worker health, which is interesting as the investigated organization is a municipality.

Pradabwong et al. (2012) conducted interview with 10 industrial companies practicing lean manufacturing. There are three different types of performance

measurement that apply for this 10 companies which are cost per unit, total sale, and part per million (PPM). The companies participated in this study confirmed that they were satisfied with the result of lean manufacturing though some companies have not completely adopted the lean approach. Furthermore, it is necessary for the top management to provide a clear policies as well as plan and direction. If lean implementation is to be successful, the communication and human resource department are also the main keys. Since the mediate effect of lean manufacturing practices on the relationship between transformational leadership and sustainability performance is a new paradigm, this paper intends to investigate to increase knowledge in academic area.

Regarding the above notion, the below hypothesis was thus examined.

H6: There is a relationship between transformational leadership and sustainability performance through lean manufacturing.

Considering the recent study, there are some studies interested in the relationship between sustainable leadership and sustainability performance; however, only few papers investigate in term of empirical study. Although there are many papers paying attention to leadership and lean practices, there is ambiguity on what is the suitable leadership style on lean manufacturing successful as a result of the lack of empirical study on the relationship between sustainable leadership and sustainability through lean manufacturing practices. According to my knowledge, it is the first time that the effect of lean manufacturing on the relationship between sustainable leadership and sustainability performance was explained. This is the incremental contribution to academic research; so the below hypothesis was thus investigated.

H7: There is a relationship between sustainable leadership and sustainability performance through lean manufacturing.

Shah and Ward (2003) examined the influenced of type of industry on the results of lean practices and found that the result from continuous process is different from the job shop or intermediate process. Thus, the authors further suggested that lean manufacturing can apply in any industry. Companies operated in continuous process tend to apply three dimensions including just in time (JIT), total quality management (TQM), and human resource management (HRM). On the other hand, companies operated in job shop or intermediate process tend to apply in total preventive/productive maintenance (TPM), total quality management (TQM), and human resource management (HRM).

Rahman et al. (2010) examined the influenced of Thai companies, multinational companies, and join venture companies on the lean manufacturing results. Thai companies tend to apply just in time and continuous flow management dimension. Multinational companies tend to apply just in time and waste elimination dimension. Venture companies tend to apply just in time dimension. The authors concluded that all companies tend to apply just in time dimension, and further proposed that lean manufacturing related to operational performance.

Womack et al. (1990) proposed that lean manufacturing was started in Toyota Motor Company in Japan. Ford manufacturing system focuses on mass production and high level of inventory whereas lean manufacturing system focuses on small quantities production, just in time, and zero level of inventory. Lean manufacturing get better results both financial and operational performance than Ford manufacturing system. Thus, most automotive and auto part companies interested in and changed from Ford system to lean practices. Present, lean manufacturing was applied in several industries (Womack et al., 1990).

Based on above concept, almost researches studied in one industry whereas few researches studied on effect of industry type on lean manufacturing as well outcomes of lean practices such as financial and operational performance. Thus, this paper intends to investigate to increase knowledge in academic area.

H8: There is a moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance.

H9: There is a moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance.

Agus and Iteng (2013), who studied 205 executives from Malaysia and revealed that there is a positive correlation between lean manufacturing and financial effectiveness result in return on sale, and return on investment. The authors further reported that there is correlation between length of lean implementation and organizational performance. In addition, the authors revealed that the relationship between technology and organizational performance, and the relationship between innovation and organizational performance are stronger for longer time in lean implementation. On the other hand, there is not different relationship between just in time and organizational performance across length of lean adoption. Based on literature review, almost studies focused on the relationship between lean practices and financial and operational performance whereas neglected on the influenced of lean implementation on lean outcomes. Thus, this paper intends to investigate to increase knowledge in academic area.

H10: There is a moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

H11: There is a moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

3.3 Instrument

The design of this study was a mixed methodology. The quantitative approach was done by using questionnaires consisting of five sections. The first section consists of demographic information of the companies such as type of industry, age of company, size of plant, union representation, and duration of lean production application, combination with the information of the respondents such as working position, experience, and educational level.

Muenjohn and Armstrong (2008) assessed the MLQ validity conducted from 138 respondents and summarized that the MLQ Form 5X model was an appropriate questionnaire to evaluate transformational leadership. Thus in the second part, transformational leadership styles were evaluated applying the MLQ Form 5X (Bass & Avolio, 1997) self-rater version survey. The questionnaire was purchased from Mind Garden, Inc. The MLQ Form 5X is designed to measure leadership with 45 items within nine leadership aspects. There are five aspects are indicated with transformational leadership (idealized influence, attributed and behavior, inspirational motivation, individual consideration, and intellectual stimulation). The remained four aspects indicated by transactional leadership (contingent reward, management-by-exception (active), management-by-exception (passive), and non-leadership (Laissez-faire)). Reliabilities for the total items and for each leadership factor scale ranged from 0.74 to 0.94. All of the scales' reliabilities were generally high, exceeding standard cut-offs for internal consistency recommended in the literature. This study uses 20 items from

transformational aspect. A Likert scale is applied to measure each aspect to measure the leadership styles and discover the relationships, ranging from 0 = not at all to 4 = frequently, if not always.

In the third part, sustainable leadership is taken from 23 items of Avery and Bergsteiner's (2011) sustainable leadership questionnaire (SLQ) with 5-point Likert scale, whereby 1 is no extent and 5 is great extent. The instrument was grounded on established scales and tested to endorse robustness applying Cronbach's alphas. The reliability tested showed that most questions in the SLQ survey higher than the minimum cut-offs of 0.70 level of reliability, as suggested by Nunnally and Bernstein (1994).

In the fourth part, lean manufacturing system is taken from 48 items of Shah and Ward (2007) with a 5-point Likert scale whereby 1 is no implementation and 5 is complete implementation. There are ten dimensions consisting of supplier feedback, just in time delivery by suppliers, supplier development, customer involvement, pull system, continuous flow, set up time reduction, total productive/preventive maintenance, statistical process control, and employee involvement. Cronbach's alpha for each of the factors ranged between 0.730 and 0.860, indicating internal consistency.

For the final part, sustainability performance separated to three main categories including economic and financial, operational, and environmental and social performance. The first aspect was economic and financial performance taken from 4 items which developed from Griffith and McDaniel (2006), Wiklund and Shepherd (2005), and Hung, Lien, Fang and McLean (2010). The questionnaires assessed the Economic and financial performance has changed in the past 3 years with 5 point Likert scale whereby, 1 is less than 0%, 2 is equal 0%, 3 is increased 1-10%, 4 is increased 11-

20%, and 5 is increased higher than 21%. The second aspect was operational performance taken from 5 items developed from the Global Reporting Initiative (GRI) (2014) index. The instrument assessed the level of the company's operational performance compare to the competitors in 5 point Likert scale whereby, (1) is the worst in industry and (5) is the best in the industry. The third aspect was environmental and social performance taken from 8 items developed from the Global Reporting Initiative (GRI) (2014) index with 5 point Likert scale which 1 is no extent, 2 is little extent, 3 is some extent, 4 is extensive extent, and 5 is great extent.

The qualitative data were collect by three methods from 40 participants. First, the data were collected by participant observation, whereby the researcher joined and worked as employees at company A and company B for 15 days from September to October 2016 which supported program that cooperation between faculty and private company. Second, the data were collected by non-participant observation in which the researcher walked, asked employees, and toured around the production line from 8 companies. Third, the data were collected from 30 participants by in-depth interviewed using semi-structure questions composed of four parts. First, demographic information of the companies such as type of industry, age of company, size of plant, number of employees, and union representation. In addition, this part includes the location, date, and time of the interview. The second part is the current situation of lean implementation. The third part is the current situation of leadership, relationship among leader and all company's members, solving problem, team, culture, and innovation. The last part is the organizational success due to apply lean practice and the overview and recommendations for manufacturing industry in Thailand.

3.4 Population and Sample

The GDP structure of the country in 2015 as categorized by major economic activity shows that the service sector made the most significant contribution to the economic system at 40.0% of the total GDP. As concerns the GDP structure of SMEs in 2015, the service sector was still the most important economic activity, followed by trade and maintenance, and the manufacturing sector, accounting for 41.4%, 29.4% and 22.1% respectively. GDP of manufacturing sector for 2015 categorized by size of enterprise this number, the GDP value of SMEs accounted for 1,225,919 million baht or 33.7% (Office of SMEs Promotion, 2016).

The manufacturing industry is essential to Thailand's economic. The main part of manufacturing industry consisted of automotive and automotive part, electric and electronics, chemical, petroleum and petrochemical, iron, plastic, textile and garment shoes and leather, tire and rubber, food and beverage, paper and publication, wood and furniture, and cement industry (Office of the national economic and social development board, 2015).

Considering the above notion, therefore, the population consisted of managers and executives of small and medium enterprises operating in Thai manufacturing industry, which have been involved in lean initiatives. Bentler and Chou (1987) recommended that under theory of normal distribution, the proportion of sample size to amount of free parameters should be at least 5:1 to achieve trust worthy parameter estimates and in order to obtain reasonable significances tests although a proportion of 10:1 would be preferred (Bentler & Chou, 1987; Salkind, 2010; Kline, 2015). Meanwhile, correspond with Hoelter's (1983) criterion, Byrne (2001) summarized that

the critical number should be greater than 200 (Garver & Mentzer, 1999; Hoelter, 1983).

The amount of free parameters (unlabeled) equals a sum of number of regression weights, covariances, variances, means, and intercepts, which are estimated from the data. Thus, the amount of free parameters for this study equals 52. Accordingly, the proportion of sample size to amount of free parameters preferred at 10:1; and the lowest sample size for this study is 520. This study respected both quantity of respondents, more than 520, and Hoelter's critical number, exceeding 200.

Table 3.1 Parameter summary

	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	31	0	0	0	0	31
Labeled	0	0	0	0	0	0
Unlabeled	25	0	27	0	0	52
Total	56	0	27	0	0	83

3.5 Reliability Analysis

All of questionnaires applied in the study contain 5-point Likert scales. The reliability is measured by the coefficient alpha (Cronbach, 1951). The Cronbach's alpha mentions to the confines to which the questions in a survey assess the homogeneous construct (Ho, 2006). The Cronbach's alpha greater than 0.70 is widely conceded (Carman, 1990; Nunnally& Bernstein, 1994). So, the value that is greater than 0.70 is conceded for this study. The Cronbach's alpha values of coefficients of the questionnaire are shown in the next chapter.

Table 3.2 The minimum criterion of reliability and validity analysis

Analysis detail	Threshold/Minimum criterion
Reliability Analysis	
- Cronbach's alpha	- is above 0.70 (Nunnally & Bernstein, 1994; Kline, 2000; George & Mallery, 2003; DeVellis, 2012)
- Composite reliability	- is above 0.70 (Nunnally & Bernstein, 1994; Kifle, Mbarika, & Tan, 2007; Rodriguez, Perez, & Gutierrez, 2007; Kim & Malhotra, 2005)
Validity Analysis	
- IOC	- was tested by minimum three raters, all items of questionnaire that the IOC score was less than 0.5 were eliminated (Rovinelli & Hambleton, 1977; Hambleton, 1980; Thaveerat, 1997)
- *p*-value	- *p*-value associated with each loading should be significant (Nunnally & Bernstein, 1994; Awang, 2012)
- Factor loading	- is above 0.6 (Nunnally & Bernstein, 1994) - is above 0.5 for a newly developed items and is above 0.6 for an established items (Awang, 2012)
- Average variance extracted (AVE)	- is above 0.5 (Pavlou & Gefen, 2004; Rodriguez et al., 2007; Wang & Wang, 2012) - is above 0.4 is acceptable (Diamantopoulos & Siguaw, 2000)
- Discriminant validity (DV)	- AVE for each construct is greater than its shared variance with any other construct (Kim & Malhotra, 2005; Bhattacherjee & Sanford, 2006) or - factor loadings of each item must be greater than the cross loadings of items of other constructs (Pavlou & Gefen 2004; Bhattacherjee & Sanford, 2006)

3.6 Validity Analysis

Validity mentions to the confines to which the survey precisely evaluates or measures the particular notion that the researcher is determined to assess (Cooper & Schindler, 2003). There are several diverse sorts of validity; yet, this study measures only two sorts of validity, i.e. content validity and constructs validity.

3.6.1 Content validity

Content validity refers to the level to the survey that completely measures or assesses the construct of interest (Cooper & Schindler, 2003). The content validity in this study was measured by applying the index of item-objective congruence

(IOC) (Rovinelli&Hambleton, 1977). The IOC was measured by four expert assessors in human resource field. The assessors would review all of the questions to explain and understand and after that demonstrate recommendations for each question by providing the question a rating of 1 (for obviously assessing), -1 (for obviously not assessing), or 0 (for level to which its assessment of the content area is ambiguous). The score of the index of item-objective congruence (IOC) for each question was computed by total rating score divided by total number of assessors. All the questions with IOC score lower than 0.5 were removed from the final questionnaire. The content validity value is shown in the next chapter.

3.6.2 Construct validity

Construct validity refers to the level to which a survey assesses the aspect or theoretical construct that is endeavored to assess (Cooper & Schindler, 2003). The construct validity for this study was measured by applying confirm factor analysis (CFA) consisting of *p*-value, factor loading, and average variance extracted (AVE), and discriminant validity. First, Nunnally and Bernstein (1994) suggested that *p*-value related to each loading should be significant. Second, Nunnally and Bernstein, (1994) proposed that factor loading should be greater than 0.6. Third, Fornell and Larcker (1981) suggested that AVE should be greater than 0.5. Lastly, Fornell and Larcker (1981) proposed that if the AVE for each construct is greater than its shared variance (squared correlation) with any other construct, discriminant validity is supported. The value of construct validity is shown in the next chapter.

CR = composite reliability
= $(\Sigma$ of standardized loading$)^2/[(\Sigma$ of standardized loading$)2 + \Sigma$ of $\varepsilon j]$

AVE = Σ of $(\text{standardized loading})^2/[(\Sigma$ of (standardized loading)2$) + \Sigma$ of $\varepsilon j]$

DV = discriminant validity = $\text{AVE}/(\text{corr.})^2 > 1$;
$(\text{corr.})^2$ = highest (correlation)2 between factors of interest and remaining factors.

Source: Berthon, Ewing & Hah (2005, p. 164).

3.7 Data Collection

3.7.1 Questionnaire translation

The questionnaire of the study was expanded from the existing investigations and previous questionnaires with high values of both validity and reliability. Nevertheless, the mother language and official language of Thailand is Thai, which is dissimilar from the primitive questionnaire; so the questionnaire needed to be interpreted into Thai language. To keep away from the difference of ethnic result and assure that interpreted edition still keeps the reliabilities and validities of the primitive questionnaires, the study employed the Brislin's (1970) interpretation model which is composed of the three processes.

The first process is a forward interpretation in which the primitive edition in English language was interpreted into Thai edition. Next, the Thai edition was commented by a monolingual commentator who could speak only Thai language to modify elusive or vague phraseologies. The questionnaire was commented again by two officers who were slightly liaised in English. The final process was a backward interpretation in which the Thai edition was interpreted into English edition by somebody who could liaise with both English and Thai languages and comprehended the questionnaire enough. The questionnaire was backward interpreted by three professional who worked for supply chain management, logistics, and industrial management area. After an interpretation process, the interpreted edition was commented and measured for the content validity by three professional who worked for supply chain management, logistics, and industrial management area. Lastly, the complete interpreted questionnaire was measured in the pilot study.

3.7.2 Pilot study

A pilot study refers to a pre-study that is a minor testing developed to measure and to collect data earlier to a main study in order to make better quality and efficiency of the latter study. The pilot study could disclose imperfections of an intended testing design or experiment design, and these could be discussed before time while questionnaires are spent on main scale studies. The objectives of the pilot test for this study are to create and measure sufficiency of research questionnaires, to evaluate the possibility of a study or a survey, to predict variability in results to assist assigning sample size, and to measure whether the research proposed theoretical model is possible and achievable. The pilot study was conducted by using the paper-questionnaires which were sent to 40 respondents out of the total sample size.

3.7.3 Main study for quantitative approach

The large scale study was performed by three techniques. The first technique is formal, in which the president, managing director, general manager, and factory manager of the firms were communicated accompanied with the letters authorized by the Rajamangala University of Technology Thanyaburi (RMUTT) to explain the objective, the significance, and the advantages of the study. Authorizations to distribute the paper or online questionnaire to their employees who worked for managers and above were certainly asked. The second technique is formal, in which the operators who manage the seminar topic concerning manufacturing industry were communicated accompanied with the letters authorized by the Rajamangala University of Technology Thanyaburi (RMUTT) to explain the objective, the significance, and the advantages of the study. Authorizations to distribute the paper questionnaire to their participants in this seminar who worked for manager position and above were certainly

asked. The last technique is formal, in which the dean of business administration faculty and engineering faculty of both government and private university were communicated accompanied with the letters authorized by the Rajamangala University of Technology Thanyaburi (RMUTT) to explain the objective, the significance, and the advantages of the study. Authorizations to distribute the paper questionnaire to their graduate student studying in business administration major and engineering major while working for manager position and above were certainly asked. After the respondents gave back the questionnaires, the outcomes were analyzed by using confirm factor analysis (CFA) and structure equation model (SEM).

3.7.4 Main study for qualitative approach

The qualitative data were collect by three methods from 40 participants. First, the data were collected by participant observation, whereby the researcher joined and worked as employees at company A and company B for 15 days from September to October 2016 which supported program that cooperation between faculty and private company. Second, the data were collected by non-participant observation in which the researcher walked, asked employees, and toured around the production line from 8 companies. Third, the data were collected from 30 participants by in-depth interviewed using semi-structure questions. The study used a snowball sampling method to collect more participants. After observing and interviewing the initial participants, the researcher requested for assistance from the initial participants to assist explore participant with an identical attribute of attentiveness.

3.8 Data Analysis

The outcomes from a sampling group were then diagnosed for the descriptive statistics, the factor analysis, and the structural equation model by using statistical software programs. On the other hand, content analysis was analyzed in terms of qualitative information.

3.8.1 Descriptive statistics

Descriptive statistics associates with the principles of quantitatively explaining the major characteristics of data collection aiming to conclude a data set of population; for instance, mean, mode, median, variance, and standard deviation. Considering employee level, these data include the working position, the ratio of each sex, age, education, and working position. Regarding the organizational level, the descriptive information comprises of type of industry, age of company, size of company, and length of lean implementation.

3.8.2 Factor analysis

Spicer (2005, p.181) proposed that the purpose of factor analysis was to discover whether it is feasible to remove the set of assessed variables to a minor set of underlying factors. In short, the factor analysis is the investigation of interrelationships among the variables in an attempt to discover a novel of variable sets. There are two categories of factor analysis, i.e. exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Exploratory factor analysis is employed when the amount of factors, suitable to clarify the interrelationships among a set of questions, is unpredictable whereas confirmatory factor analysis is applied when the investigators have some understanding about the quantity of factors suitable to clarify the interrelationships among a set of questions.

As to the review of the literatures, the researcher has some comprehension about the amount of factors which are suitable to clarify the interrelationships among a set of questions. Therefore, in this study, confirmatory factor analysis (CFA) was applied to assert the structure of factors by both validity and reliability analysis. This study is proposed to explain overall information, and the first order factor analysis was applied to examine the structure of factors of transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance.

3.8.3 Structure equation model (SEM)

Structure equation model (SEM) was defined by Wright in 1921 as a statistical technique for examining and anticipating causal relations applying an amalgamation of statistical data and qualitative causal suppositions (Wright, 1921). Moreover, Byrne (2010) explained that structure equation model (SEM) is a statistical methodology that takes a confirmatory approach, for example, hypothesis investigating to the diagnosis of a structural theory underpinning on some phenomena. This study is aimed to find out the suitable research or theoretical framework associated with seven indices presented in table 3.3.

3.8.4 Content analysis

Content analysis was done by means of content analysis by 3 professionals working for industrial management and industrial engineer in order to analyze the current situation, the problems, and to suggest solutions and guidance for organizational success related to lean implementation.

Table 3.3 The minimum criterion of model fit indices

Model fit index	Acceptable threshold levels	Comments
$\chi 2$ or CMIN	- should not be significant at a 0.05 threshold (p>0.05) (Awang, 2012) - should not be significant above 0.05 and 1.00 threshold to judge good fit (0.05<p≤1.00) and between 0.01 and 0.05 threshold to judge acceptable fit (0.01≤p≤0.05) (Schermelleh-Engel & Moosbrugger, 2003)	- adjusts for sample size (Hair, Anderson, Tatham & Black 2010; Hooper, Coughlan & Mullen, 2008) - sensitive to sample size (Byrne, 2001; Schermelleh-Engel & Moosbrugger, 2003) - sensitive to sample size > 200 (Wheaton, Muthen, Alwin & Summers, 1997)
$\chi 2$/df or CMIN/df	- should be between 2 and 3 to judge acceptable fit and between 0 and 2 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be less than 5.0 to judge the reasonable fit (Marsh & Hocevar, 1985; Bentler, 1989; Awang, 2012)	- the $\chi 2$ value will be greater when the number observed variables increases (Hair et al., 2010) thus has recommended using ratio high as 5 indicate a reasonable fit (Marsh & Hocevar, 1985; Awang, 2012)
NFI	- should be greater than 0.95 to judge the good fit (Schermelleh-Engel & Moosbrugger, 2003; Hooper et al., 2008) and between 0.90 and 0.95 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be greater than 0.90 to judge satisfactory fit (Awang, 2012) - should be between 0.80 and 0.90 to judge acceptable fit (Forza & Filippini,1998)	
CFI	- should be greater than 0.97 to judge the good fit and between 0.95 and 0.97 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be greater than 0.95 to judge good fit (Hooper et al., 2008) - should be greater than 0.90 to judge satisfactory fit (Awang, 2012) - should be between 0.80 and 0.90 to judge acceptable fit (Forza & Filippini,1998)	
TLI	- Should be greater than 0.95 to judge good fit (Hooper et al., 2008) - Should be greater than 0.90 to judge satisfactory fit (Awang, 2012)	
AGFI	- should be greater than 0.90 to judge the good fit and between 0.85 and 0.90 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be greater than 0.95 to judge good fit (Hooper et al., 2008) - should be greater than 0.90 to judge satisfactory fit (Hair et al., 2010; Awang, 2012) - should be between 0.80 and 0.90 to judge acceptable fit (Forza & Filippini,1998)	
PGFI	- Should be greater than 0.5 to judge acceptable fit (Hair et al., 2010)	
RMSEA	- should be less than 0.05 to judge good fit and between 0.05 and 0.08 to judge reasonable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be less than 0.07 to judge acceptable fit (Steiger, 2007) - should be less than 0.08 to judge acceptable fit (Awang, 2012)	
AIC	- smaller than AIC for comparison model (Schermelleh-Engel & Moosbrugger, 2003)	
CAIC	- smaller than CAIC for comparison model (Schermelleh-Engel & Moosbrugger, 2003)	
ECVI	- smaller than ECVI for comparison model (Schermelleh-Engel & Moosbrugger, 2003)	

In the present study, the associations among variables were measured by *t*-test associated with critical ratios (C.R.) and *p*-value. As to Garson (2005), random

sample variables with standard normal distributions, estimates with critical ratios (C.R.) greater than 1.96 are significant at the 0.05 level. So, each endogenous variable's CR value evaluated with those more than 1.96 is supported with statistical significance. Meanwhile, *p*-value lower than 0.05 was significant at 0.05 level (**p*-value < 0.05), *p*-value lower than 0.01 was significant at 0.01 level (***p*-value< 0.01), and *p*-value lower than 0.001 was significant at 0.001 level (****p*-value< 0.001) (Arbuckle, 2011).

3.9 Timetable

This study was expected to take eighteen months, from May 2016 to October 2017. The first procedure is to clarify research question and review literature, from May 2016 to June 2016. The second procedure is to gather and analyze data, from July 2016 to March 2017. The next procedure is to analyze the data, from April 2017 to June 2017. The latter procedure is to elucidate and provide conclusion, from July 2017 to August 2017. The last procedure is to complete the report, from September 2017 to October 2017.

3.10 Chapter Summary

Chapter three describes the design of research methodology consisting of the theoretical model/framework, research hypotheses, the instrument, population and sample, pilot study, reliability analysis, validity analysis, data collection, data analysis, and timetable. Next, chapter four will illustrate the findings of this study.

CHAPTER 4

RESEARCH RESULTS

Chapter four starts with data arrangement, followed by pilot test, purification and reliability analysis, construct evaluation and validity analysis, structure equation model of proposed theoretical model, hypotheses examining and findings, and qualitative results. The chapter summarizes the interrelated areas together with an overview of the later chapter.

4.1 Data Arrangement

4.1.1 Normal distribution of sample

Before proceeding with any statistical analysis, the normal distribution principle of gathered responses should be examined. Normal distribution was measured by two indices, i.e., value of skewness and kurtosis. In order to adjudicate the normal distribution, Stuart and Ord (1994) suggested that the skewness scales should be ranging from -3 to +3. Likewise, Decarlo (1997) suggested that the kurtosis scales should be ranging from -3 to +3 to adjudicate the normal distribution. In the meantime, data were gathered from 598 respondents, a large sample to suppose that they under the normal distribution principle. The findings presented that the skewness scales were between -0.902 and 0.2.554 while the kurtosis scales were between -1.210 and 0.075 (shown in appendix C.1). Therefore, it could be summarized that the normal distribution principle of sample group in this study was accepted.

4.1.2 The rate of response

The sample group for the study was derived from existing workers who worked for top executives and middle management managers of small and medium companies operating in Thai manufacturing industry, which was designed to be at the lowest level of 520 respondents. The sample size of 40 was designed for the pilot test. Veritable sample size was a total of 598 respondents; there were 40 pilot test respondents and 598 respondents in the main study.

From the total 1740 questionnaires, there were 598 questionnaires coming back to the researcher; so the response ratio was 34.4 percent. The respondents were from manufacturing companies.

4.1.3 Respondents' profile

In order to gather demographic information, the questionnaires were dispensed to the targeted respondents. The details of the acquired information are presented in table 4.1.

Table 4.1 Demographic of respondents

Characteristics	Frequency	Percent
Response rate	598	34.4
Gender		
Male	336	56.2%
Female	262	43.8%
Age		
Below 30	165	27.6
30-35	129	21.6
36-40	116	19.4
Above 40	188	31.4

Table 4.1 Demographic of respondents (Cont.)

Characteristics	Frequency	Percent
Working position		
Managing director	71	11.9
General/Factory/Production manager	232	38.8
Financial/Quality control manager	105	17.5
Senior engineer/Senior supervisor	190	31.8
Education level		
Below bachelor	68	11.4
Bachelor's degree	452	75.6
Master's degree and above	78	13.0
Industry		
Chemical	21	3.5
Petroleum	13	2.2
Electronics/Electrics	62	10.4
Steel and metal	43	7.2
Automotive/Part	216	36.1
Plastic	57	9.5
Shoes/Leather	4	0.7
Food/Beverage	73	12.2
Garments/Textile	22	3.7
Wood/Home Furniture/Office Furniture	1	0.2
Rubber/Tire	7	1.2
Paper/Publishing/Stationery	13	2.2
Pharmaceutical/Medical product	11	1.8
Cement and construction	23	3.8
Other	32	5.4
Type of Industry		
Automotive industry	216	36.1
Non-automotive industry	382	63.9

Table 4.1 Demographic of respondents (Cont.)

Characteristics	Frequency	Percent
Age of Company		
Less than 5 years (Late entrance)	144	24.0
6-15 years (Medium entrance)	178	29.8
Above 15 years (Early entrance)	276	46.2
Type of Process		
Job shop/Intermitted process	216	36.1
Mass/Continuous process	382	63.9
Union		
Yes	155	25.9
No	443	74.1
Length of Lean Implementation		
Less than 5 years	535	89.5
Above 5 years	63	10.5

Table 4.2 Characteristics of the majority of respondents

Characteristics	Percent
Response rate	34.4%
Male	56.2%
Above 40 years old	31.4%
General/Factory/Production manager	38.8%
Bachelor's degree	75.6%
Non-automotive industry	63.9%
Company age above 15 years	46.2%
Company work without union	74.1%
Length of lean implementation less than 5 years	89.5%

Data were collected from current top executives and middle management managers of small and medium companies operating in Thai manufacturing industry both automotive and non-automotive industry using simple random sampling and

snowball sampling. The data gathering was conducted from July 2016 to March 2017, and the attributes of the larger number of respondents were concluded as follows. The larger part of the respondents were male, accounting for 56.2 percent, with the age above 40 years old accounting for 31.4 percent, and working for general/factory/production manager accounting for 38.8 percent. The educational level was mostly Bachelor's degree which accounted for 75.6 percent. In addition, the respondents working in non-automotive industry accounted for 63.9 percent, age of company above 15 years for 46.2 percent, and working in company without union for 74.1 percent. In addition, the length of lean implementation less than 5 years accounted for 89.5 percent.

Regarding the qualitative perspective, information was carried out by in-depth interview with 40 top executives and middle management managers (20 participants from automotive/part industry and 20 participants from non-automotive industry).

4.2 Pilot Study

After the pilot study was examined, some questions were a little modified to make clear comprehension. The Cronbach's alpha scale for all factors including transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance is above than 0.7; thus, it was confirmed that the instruments were reliable to test the relationship. In addition, the pilot study was applied to evaluate the possibility of a study. The findings reported that all values of factor loading are greater than 0.6, which signifies that construct validity of all instruments is confirmed. Furthermore, all *p*-values related to each loading are significant. Therefore, it could be summarized that the study is of possibility.

4.3 Main Study

The findings from the pilot study show that all instruments have both validity and reliability, and the main study of the proposed theoretical model is achievable and practicable. Therefore, the main study was operated.

4.4 Purification and Reliability Analysis

Based on research methodology, the Cronbach's alpha which is greater than 0.70 is admitted for the study. The findings of each scale reliability analysis are illustrated as follows.

4.4.1 Transformational leadership scale

The last survey comprises 20 questions, of which the scale of the Cronbach's alpha is 0.927. Therefore, it could be summarized that the MLQ Form 5X survey is reliable for the assessment of transformational leadership.

4.4.2 Sustainable leadership scale

The final survey comprises 23 questions, of which the scale of the Cronbach's alpha is 0.962. Therefore, it could be summarized that the sustainable leadership survey of the study is reliable for the assessment of sustainable leadership.

4.4.3 Lean manufacturing scale

The final survey comprises 48 questions, of which the scale of the Cronbach's alpha is 0.960. Therefore, it could be summarized that the lean manufacturing survey of the study is reliable for the assessment of lean manufacturing.

4.4.4 Sustainability performance scale

The final survey comprises seventeen questions, of which the scale of the Cronbach's alpha is 0.828. Therefore, it could be summarized that the

sustainability performance survey of the study is reliable for the assessment of sustainability performance.

Table 4.3 Reliability assessment results

Factors	Cronbach's alpha
Transformational leadership	0.927
- Idealized influence (Attributed)	0.619
- Idealized influence (Behavior)	0.746
- Inspiration motivation	0.815
- Intellectual stimulation	0.774
- Individual consideration	0.707
Sustainable leadership	0.962
- Foundation practices	0.942
- Higher-level practices	0.893
- Key performance drivers	0.849
Sustainability performance	0.828
- Economic performance	0.697
- Operational performance	0.851
- Environmental and social performance	0.899
Lean manufacturing	0.960
- Supplier feedback	0.841
- Just in time delivery by suppliers	0.636
- Supplier development	0.824
- Customer involvement	0.864
- Pull system	0.863
- Continuous flow	0.894
- Setup time reduction	0.818
- Statistical process control	0.904
- Total productive/preventive maintenance	0.920
- Employee involvement	0.923

4.5 Construct Evaluation and Validity Analysis

4.5.1 Validity analysis of transformational leadership

4.5.1.1 Content validity

The outcomes show that the score of IOC of all 20 items are more than 0.5. It can thus be summarized that transformational leadership constructs being assessed by each question.

4.5.2.2 Construct validity

First, all *p*-values related to each loading are lower than 0.05. In addition, all values of factor loading are greater than 0.6. Furthermore, all scales of average variance extracted (AVE) of five dimensions are greater than 0.5. Finally, all discriminant validity is above 1.0. As these outcomes are greater than the lowest threshold, it could be supported that the structure of transformational leadership survey of MLQ Form 5x is best described by 20 questions with 5 dimensions.

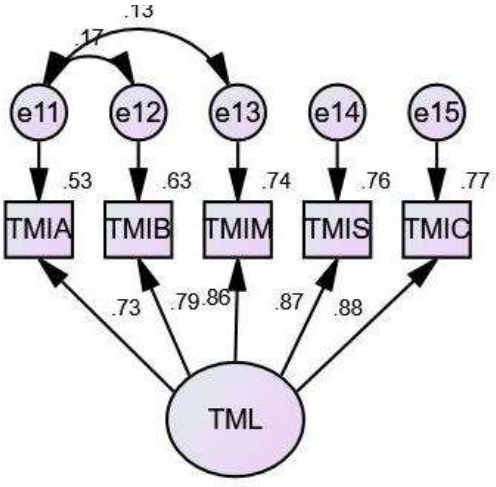

Figure 4.1 Construct validity results of transformational leadership using CFA

4.5.2 Validity analysis of sustainable leadership

4.5.2.1 Content validity

The outcomes show that the scores of IOC of all 23 items are more than 0.5. It can thus be summarized that sustainable leadership constructs being assessed by each question.

4.5.2.2 Construct validity

The first finding shows that all *p*-values related to each loading are lower than 0.05. The second outcome shows that all values of factor loading are greater than 0.6. For the third one, all scales of average variance extracted (AVE) of three aspects are greater than 0.5. Finally, all discriminant validity is above 1.0. Accordingly, all findings are more than the lowest threshold. Therefore, it can be supported that the structure of sustainable leadership survey is best represented by these 23 items with 3 dimensions.

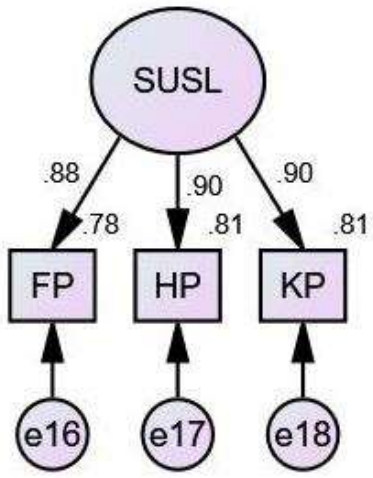

Figure 4.2 Construct validity results of sustainable leadership using CFA

4.5.3 Validity analysis of lean manufacturing

4.5.3.1 Content validity

The findings of score of IOC of all 48 questions are above 0.5. Therefore, it could be summarized that lean manufacturing construct being assessed by each question.

4.5.3.2 Construct validity

The first finding shows that all *p*-values related to each loading are lower than 0.05. The second outcome shows that almost values of factor loading are greater than 0.6. Only setup time reduction dimension equal 0.37. Although, the factor loading of setup time reduction dimension is less than 0.6, the IOC from both 3 experts are higher than 0.5, as well as many studies confirmed that the setup time reduction is benefit of lean practice. Thus, this study will remain this aspect. For the third one, all scales of average variance extracted (AVE) of ten aspects are greater than 0.5. Finally, all discriminant validity is above 1.0. Accordingly, all findings are more than the lowest threshold. Therefore, it can be supported that the structure of lean manufacturing survey is best represented by these 48 items with 10 dimensions.

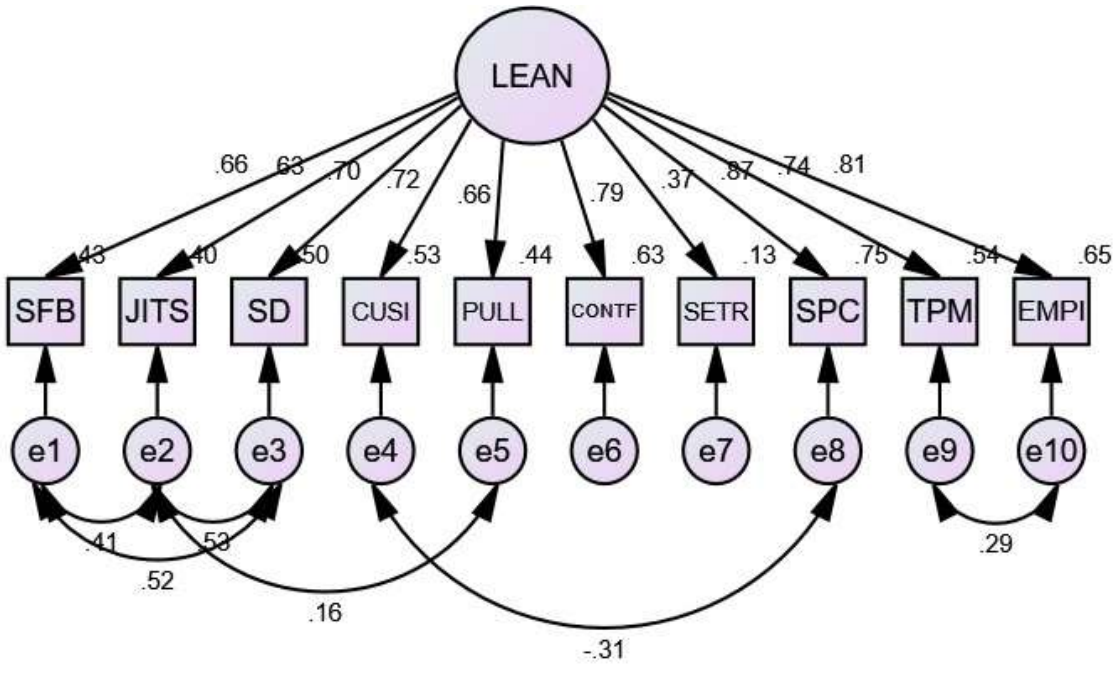

Figure 4.3 Construct validity results of lean manufacturing using CFA

4.5.4 Validity analysis of sustainability performance

4.5.4.1 Content validity

The outcomes show that the score of IOC of all 17 items are more than 0.5. It can thus be summarized that sustainability performance construct is assessed by each question.

4.5.4.2 Construct validity

The first finding shows that all *p*-values related to each loading are lower than 0.05. The second outcome shows that almost values of factor loading are greater than 0.6. Only financial performance dimension equals 0.48. For the third one, scale of average variance extracted (AVE) equals 0.37. Although, the factor loading of setup financial performance dimension is less than 0.6 and scale of average variance extracted (AVE) is less than 0.5, the IOC from both 3 experts are higher than 0.5, all discriminant validity is above 1.0, as well as many studies confirmed that financial performance dimension is the vital factors of performance assessment. Thus, this study will remain this aspect. Therefore, the structure of sustainability performance survey is best represented by these 17 items with 3 dimensions.

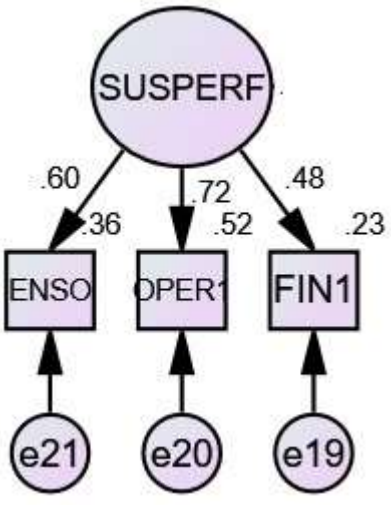

Figure 4.4 Construct validity results of sustainability performance using CFA

Table 4.4 Results of reliability and validity measurement

Factor	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)	Highest Correlation^2	Discriminant Validity (DV)
Transformational leadership	0.927	0.914	0.684	0.552	1.239
Sustainability leadership	0.962	0.922	0.798	0.653	1.222
Lean manufacturing	0.960	0.908	0.505	0.504	1.002
Sustainability performance	0.828	0.631	0.370	0.197	1.878

4.6 Hypothesis Examination

Four surveys were evaluated for validity and reliability while the proposal theoretical model was evaluated for the good-fitness model by applying structure equation model (SEM). The proposed theoretical model includes the relationships among four variables comprising transformational leadership, sustainability leadership, lean manufacturing, and sustainability performance.

This part illustrates the findings of seven essential research questions: (1) Is there a relationship between transformational leadership and lean manufacturing?, (2) Is there a relationship between transformational leadership and sustainability performance?, (3) Is there a relationship between sustainable leadership and lean manufacturing?, (4) Is there a relationship between sustainable leadership and sustainability performance?, (5) Is there a relationship between lean manufacturing and sustainability performance?, (6) Is there a relationship between transformational leadership and sustainability performance through lean manufacturing?, (7) Is there a relationship between sustainable leadership and sustainability performance through lean

manufacturing?, (8) Is there the moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance?, (9) Is there the moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance?, (10) Is there the moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance?, and (11) Is there the moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance?. The findings for each research question are shown in following details.

4.6.1 Initial model 1 (Transformational leadership, lean manufacturing, and sustainability performance)

Initial model 1 intended to test the structural relationships among transformational leadership, lean manufacturing, and sustainability performance.

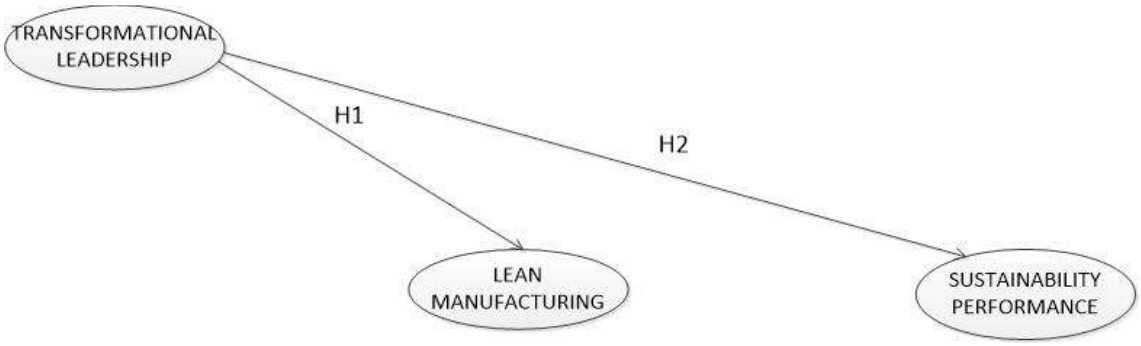

Figure 4.5 The competing theoretical model of the initial model 1

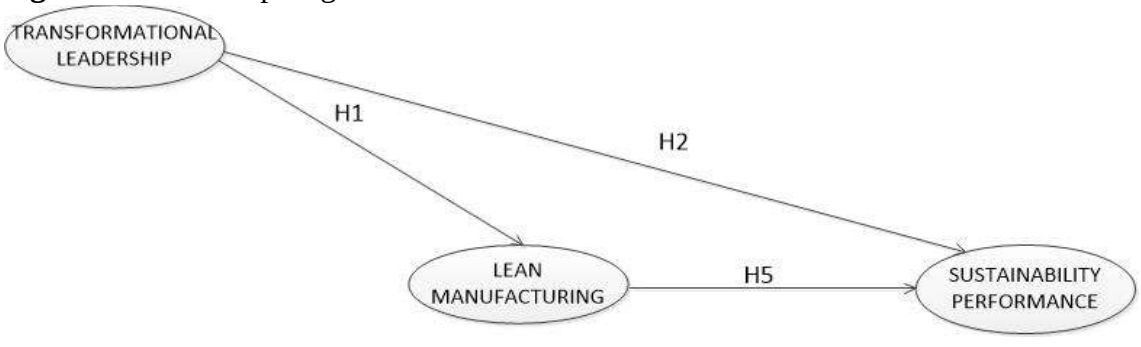

Figure 4.6 The proposed theoretical model of the initial model 1

4.6.1.1 Model fit testing

The competing model was to examine the direct effect of transformational leadership on lean manufacturing, and direct effect of transformational leadership on sustainability performance, which is presented in figure 4.5. The model fit statistics of the competing model is Hoelter's number = 137, CMIN = 674.318 at p = 0.000, df = 127, CMIN/df = 5.310, CFI = 0.918, IFI = 0.918, NFI = 0.901, TLI = 0.901, AGFI = 0.849, PGFI = 0.660, and RMSEA = 0.085. On the other hand, the model fit statistics of the proposed theoretical model is Hoelter's number = 157, CMIN = 583.957 at p = 0.000, df = 126, CMIN/df = 4.635, CFI = 0.931, IFI = 0.931, NFI = 0.914, TLI = 0.916, AGFI = 0.866, PGFI = 0.664, and RMSEA = 0.078.

Table 4.5 Model fit indices of the competing compared to the proposed initial model 1

Initial model 1	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	TLI	RMSEA
Competing model	674.318	0.000	127	5.310	0.918	0.918	0.849	0.901	0.901	0.085
Proposed model	583.957	0.000	126	4.635	0.931	0.931	0.866	0.914	0.916	0.078

Initial model 1	AIC (Default model)	BCC (Default model)	BIC (Default model)	CAIC (Default model)
Competing model	762.318	765.211	955.636	999.636
Proposed model	673.957	676.916	871.669	916.669

The Chi-square is important statistic. However, a statistical significance test is sensitive to sample size, which means that the Chi-square statistic almost always denies the model when large samples are used (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1996). Therefore, some researchers suggested that a model could also be admitted if the larger number of fit indices showed superior adoption measures and only a little was less than the preferred threshold (Fornell & Larcker, 1981; Bagozzi & Yi, 1988). Although the result of Chi-square statistic of the proposed theoretical model presented significance at a 0.05 threshold, the remaining results were greater than

the minimum threshold. Therefore, it could be summarized that both competing model and proposed model are appropriate to clarify the relationships among variables, i.e. transformational leadership, lean manufacturing, and sustainability performance.

According to the above results, it is showed that the model fit statistics of the proposed model is greater than the competing model. Therefore, it could be summarized that the relationships among transformational leadership, lean manufacturing, and sustainability performance are better described by an effect of transformational leadership on sustainability performance through lean manufacturing.

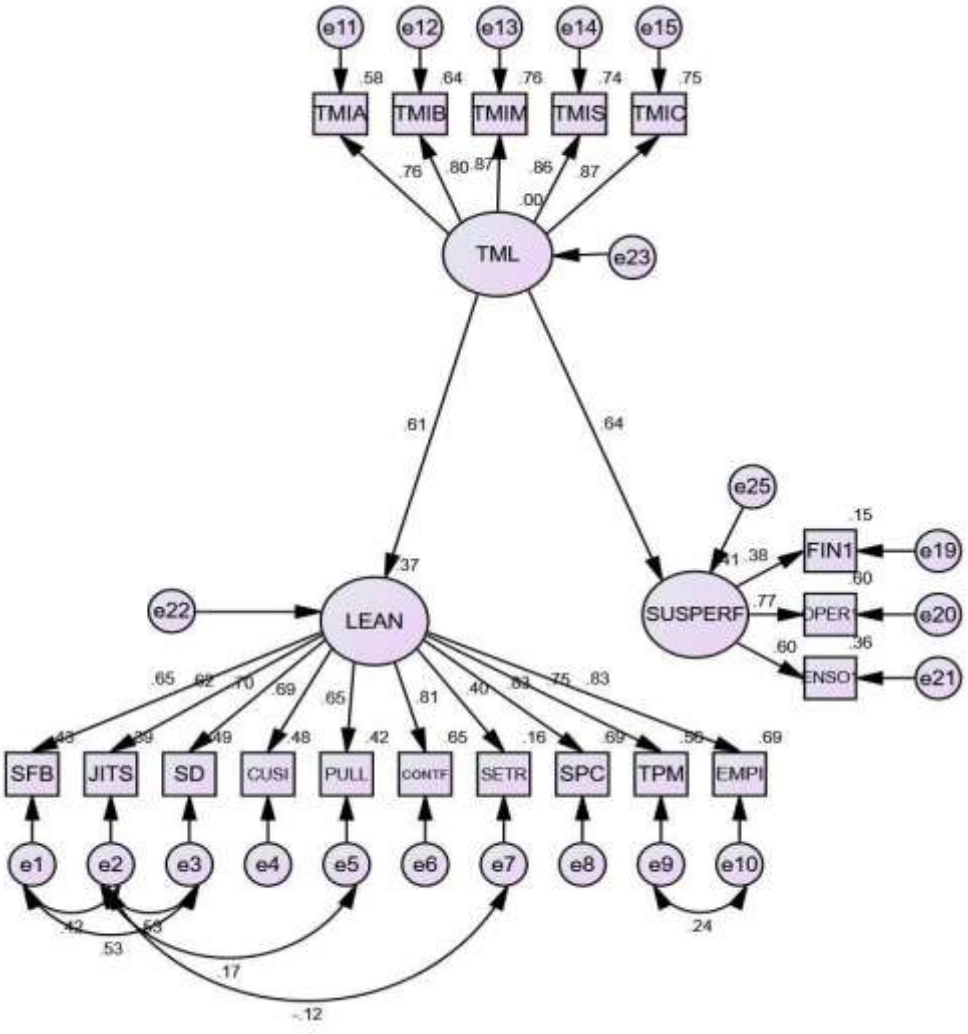

Figure 4.7 Structural model of the competing model of the initial model 1

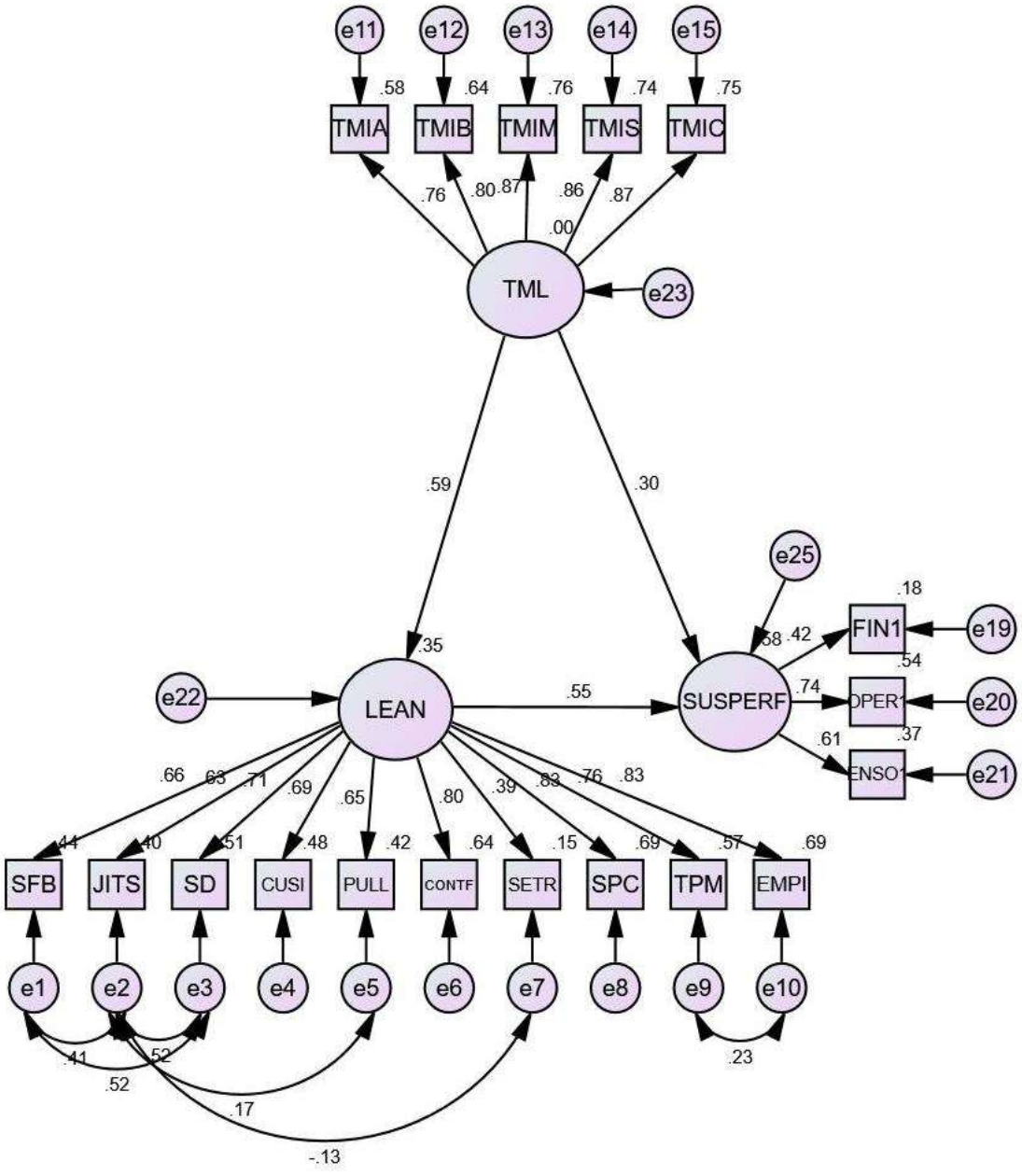

Figure 4.8 Structural model of the proposed theoretical model of the initial model 1

Table 4.6 Hypotheses testing results of the proposed model of the initial model 1

			Estimate	S.E.	C.R.	*p*-value
H1: Transformational leadership	--->	Lean manufacturing	0.928	0.071	13.036	***
H2: Transformational leadership	--->	Sustainability performance	0.263	0.055	4.820	***
H5: Lean manufacturing	--->	Sustainability performance	0.306	0.043	7.030	***

****p*-value < 0.001 (*p*-value less than 0.001 was at the significant level of 0.001)

4.6.1.2 Direct effect testing

H1: There is a positive relationship between transformational leadership and lean manufacturing.

Based on the results of the proposed theoretical model, the value of *t*-test presented that the estimated value was 0.928, standard error (S.E.) was 0.071, critical ratio (C.R.) was 13.036, and *p*-value was 0.000, displaying that there was a significant positive relationship between transformational leadership and lean manufacturing at a significant level of 0.001. Therefore, it could be summarized that H1 was accepted.

H2: There is a positive relationship between transformational leadership and sustainability performance.

Based on the results of the proposed theoretical model, the value of *t*-test presented that the estimated value was 0.263, standard error (S.E.) was 0.055, critical ratio (C.R.) was 4.820, and *p*-value was 0.000, displaying that there was a significant positive relationship between transformational leadership and sustainability performance at a significant level of 0.001. Therefore, it could be summarized that H2 was accepted.

H5: There is a positive relationship between lean manufacturing and sustainability performance.

Based on the results of the proposed theoretical model, the value of *t*-test presented that the estimated value was 0.306, standard error (S.E.) was 0.043, critical ratio (C.R.) was 7.030, and *p*-value was 0.000, displaying that there was a significant positive relationship between lean manufacturing and sustainability

performance at a significant level of 0.001. Therefore, it could be summarized that H5 was accepted.

4.6.1.3 Mediate effect testing

H6: There is a relationship between transformational leadership and sustainability performance through lean manufacturing.

Comparing the model fit statistics of the competing model (figure 4.7) and the proposed model (figure 4.8) of the initial model 1, which is presented in table 4.5, these results confirmed that the model fit statistics of the proposed model of the initial model 1 are greater than those of the competing model of the initial model 1. Thus, it could be asserted that the relationships among transformational leadership, lean manufacturing, and sustainability performance are better explained by an influence of transformational leadership on sustainability performance via lean manufacturing.

Table 4.7 Standardized direct, indirect, and total effects of the competing model of the initial model 1

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Transformational leadership	--->	Lean manufacturing	0.610	0.000	0.610
Transformational leadership	--->	Sustainability performance	0.641	0.000	0.641

Table 4.8 Standardized direct, indirect, and total effects of the proposed model of the initial model 1

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Transformational leadership	--->	Lean manufacturing	0.593	0.000	0.593
H6: Transformational leadership	--->	Sustainability performance	0.301	0.324	0.625
Lean manufacturing	--->	Sustainability performance	0.547	0.000	0.547

Regarding the competing model of the initial model 1, the standardized direct effect between transformational leadership and sustainability performance was 0.641. In contrast, the findings from the proposed model of the initial model 1 revealed that standardized direct effect between transformational leadership and sustainability performance was 0.301 while the standardized indirect effect was 0.324, and standardized total effect was 0.625. Since the standardized direct effect of the proposed model of the initial model 1 was less than that of the competing model of the initial model 1, it could be summarized that there is an effect of transformational leadership on sustainability performance through lean manufacturing.

Due to the greater model fit statistics and the low level of the standardized direct effect, it could be summarized that H6 was supported.

Regarding the results in table 4.8, the equations for the proposed model of the initial model 1 were conducted as followed.

$$\hat{Z}_{\text{Lean manufacturing}} = 0.593\ \text{Transformational leadership} \quad (1)$$

$$\hat{Z}_{\text{Sustainability performance}} = 0.625\ \text{Transformational leadership} + 0.547\ \text{Lean manufacturing} \quad (2)$$

4.6.1.4 Moderate effect testing

H8: There is a moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance.

Considering the moderate effect of automotive and nonautomotive industry, the Chi-square of the unconstrained was 952.664 and degree of freedom was 252, whereas the Chi-square of the fully constrained was 995.450 and degree of freedom was 270. The difference of the Chi-square was 42.786 and degree of

freedom was 18. The *p*-value was 0.001 which could be summarized that the model is different across type of industry. After checking each specific path, the results reported that industry has moderate effect on the path from transformational leadership and lean production at 95% confidence whereas industry has no moderate effect on the rest of all path levels. Thus, it can be concluded that H8 are partial support.

H9: There is a moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance.

Considering the moderate effect of lean adoption less than 5 years comparing to more than 5 years, the Chi-square of the unconstrained was 833.552 and degree of freedom was 252, whereas the Chi-square of the fully constrained was 864.683 and degree of freedom was 270. The difference of the Chi-square was 31.131 and degree of freedom was 18. The *p*-value was 0.028 which could be confirmed that the model is different across length of lean adoption on the structural relationships. After checking each specific path, the results reported that length of lean adoption has no moderate effect on the all path levels at 95% confidence. Thus, it can be concluded that H9 are partial supported.

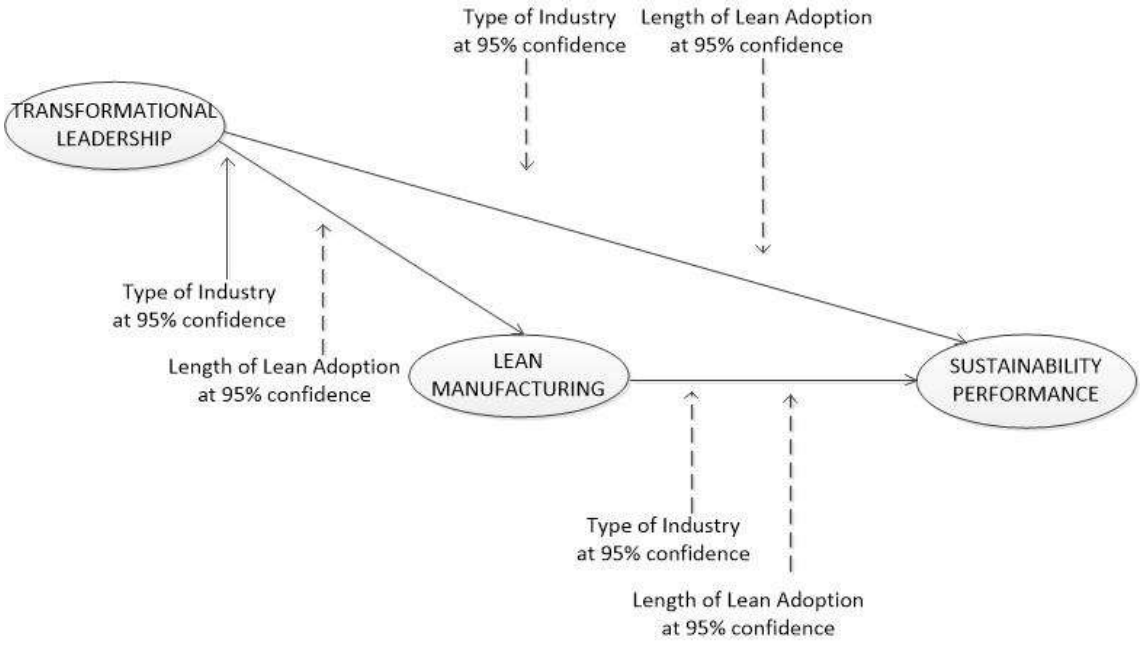

Figure 4.9 Moderate effect testing results of the initial model 1

4.6.2 Initial model 2 (Sustainable leadership, lean manufacturing, and sustainability performance)

Initial model 2 intended to test the structural relationships among sustainable leadership, lean manufacturing, and sustainability performance.

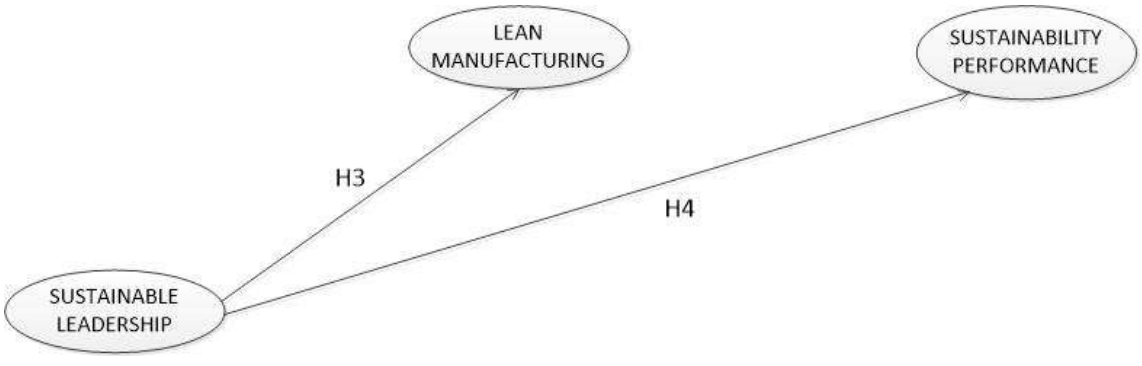

Figure 4.10 The competing theoretical model of the initial model 2

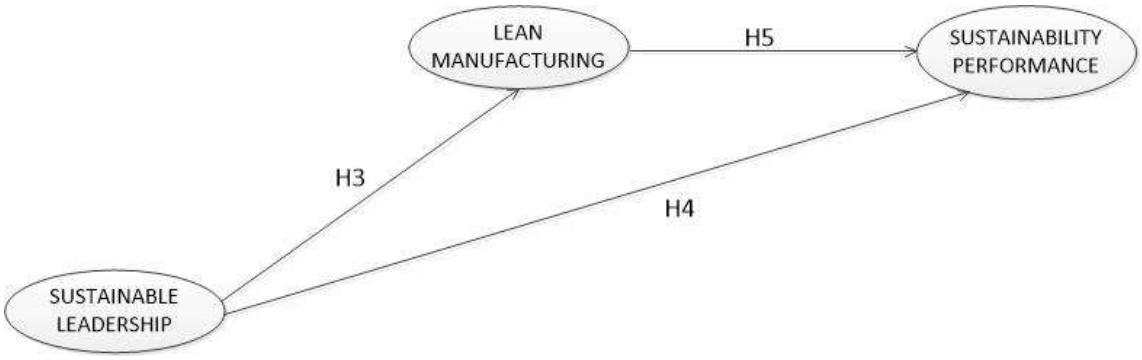

Figure 4.11 The proposed theoretical model of the initial model 2

4.6.2.1 Model fit testing

The competing model was to examine the direct effect of sustainable leadership on lean manufacturing, and direct effect of sustainable leadership on sustainability performance, which is presented in figure 4.10. The model fit statistics of the competing model is Hoelter's number = 140, CMIN = 503.092 at p = 0.000, df = 94, CMIN/df = 5.352, CFI = 0.930, IFI = 0.930, NFI = 0.916, TLI = 0.911, AGFI = 0.866, PGFI = 0.627, and RMSEA = 0.085. On the other hand, the model fit statistics of the proposed theoretical model is Hoelter's number = 166, CMIN = 419.994 at p = 0.000, df = 93, CMIN/df = 4.516, CFI = 0.944, IFI = 0.944, NFI = 0.930, TLI = 0.928, AGFI = 0.886, PGFI = 0.630, and RMSEA = 0.077.

Table 4.9 Model fit indices of the competing compared to the proposed initial model 2

Initial model 2	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	TLI	RMSEA
Competing model	503.092	0.000	94	5.232	0.930	0.930	0.866	0.916	0.911	0.085
Proposed model	419.994	0.000	93	4.516	0.944	0.944	0.886	0.930	0.928	0.077

Initial model 2	AIC (Default model)	BCC (Default model)	BIC (Default model)	CAIC (Default model)
Competing model	587.092	589.554	771.623	813.623
Proposed model	505.994	508.514	694.918	737.918

The Chi-square is essential statistic. However, a statistical significance test is sensitive to sample size, which means that the Chi-square statistic nearly always rejects the model when large samples are used (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1996). Therefore, some researchers suggested that a model could also be admitted if the larger number of fit indices showed superior adoption measures and only a little were less than the preferred threshold (Fornell & Larcker, 1981; Bagozzi & Yi, 1988). Although the result of Chi-square statistic of the proposed theoretical model presented significance at a 0.05 threshold, the remaining results were greater than the minimum threshold. Therefore, it could be summarized that both competing model and proposed model are appropriate to clarify the relationships among variables consisting of sustainable leadership, lean manufacturing, and sustainability performance.

According to the above results, the model fit statistics of the proposed model is greater than the competing model. Therefore, it could be summarized that the relationships among sustainable leadership, lean manufacturing, and sustainability performance are better described by an effect of sustainable leadership on sustainability performance through lean manufacturing.

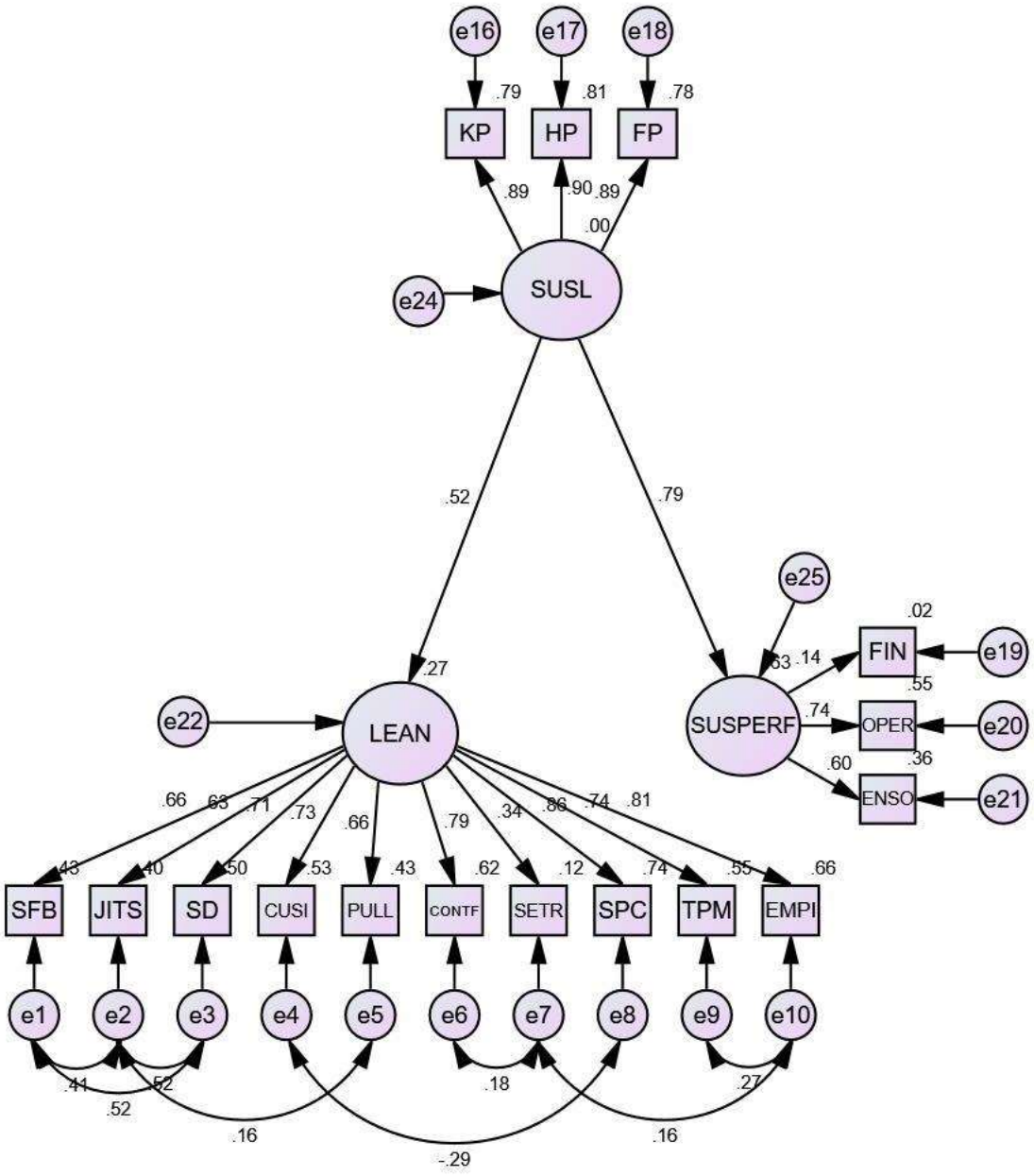

Figure 4.12 Structural model of the competing model of the initial model 2

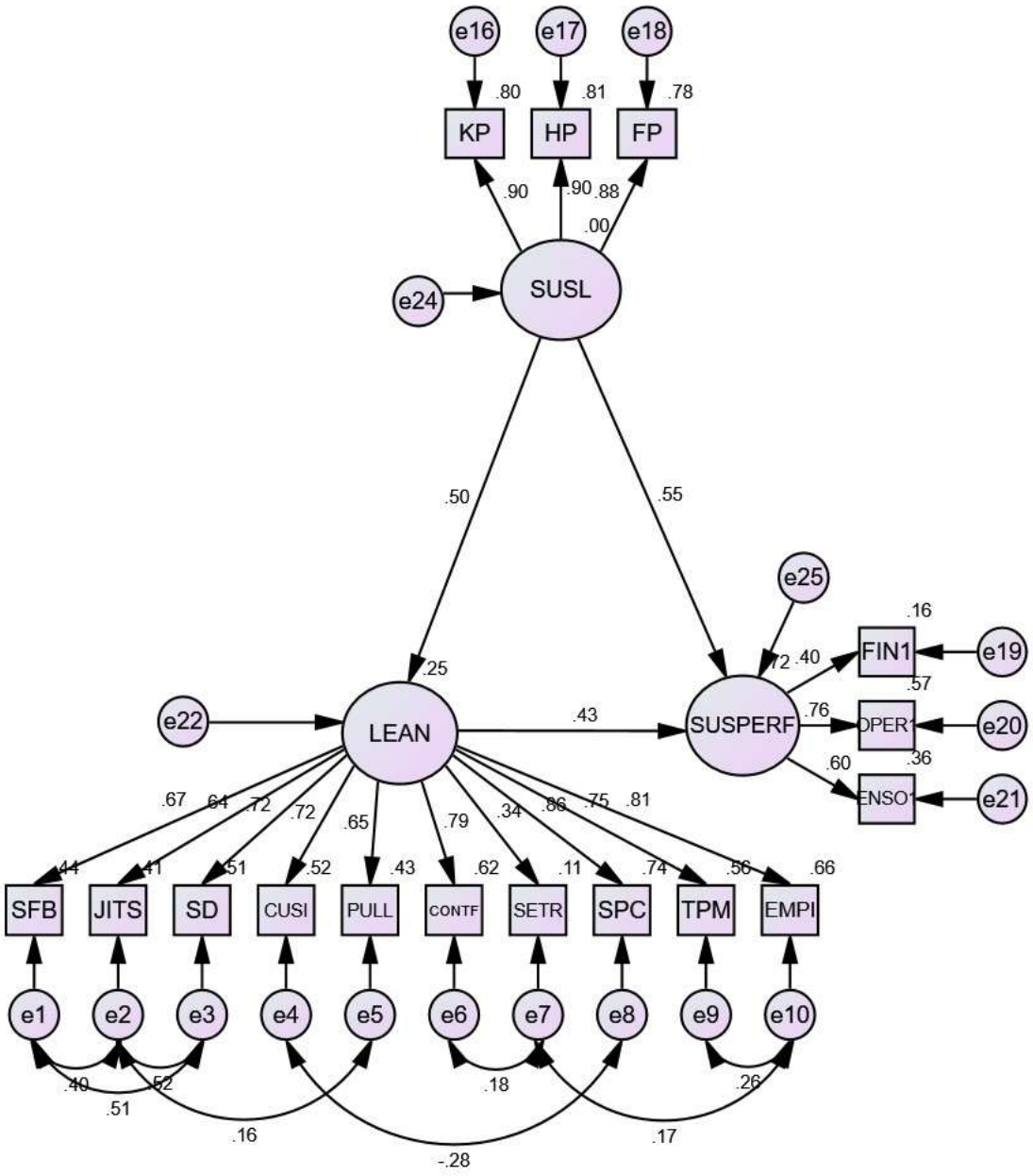

Figure 4.13 Structural model of the proposed theoretical model of the initial model 2

Table 4.10 Hypotheses testing results of the proposed model of the initial model2

			Estimate	S.E.	C.R.	*p*-value
H3: Sustainable leadership	--->	Lean manufacturing	0.608	0.052	11.620	***
H4: Sustainable leadership	--->	Sustainability performance	0.360	0.047	7.603	***
H5: Lean manufacturing	--->	Sustainability performance	0.234	0.035	6.763	***

****p*-value < 0.001 (*p*-value less than 0.001 was at the significant level of 0.001)

4.6.2.2 Direct effect testing

H3: There is a positive relationship between sustainable leadership and lean manufacturing.

Based on the results of the proposed theoretical model, the value of *t*-test presented that the estimated value was 0.608, standard error (S.E.) was 0.052, critical ratio (C.R.) was 11.620, and *p*-value was 0.000, displaying that there was a significant positive relationship between sustainable leadership and lean manufacturing at a significant level of 0.001. Therefore, it could be summarized that H3 was accepted.

H4: There is a positive relationship between sustainable leadership and sustainability performance.

Based on the results of the proposed theoretical model, the value of *t*-test presented that the estimated value was 0.360, standard error (S.E.) was 0.047, critical ratio (C.R.) was 7.603, and *p*-value was 0.000, displaying that there was a significant positive relationship between sustainable leadership and sustainability performance at a significant level of 0.001. Therefore, it could be summarized that H4 was accepted.

H5: There is a positive relationship between lean manufacturing and sustainability performance.

Based on the results of the proposed theoretical model, the value of *t*-test presented that the estimated value was 0.234, standard error (S.E.) was 0.035, critical ratio (C.R.) was 6.763, and *p*-value was 0.000, displaying that there was a significant positive relationship between lean manufacturing and sustainability

performance at a significant level of 0.001. Therefore, it could be summarized that H5 was accepted.

4.6.2.3 Mediate effect testing

H7: There is a relationship between sustainable leadership and sustainability performance through lean manufacturing.

Comparing the model fit statistics of the competing model (figure 4.12) and the proposed model (figure 4.13) of the initial model2, which is presented in table 4.9, these results confirmed that the model fit statistics of the proposed model of the initial model 2 are greater than those of the competing model of the initial model 2. Thus, it could be asserted that the relationships among sustainable leadership, lean manufacturing, and sustainability performance are better explained by an influence of sustainable leadership on sustainability performance via lean manufacturing.

Table 4.11 Standardized direct, indirect, and total effects of the competing model of the initial model 2

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Sustainable leadership	--->	Lean manufacturing	0.524	0.000	0.524
Sustainable leadership	--->	Sustainability performance	0.774	0.000	0.774

Table 4.12 Standardized direct, indirect, and total effects of the proposed model of the initial model 2

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Sustainable leadership	--->	Lean manufacturing	0.501	0.000	0.501
H7: Sustainable leadership	--->	Sustainability performance	0.548	0.217	0.764
Lean manufacturing	--->	Sustainability performance	0.433	0.000	0.433

Regarding the competing model of the initial model 2, the standardized direct effect between sustainable leadership and sustainability performance was 0.774. In contrast, the findings from the proposed model of the initial model 2 revealed that standardized direct effect between sustainable leadership and sustainability performance was 0.548 while the standardized indirect effect was 0.217, and standardized total effect was 0.764. Since the standardized direct effect of the proposed model of the initial model 2 was less than that of the competing model of the initial model 2, it could be summarized that there is an influence of sustainable leadership on sustainability performance via lean manufacturing.

Due to the greater model fit statistics and the low level of the standardized direct effect, it could be summarized that H7 was supported.

Regarding the results in table 4.12, the equations for the proposed model of the initial model 2 were conducted as followed.

$$\hat{Z}_{\text{Lean manufacturing}} = 0.501\ \text{Sustainable leadership} \quad (3)$$

$$\hat{Z}_{\text{Sustainability performance}} = 0.764\ \text{Sustainable leadership} + 0.433\ \text{Lean manufacturing} \quad (4)$$

4.6.2.4 Moderate effect testing

H10: There is a moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

Considering the moderate effect of automotive and nonautomotive industry, the Chi-square of the unconstrained was 728.446 and degree of freedom was 186, whereas the Chi-square of the fully constrained was 761.239 and

degree of freedom was 202. The difference of the Chi-square was 32.793 and degree of freedom was 16. The p-value was 0.008 which could be summarized that the model is different across type of industry. After checking each specific path, the results reported that industry has moderate effect on the path from sustainable leadership and lean production at 95% confidence whereas industry has no moderate effect on the rest of all path levels. Thus, it can be concluded that H10 are partial support.

H11: There is a moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.

Considering the moderate effect of lean adoption less than 5 years comparing to more than 5 years, the Chi-square of the unconstrained was 609.629 and degree of freedom was 186, whereas the Chi-square of the fully constrained was 645.138 and degree of freedom was 202. The difference of the Chi-square was 35.509 and degree of freedom was 16. The p-value was 0.003 which could be confirmed that the model is different across length of lean adoption. After checking each specific path, the results reported that length of lean adoption has moderate effect on the path from sustainable leadership and lean production at 99% confidence whereas length of lean adoption has no moderate effect on the rest of all path levels. Thus, it can be concluded that H11 are partial supported.

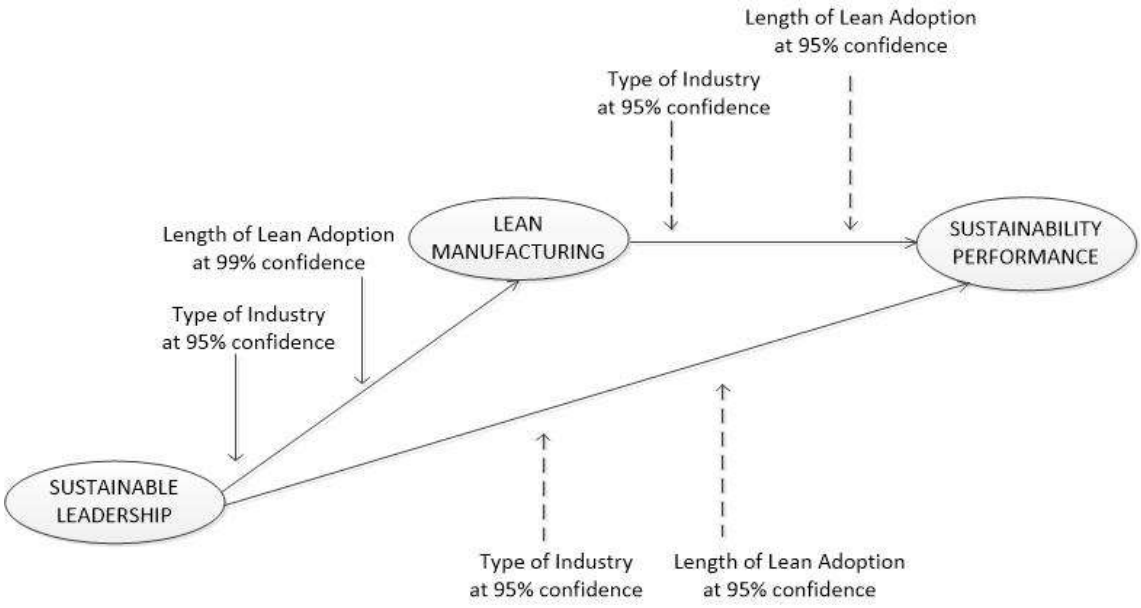

Figure 4.14 Moderate effect testing results of the initial model 2

4.6.3 Full model (Transformational, sustainable leadership, lean manufacturing, and sustainability performance)

Full model intended to test the structural relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance.

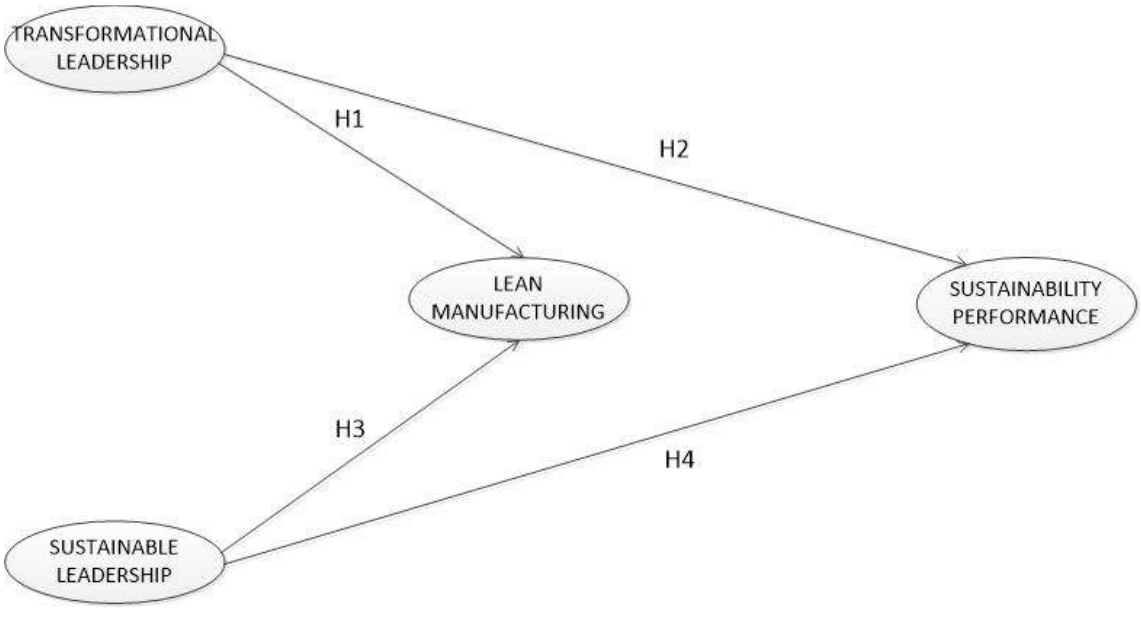

Figure 4.15 The competing theoretical model of the full model

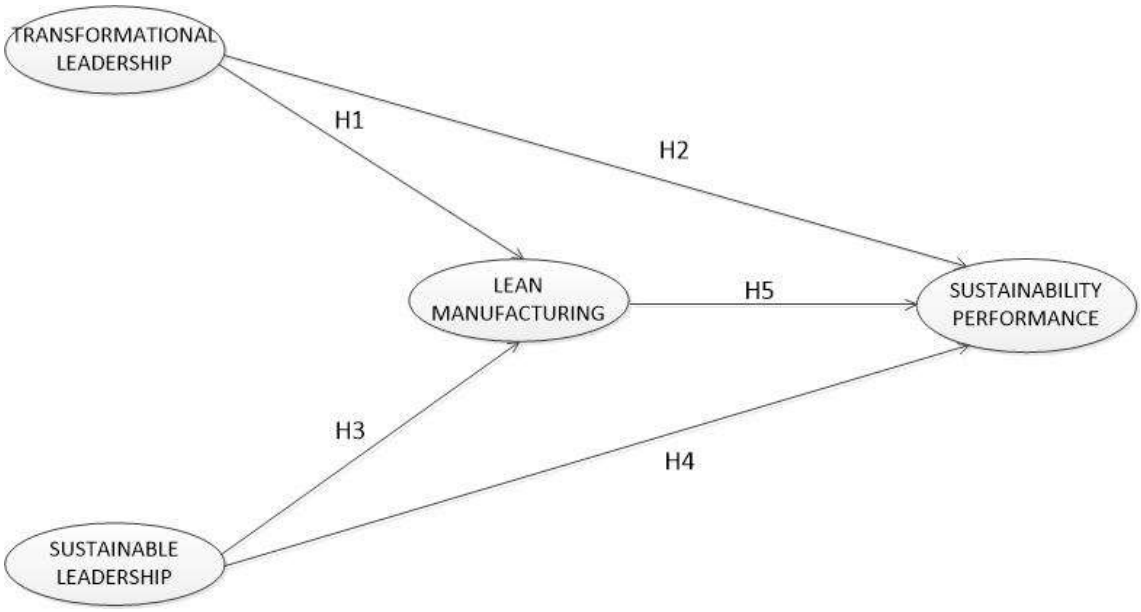

Figure 4.16 The proposed theoretical model of the full model

4.6.3.1 Model fit testing

The competing model was to examine the direct effect of transformational leadership on lean manufacturing, the direct effect of transformational leadership on sustainability performance, the direct effect of sustainable leadership on lean manufacturing, and the direct effect of sustainable leadership on sustainability performance, which is presented in figure 4.15. The model fit statistics of the competing model is Hoelter's number = 139, CMIN = 908.674 at p = 0.000, df = 179, CMIN/df = 5.076, CFI = 0.917, IFI = 0.917, NFI = 0.899, TLI = 0.903, AGFI = 0.834, PGFI = 0.675, and RMSEA = 0.083. On the other hand, the model fit statistics of the proposed theoretical model is Hoelter's number = 154, CMIN = 814.991 at p = 0.000, df = 178, CMIN/df = 4.579, CFI = 0.928, IFI = 0.928, NFI = 0.909, TLI = 0.915, AGFI = 0.848, PGFI = 0.680, and RMSEA = 0.077.

Table 4.13 Model fit indices of the competing compared to the proposed of full model

Full Model	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	TLI	RMSEA
Competing model	908.674	0.000	179	5.076	0.917	0.917	0.834	0.899	0.903	0.083
Proposed model	814.991	0.000	178	4.579	0.928	0.928	0.848	0.909	0.915	0.077

Full Model	AIC (Default model)	BCC (Default model)	BIC (Default model)	CAIC (Default model)
Competing model	1012.674	1016.654	1241.141	1293.141
Proposed model	920.991	925.047	1153.851	1206.851

Although the result of Chi-square statistic of the proposed theoretical model presented significance at a 0.05 threshold, the remaining results were greater than the minimum threshold. Therefore, it could be summarized that both competing model and proposed model are appropriate to clarify the relationships among variables consisting of transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance.

According to the above results, the model fit statistics of the proposed model is greater than the competing model. Therefore, it could be summarized that the relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance are better described by an effect of transformational leadership on sustainability performance through lean manufacturing together with the effect of sustainable leadership on sustainability performance through lean manufacturing.

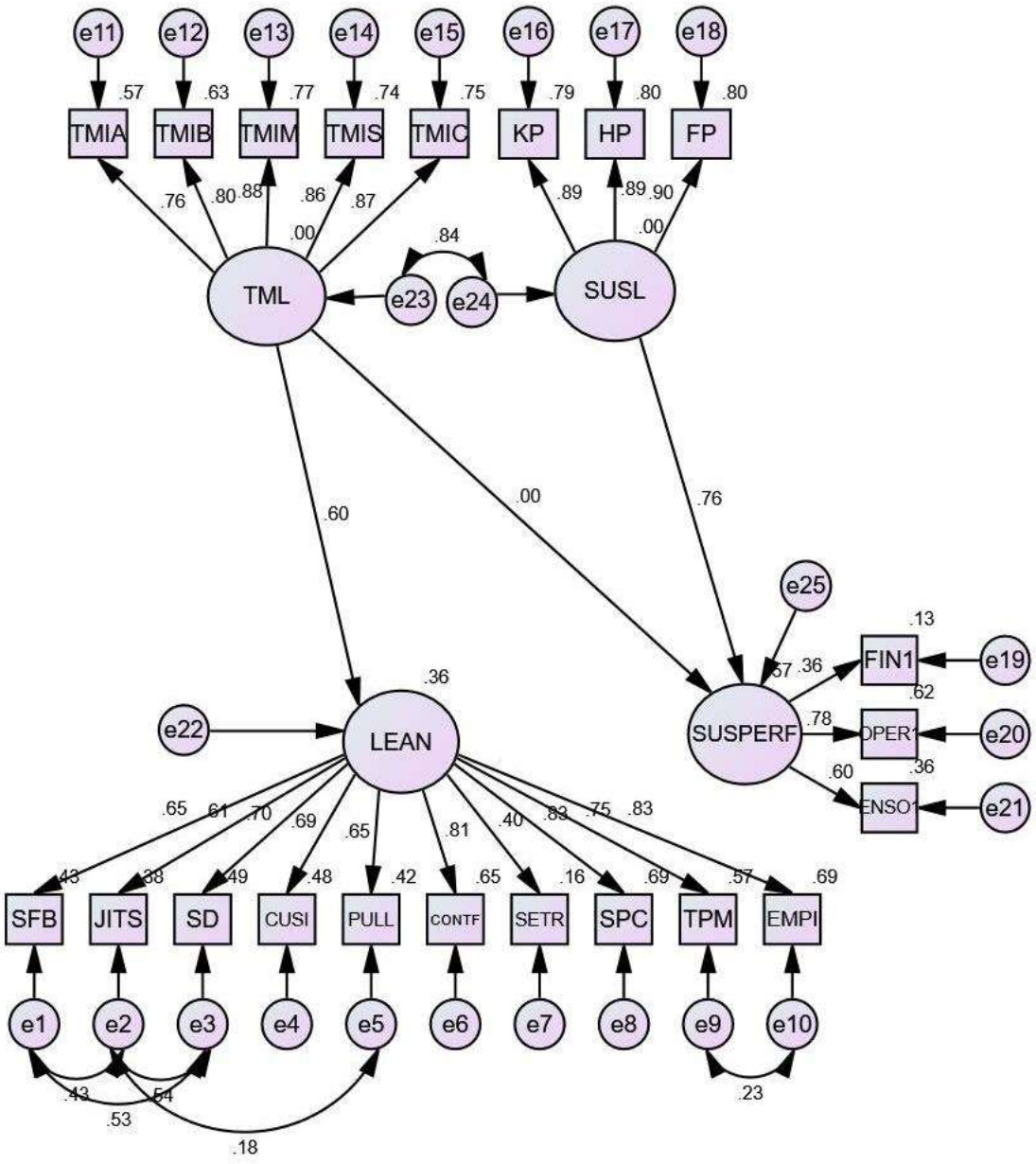

Figure 4.17 Structural model of the competing model of the full model

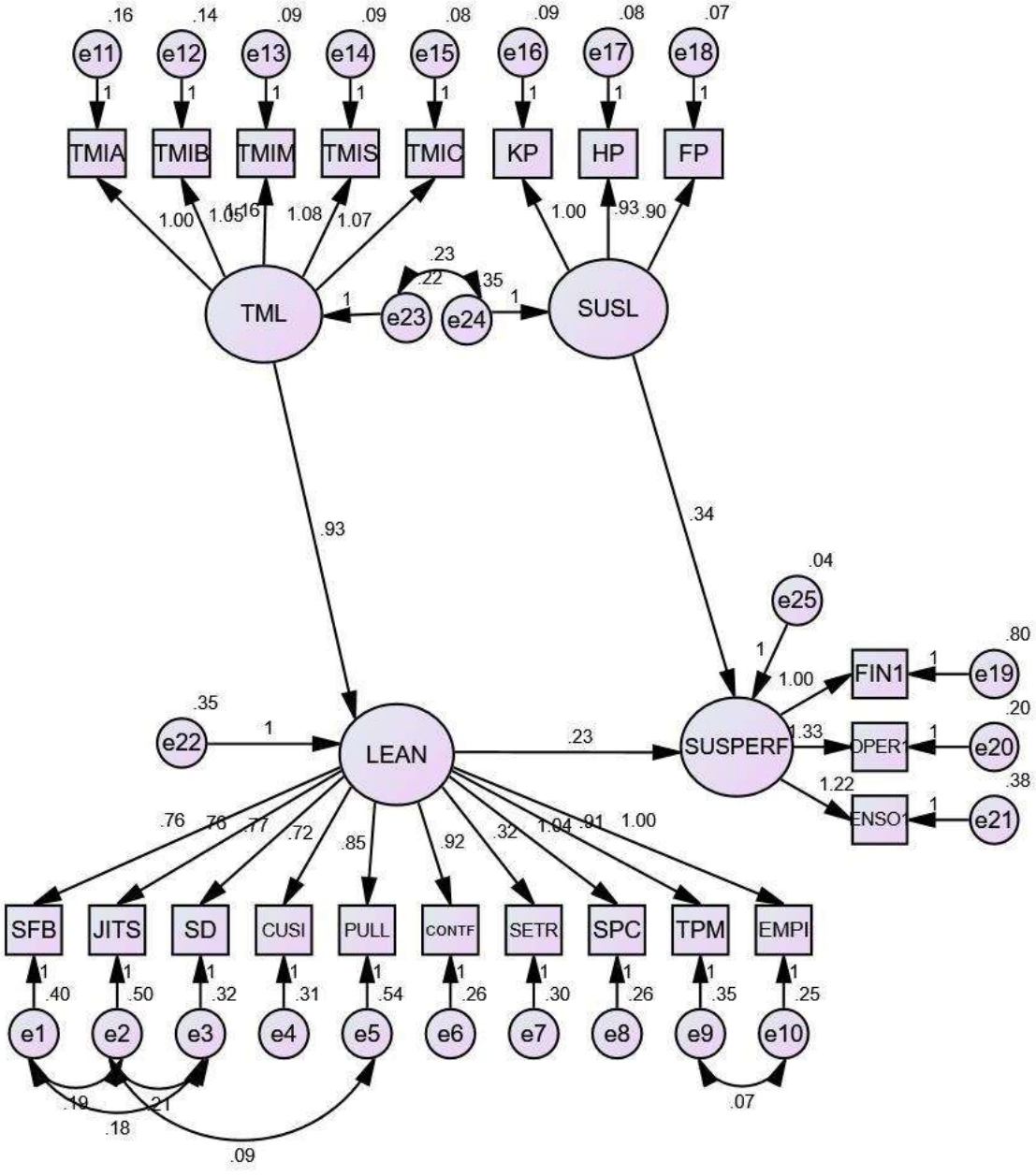

Figure 4.18 Structural model of the proposed theoretical model of the full model

4.6.3.2 Structural relationship testing

Based on the model fit testing, the results showed that the proposed theoretical model of the full model is appropriated to test the structural relationship rather than the competing model. Considering the results of test of regression weight, the findings revealed that the relationship between sustainable leadership and lean manufacturing is insignificant, *p*-value = 0.344 at 0.05 level, which

is opposed with the above results of H3. The result suggested that this relationship should be deleted from the full model. After deleting this relationship, the result showed that the relationship between transformational leadership and sustainability is significant with *p*-value = 0.018 at 0.05 level; however, the standardized regression weight is negative at -0.350, opposed to the above results of H2.

Table 4.14 Model fit indices of the competing and proposed model of the full model after deleting the regression weight between sustainable leadership and lean manufacturing, and after deleting the regression weight between transformational leadership and sustainability performance

Model	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	TLI	RMSEA
Competing model	912.388	0.000	181	5.041	0.917	0.917	0.836	0.899	0.903	0.082
Proposed model	830.978	0.000	180	4.617	0.926	0.926	0.847	0.908	0.914	0.078

Model	AIC (Default model)	BCC (Default model)	BIC (Default model)	CAIC (Default model)
Competing model	1012.388	1016.214	1232.067	1282.067
Proposed model	932.978	936.880	1157.051	1208.051

Table 4.15 Standardized direct, indirect, and total effects of the competing model of the full model after deleting the regression weight between sustainable leadership and lean manufacturing, and after deleting the regression weight between transformational leadership and sustainability performance

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Transformational leadership	--->	Lean manufacturing	0.600	0.000	0.600
Sustainable leadership	--->	Sustainability performance	0.758	0.000	0.758

Table 4.16 Standardized direct, indirect, and total effects of the proposed model of the full model after deleting the regression weight between sustainable leadership and lean manufacturing, and after deleting the regression weight between transformational leadership and sustainability performance

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Transformational leadership	--->	Lean manufacturing	0.593	0.000	0.593
Lean manufacturing	--->	Sustainability performance	0.441	0.000	0.441
Sustainable leadership	--->	Sustainability performance	0.528	0.000	0.528
Transformational leadership	--->	Sustainability performance	0.000	0.214	0.214

Regarding the results in table 4.16, the equations for the revised proposed theoretical model were conducted.

$$\hat{Z}\,\text{Lean manufacturing} = 0.593\,\text{Transformational leadership} \quad (5)$$

$$\hat{Z}\,\text{Sustainability performance} = 0.441\,\text{Lean manufacturing} + 0.528\,\text{Sustainable leadership} + 0.214\,\text{Transformational leadership} \quad (6)$$

4.6.3.3 Revised model

Since transformational leadership and sustainable leadership have some correlation and share some variance, the suppression value is found in the structural model. Deleting a line will make the unrealistic relationship of the model. In order to keep the realistic relationship, the second order of leadership was applied, which was composed of two dimensions including transformational leadership and sustainable leadership depicted in figure 4.19 and 4.20.

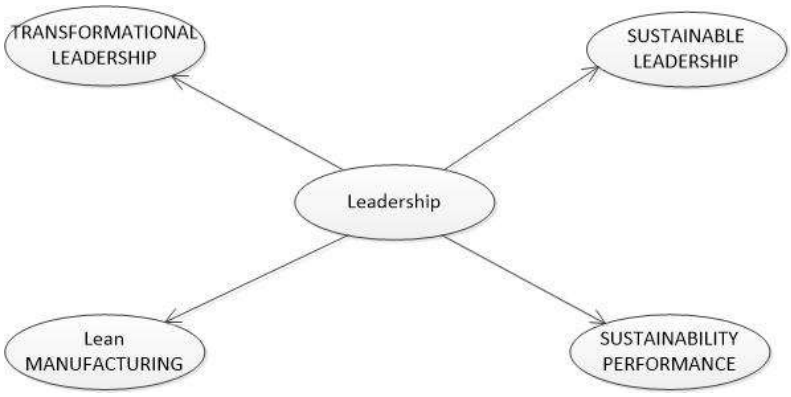

Figure 4.19 The competing model of the revised full model

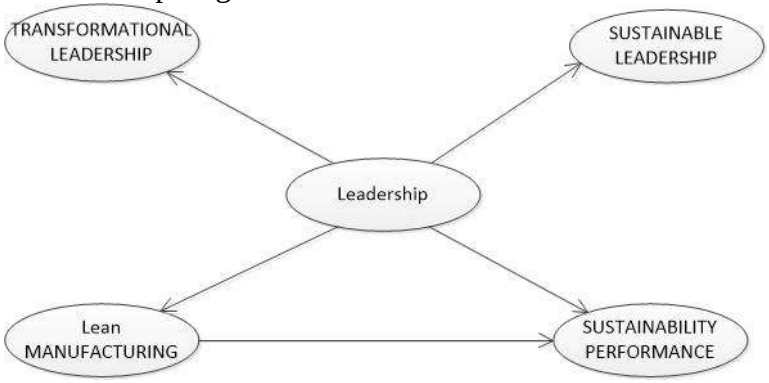

Figure 4.20 The proposed theoretical model of the revised full model

Table 4.17 Model fit indices of the competing and proposed model of the revised full model

Model	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	TLI	RMSEA
Competing model	1084.871	0.000	181	5.994	0.897	0.898	0.818	0.879	0.881	0.091
Proposed model	863.945	0.000	179	4.827	0.922	0.922	0.841	0.904	0.909	0.080

	AIC (Default model)	BCC (Default model)	BIC (Default model)	CAIC (Default model)
Competing model	1184.871	1188.697	1404.551	1454.551
Proposed model	967.945	971.924	1196.412	1248.412

Although the result of Chi-square statistic of the proposed theoretical model presented significance at a 0.05 threshold, the remaining results were greater than the minimum threshold. Therefore, it could be summarized that both

competing model and proposed model are appropriate to clarify the relationships among variables consisting of leadership, lean manufacturing, and sustainability performance.

According to the above results, the model fit statistics of the proposed model is greater than the competing model. Therefore, it could be summarized that the relationships among leadership, lean manufacturing, and sustainability performance are better described by an effect of leadership on sustainability performance through lean manufacturing.

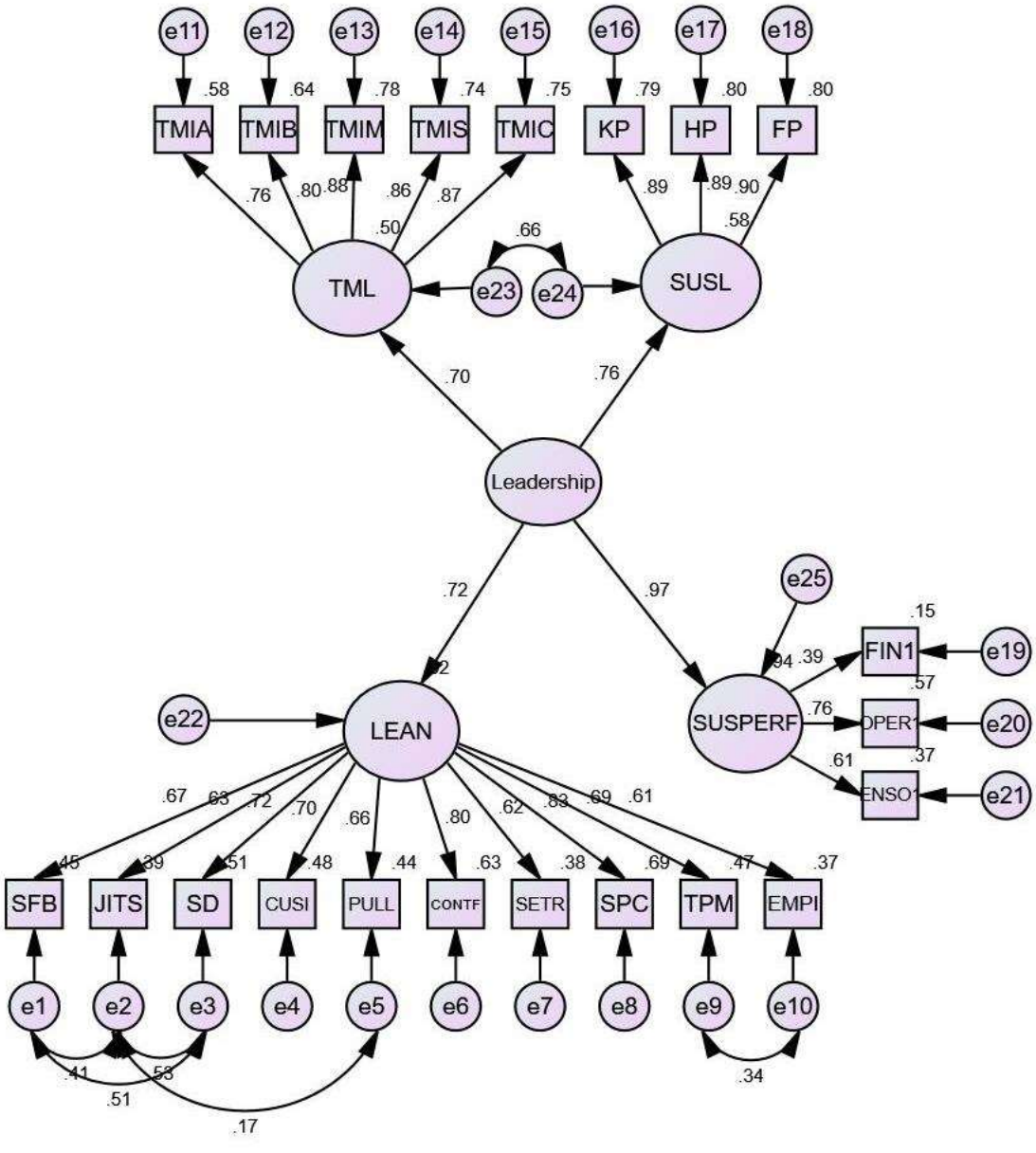

Figure 4.21 Structural model of the competing model of the revised full model

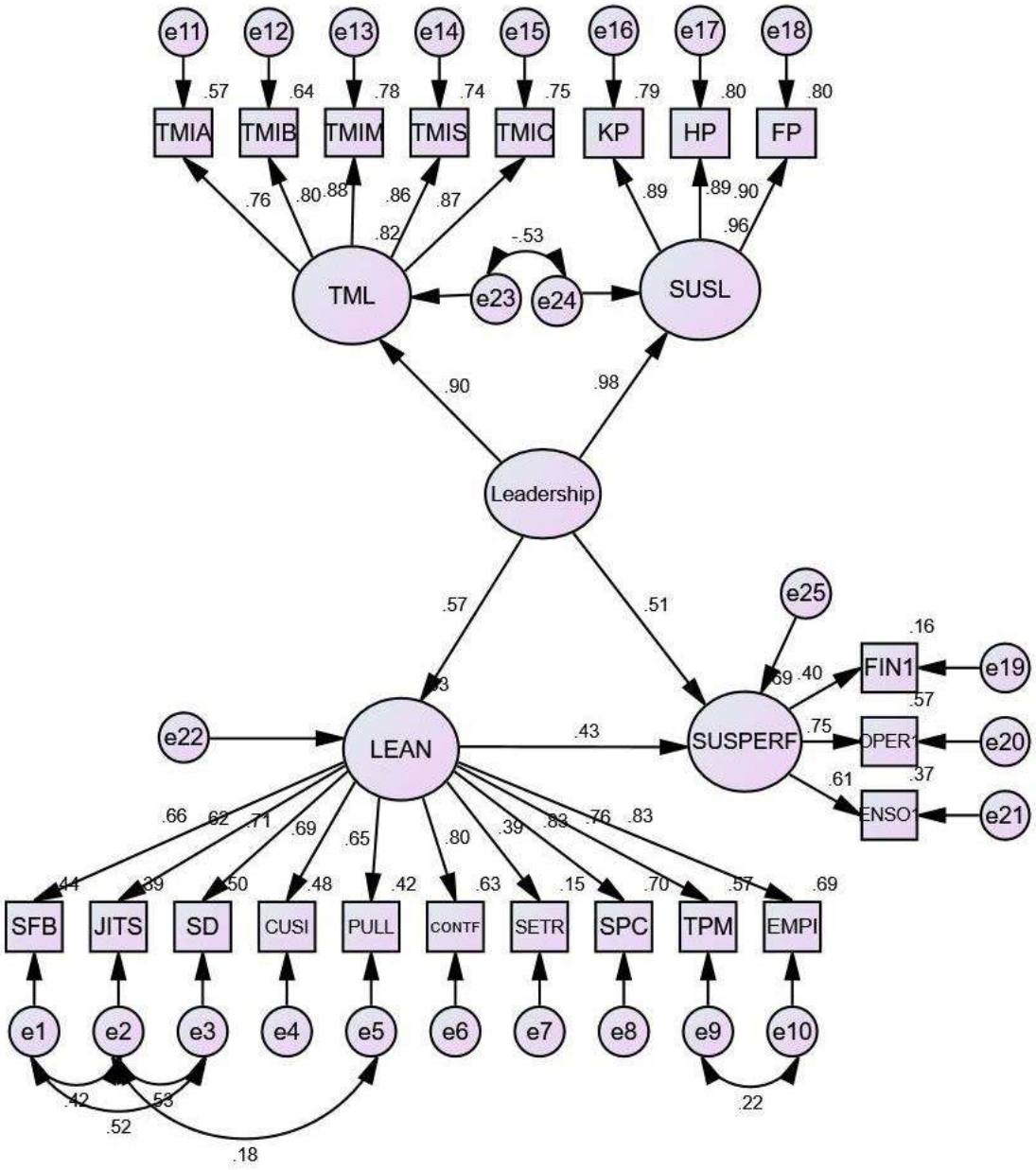

Figure 4.22 Structural model of the proposed model of the revised full model

Table 4.18 Hypotheses testing results of the proposed model of the revised full model

			Estimate	S.E.	C.R.	*p*-value
Leadership	--->	Lean manufacturing	1.560	0.139	11.195	***
Leadership	--->	Sustainability performance	0.467	0.083	5.639	***
Lean manufacturing	--->	Sustainability performance	0.222	0.039	5.734	***

****p*-value < 0.001 (*p*-value less than 0.001 was at the significant level of 0.001)

Table 4.19 Standardized direct, indirect, and total effects of the competing model of the revised full model

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Leadership	--->	Lean manufacturing	0.722	0.000	0.722
Leadership	--->	Sustainability performance	0.971	0.000	0.971

Table 4.20 Standardized direct, indirect, and total effects of the proposed model of the revised full model

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Leadership	--->	Lean manufacturing	0.571	0.000	0.571
Leadership	--->	Sustainability performance	0.510	0.243	0.753
Lean manufacturing	--->	Sustainability performance	0.425	0.000	0.425

Regarding the competing model of the revised full model, the standardized direct effect between leadership and sustainability performance was 0.971. In contrast, the findings from the proposed model of the revised full model revealed that standardized direct effect between leadership and sustainability performance was 0.510 while the standardized indirect effect was 0.243, and standardized total effect was 0.753. Since the standardized direct effect of the proposed model of the revised full model was less than that of the competing model of the revised full model, it could be summarized that there is an influence of leadership on sustainability performance via lean manufacturing.

Due to the greater model fit statistics and the low level of the standardized direct effect, it could be summarized that there is an influence of leadership on sustainability performance via lean manufacturing.

Regarding the results in table 4.20, the equations for the proposed model of the revised full model were conducted as followed.

$$\hat{Z}_{\text{Lean manufacturing}} = 0.571\,\text{Leadership} \quad (7)$$

$$\hat{Z}_{\text{Sustainability performance}} = 0.753\,\text{Leadership} + 0.425\,\text{Lean manufacturing} \quad (8)$$

Table 4.21 Summary of hypothesis testing

Hypothesis and its description	Results
H1: There is a positive relationship between transformational leadership and lean manufacturing.	Supported
H2: There is a positive relationship between transformational leadership and sustainability performance.	Supported
H3: There is a positive relationship between sustainable leadership and lean manufacturing.	Supported
H4: There is a positive relationship between sustainable leadership and sustainability performance.	Supported
H5: There is a positive relationship between lean manufacturing and sustainability performance.	Supported
H6: There is a relationship between transformational leadership and sustainability performance through lean manufacturing.	Supported
H7: There is a relationship between sustainable leadership and sustainability performance through lean manufacturing.	Supported
H8: There is a moderate effect of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance.	Supported (Partial)
H9: There is a moderate effect of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance.	Supported (Partial)
H10: There is a moderate effect of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.	Supported (Partial)
H11: There is a moderate effect of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance.	Supported (Partial)

4.7 Qualitative Results

Referring to quality, the in-depth interview was conducted with middle and top managers working in 20 automotive companies and 20 non-automotive companies. Content analysis was done by means of content analysis by 3 experts presented in table 4.22 and below details.

Table 4.22 Content analysis results from 3 experts

Dimension/Situation details	Some extent	Moderate extent	Extensive/ full extent
Supplier feedbacks and involvements	28	11	1
Customer feedbacks and involvements	6	20	14
Process standardization and working instruction	11	20	9
Employee feedbacks and involvements	27	11	2
Leaderships, management skills, relationships, innovation	16	18	6
Organizational success caused by lean implementation	31	7	2

Participants informed that they knew and applied some dimensions of lean manufacturing as they thought lean manufacturing was suitable for only automotive/part industry despite less attention and implementation in other industries. The company takes the most attention on customer involvement, some attention on employee and supplier involvement, which is consistent with quantitative results. Some managers informed that due to low educational degree of their employees as well as most foreigner employees from Myanmar, Laos, Vietnam, and Cambodia, who need more coaching, training, and caring, managers tend to give advices and exchange ideas with their followers rather than inspire and give them opportunities to make decision.

According to the results, it was found that the organizational complexity level was moderate, which did not need to be changed. Thus, managers were interested in exchanging with employees than inspiring them to be changed. Moreover, the large companies focused more on lean manufacturing practice rather than smaller companies operating in fierce competition with small number of employees, which did not have enough resources to set and control lean manufacturing system.

4.7.1 Supplier feedbacks and involvements

Participants informed that the company takes some attention on supplier involvement, which is consistent with quantitative results. There are many reasons that the relationship between company and suppliers is at low level and suppliers do not encourage just in time policy. First, due to material prices had been changing frequently depending on market prices. Purchasing in bulk raw materials resulted in a risk of loss from the price difference. Second, materials for some industry such as plastic, garment, and OEM industry had to be ordered from suppliers which were determined by customers. Therefore, suppliers had high level of bargaining power to ask maximum purchased volume, leading to high level of raw material inventory. Third, raw materials inventory for some industry such as electric and electronic, automotive, and garment industry was very high because the companies needed to import raw materials from Germany, America, and Japan, the process of which took a long time for transportation. Therefore, the company selected to purchase in bulk raw materials, in order to avoid the shortage of materials.

4.7.2 Customer feedbacks and involvements

Participants informed that the company takes the most attention on customer involvement, which is consistent with quantitative results. Customers are the

most important for organization success therefore company need to operate well to meet customers' requirements including superior quality, reasonable cost, and on time delivery. For instance, some companies measured performance based on the measurement by using cycle or takt time received from customers, defect rate for all industry was controlled by customer at 2-3% using 3 stations of quality control points, i.e. incoming point, in-process point, and outgoing point, and some companies were evaluated and received certificate from customers. Most participants work with Japanese customers who often visited manufacturing production line.

4.7.3 Process standardization and work instruction

Participants informed that the company takes the most attention on customer involvement, which is consistent with quantitative results. Due to some companies especially OEM companies must to follow process and work instruction received from customers. In addition, most of companies were ISO 9001 qualified, guaranteeing the productivity control for all processes by using work instructions.

4.7.4 Employee feedbacks and involvements

Participants informed that the company takes some attention on employee involvement, which is consistent with quantitative results. Some managers informed that due to low educational degree of their employees as well as most foreigner employees from Myanmar, Laos, Vietnam, and Cambodia, thus managers do not trust and do not give them opportunity to exchange ideas and potentials. In addition, SMEs companies operating in fierce competition with small number of employees did not have enough resources to encourage lean implementation. Managers do not take more attention and explanations before lunch lean program resulted in misunderstanding with employees. Employees perceived lean practices as extra work without extra pay. In

addition, most companies were located in an area with many factories; thus, employees had an opportunity to compare the compensation, welfare, and benefits offered in the companies nearby. Due to managers avoided problem occur from staff turnover rate; therefore, managers do not much force employees to join lean program.

4.7.5 Leadership skills

Most participants informed that they proficient in technical skills, human, and communication skills whereas scarce in conceptual skills. Moreover, most participants informed that they cannot work well in decision making and cannot be representative for their company. In addition, most participants informed that due to low skill and dedication employees; thus, difficult to create teamwork, culture, and innovation.

4.7.6 Organizational success

Participants informed that lean practices were appropriate for automotive industry though less attention and implementation in other industries. Two companies, get TPS training program from Thailand Automotive Institute, informed that fully success which come from electric and plastic industry. Due to fully success companies do not come from automotive industry which supported quantitative results that lean practices can apply in any industry. Most participants informed that they have some knowledge and skills associate with lean practices; thus, they do not work well for lean implementation. Participants from automotive industry informed that the company implement lean program for long time; however, the program fails due to implement without continuous and serious policy. On the other hand, participations from nonautomotive industry informed that the company implement lean practices due to popular program but do not success due to execute in early stage.

4.8 Chapter Summary

This chapter presents the outcomes of the investigation, which report that there are significant positive relationships between transformational leadership and lean manufacturing, transformational leadership and sustainability performance, sustainable leadership and lean manufacturing, sustainable leadership and sustainability performance, and lean manufacturing and sustainability performance. Moreover, the findings show that there is an effect of transformational leadership on sustainability performance through lean manufacturing. In addition, the results reveal that there is an effect of sustainable leadership on sustainability performance through lean manufacturing. A deliberation of these findings with suggestions and implications is shown in chapter 5.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Chapter five begins with a summarization of the results, followed by discussions and conclusions, implications for the study and practice, recommendations for future research, and limitations of the study. The chapter concludes with a summarization of relevant points.

5.1 Summary of the Results

The aim of this study is to investigate the connections among transformational leadership, sustainable leadership, lean manufacturing, and sustainability. A total of 598 samples (216 respondents from automotive industry, 382 respondents from non-automotive industry) data were gathered from July 2016 to March 2017. On the one hand, qualitative method was carried out by in-depth interview from 40 top executives and middle management managers (20 participants from automotive industry and 20 participants from non-automotive industry).

5.1.1 The majority part of the respondents were male, accounting for 56.2 percent, with the age above 40 years accounting for 31.4 percent, and working for general/factory/production manager accounting for 38.8 percent. The educational level was mostly Bachelor's degree which accounted for 75.6 percent. In addition, the respondents working in non-automotive industry accounted for 63.9 percent, age of company above 15 years for 46.2 percent, and working in company without union for 74.1 percent. In addition, the length of lean implementation less than 5 years accounted for 89.5 percent.

5.1.2 The results showed that there are significant positive relationships between transformational leadership and lean manufacturing (H1), transformational leadership and sustainability performance (H2), sustainable leadership and lean manufacturing (H3), sustainable leadership and sustainability performance (H4), and lean manufacturing and sustainability performance (H5).

5.1.3 The findings further showed that there is an effect of transformational leadership on sustainability performance through lean manufacturing (H6). Moreover, the results reveal that there is an effect of sustainable leadership on sustainability performance through lean manufacturing (H7).

5.1.4 The findings further showed that there is a partial moderate effect of type of industry and length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance (H8 and H9). Moreover, the results reveal that there is a partial moderate effect of type of industry and length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance (H10 and H11).

The discussions and conclusions for each research hypothesis are demonstrated in the following part.

5.2 Discussions of the Results

5.2.1 The hypothesis H1 intended to examine the relationship between transformational leadership and lean manufacturing.

According to literature review, the findings suggested that transformational leadership is interrelated and essential in organizational changes that are basic foundation required in lean implementation. Despite the leadership being

comprehended as a critical success factor in publication on lean implementation, there are few empirical studies examining the role of leadership in the extent of lean practices (Kim & Hochstatter, 2016).

The finding revealed that there is positive relationship between transformational leadership and lean manufacturing practice, which confirmed the previous studies of Cheerawit et al. (2014) and Kim and Hochstatter (2016). However, it is opposed to the results of Marynell (2013) and Langlois (2015). This is because the majority of respondents come from the small and medium enterprises, which can make a response more simply to the demand shifts and requires, attract new generation, better growth-oriented employees who may provoke innovation, and frequently originally create themselves differentiated from rivals through product innovation (Ettlie, 1983; Goodman & Abernathy, 1978). Both differentiate strategy and new generation employees lead to the change, which is the essential foundation of lean practice.

When companies are implementing organizational change, such as lean production, the leadership must not be disregarded. Transformational leadership will be useful when a company is trying to lead change. Leadership positively affects both lean practice and firm performance. Due to high competition and dynamic changes, companies were struggling with the increase in dynamic capabilities, organizational learning, and innovation. Since transformational leadership is suitable for application in contingency situation (Bass, 1985), a company will be willing and agree that transformational leadership is fit to the company that has adaptation as the main purpose (Pawar & Eastman, 1997).

Thus, managers should apply characteristics of leadership to encourage lean success and firms' achievement. Leaders should explain the

organization's vision, indicating commitment and creating sense of lean implementation across the whole companies and all followers, assuring the success in the organizations' goal (Bodla & Nawaz, 2010). In addition, leaders must create expectation, inspire, and motivate their employees to attain the company's target. Efficient communication is the essential factor, including upward, downward, horizontal, formal, and informal communication. Coaching and feedback can assist to overcome hurdles and barriers, as well as personal improvement that encourage personal skills to remedy hurdles and obstacles by themselves (Woehl, 2011). From this positive environment, situation, and relationships, managers can drive implementation of lean practice and lead to high level of firm performance.

5.2.2 The hypothesis H2 intended to examine the relationship between transformational leadership and sustainability performance.

From the results, it is evident that there is a positive relationship between transformational leadership and sustainability performance. Based on literature review, the findings showed the connection between transformational leadership and firm performance, which was separated into two dimensions, i.e. operational and financial performance, which asserted the previous researches, such as Cheerawit et al. (2014) and Wongyanon et al. (2015). According to the author's knowledge, it is revealed for the first time that the positive relationship between transformational leadership and firm performance, separated into three dimensions including operational, financial, and environmental and social performance, is the added contributions to research in academic field.

Leaders who apply transformational leadership characteristics will endeavor in making changes and encouraging employee development and performance,

which leads to high level of firm performance. According to the fierce competition in recent time, companies cannot do business without social and environmental consideration and awareness. Doing business with transparency and ethical will increase good image and reputation. This will ultimately affect sales and profits.

5.2.3 The hypothesis H3 intended to examine the relationship between sustainable leadership and lean manufacturing.

According to the author's knowledge, it is revealed for the first time that the positive relationship between sustainable leadership and lean manufacturing is the added contribution to research in academic field as sustainable leadership comprises foundation executions, higher-level executions, and main performance motivators. First, foundation executions are associated with technical, operational, and human skill. Second, higher-level practices are related to conceptual skill, team and culture building. Finally, key performance drivers are associated to innovation and employee engagement building. Presently, business cannot survive with only one skill such as technical, operational, human relationship, or conceptual skill; however it requires combination of these skills. Moreover it requires advanced technological, forefront innovation, quick adaptation, as well as employee and all supply chain members engagement. These characteristics are necessary factors of changes and adaptation, which is an essential pillar of lean manufacturing.

5.2.4 The hypothesis H4 intended to examine the relationship between sustainable leadership and sustainability performance.

Sustainable leadership is an emergent leadership paradigm; however, there are still few studies on independents and consequences. So, it is vague to identify that sustainable leadership leads to sustainability performance.

The findings indicated that there is a positive relationship between sustainable leadership and sustainability performance. Based on literature review, the findings showed the connection between sustainable leadership and firm performance which are separated into two dimensions including operational and financial performance, which asserted the previous researches such as Metsämuuronen et al. (2012) and Kantabutra and Avery (2013). According to the author's knowledge, it is revealed for the first time that the positive relationship between sustainable leadership and firm performance, separated into three dimensions including operational, financial, and environmental and social performance, are the added contributions to research in academic field.

Practices of Sustainable leadership are indicated as concentration on a long-term approach, employee improvement, a robust innovation, company culture, environmental and social responsibility and ethical actions. As sustainable leadership principle is composed of vital multi skills, it leads to encouragement of brand and prominence, employee and customer satisfaction, operational performance, financial effectiveness, and social and environmental performance.

5.2.5 The hypothesis H5 intended to investigate the relationship between lean manufacturing and sustainability performance.

The finding showed that there is a positive association between lean manufacturing practice and operational and financial effectiveness, which asserts the preceding publications, such as that of Oslen (2004), Arawati and Mohd (2012), and Hibadullah et al., (2013). Lean foundation emerged from reducing wastes in production line and respected employees. Organizations implementing lean manufacturing will reduce production cost, increase supplier relationship, enhance customer satisfaction,

and high level of net profit, which results in high level of operational and financial performance. Companies with high level of lean manufacturing will get higher operational performance than competitors in faster delivery, quicker and more accurate response, lower setup time and operational cost, higher operational performance, customer satisfaction, operational profit, and improvement of product quality.

Not only is lean manufacturing practice associated with insiders, but it is also related to outsiders such as diversity of employees, safety and occupational health, stakeholder participation in society and community, social and environmental problems, community connections, natural resource conservation, and emission levels. Customers will sense and judge the firms' responsibility and ethics. When they get good quality products and reasonable price, this will result in high level of trust. High trust leads to positive word of mount, which is essential for company success in social and worldwide market.

5.2.6 The hypothesis H6 intended to examine an influence of transformational leadership on sustainability performance through lean manufacturing

The finding showed that there is a partial effect of lean manufacturing on the relationship between transformational and sustainability performance. Based on omnipotent management view, it is suggested that the organizational success result from management skills and competencies. Meanwhile, the symbolic management view proposed that firm will achieve their goals due to opportunities from both external and internal environment. External opportunities occur from economics situations, demographic trend, social and culture, government policy, and politics. On the other hand, internal opportunities come from operational systems, employee skill and development, and organizational culture.

Managers take responsibility in creating change to reduce wastes and increase productivity and quality, motivating employees to utilize their effort and voluntary in high level, inspiring followers to understand the vision of top management, willing to be a part of company, behaving as brand personalities that create organizational culture such as working smart, extra voluntary, transparency, responsibility, and ethics. When employees from all level work together in the same directions and harmony, this will result in changes and adaptations that coincidence with dynamic and ferocious completion. Changes, continuous improvement, and all supply chain member involvement are critical success factors of lean manufacturing. Company accomplishing in doing lean will get good outcomes, including high profits, high sales and market shares, lower production cost, reduce in manufacturing time, good product quality, high level of brand image, and high level of customer and society satisfaction.

5.2.7 The hypothesis H7 intended to examine an influence of sustainable leadership on sustainability performance through lean manufacturing.

According to the author's knowledge, it is revealed for the first time that there is a partial effect of lean manufacturing on the relationship between sustainable leadership and sustainability performance, which are the added contributions to research in academic field. Leaders who possess multi skills such as technical, operational, human skill, conceptual skill, team and culture building, innovation creation, and employee engagement building, are able to coach and support employees when they face problems. When employees believe in managers, they will believe in themselves, trust in operational and lean practice, willing to employ more effort and discretionary in their job, which finally brings about superior firm performance.

5.2.8 Discussion of H8 to H11

The quantitative results reported that the model is partial difference between companies which operated in automotive and non-automotive companies, and the model is partial difference between companies which implemented lean program less than 5 years and above 5 years. According to the author's knowledge, it is the first time which revealed that influence of type of industry and length of lean adoption on the simultaneous relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability which are the added contributions to research in academic field.

The hypothesis H8 intended to examine a moderate of type of industry on the relationships among transformational leadership, lean manufacturing, and sustainability performance. The results showed that industry has moderate effect on the path from transformational leadership and lean production whereas industry has no moderate effect on the rest of all path levels. Consistent with hypothesis H10 which intended to examine a moderate of type of industry on the relationships among sustainable leadership, lean manufacturing, and sustainability performance. The results showed that industry has moderate effect on the path from sustainable leadership and lean production whereas industry has no moderate effect on the rest of all path levels.

The hypothesis H9 intended to examine a moderate of length of lean adoption on the relationships among transformational leadership, lean manufacturing, and sustainability performance. The results showed that length of lean adoption has moderate effect on the simultaneous structural relationship whereas length of lean adoption has no moderate effect on all of the path levels.

Meanwhile, hypothesis H11 intended to examine a moderate of length of lean adoption on the relationships among sustainable leadership, lean manufacturing, and sustainability performance. The results showed that industry has moderate effect on the path from sustainable leadership and lean production whereas length of lean adoption has no moderate effect on the rest of all path levels.

Automotive companies familiar with lean practices for long time thus leaders can improve lean level easier than nonautomotive which implement lean in early stage which is consistent with qualitative results. Transformational leaders must affect the firm by describing the organizational vision, explaining commitment and creating a sense of unity to implement lean practices across the whole company and all employees, making sure that the company will be able to accomplish its goals (Bodla & Nawaz, 2010). In addition, transformational leaders can inspire motivations and eagerness through clarifying the defining of lean and the challenge of its practice to all employees. Communication throughout the company is essential (Ling, Simsesk, Lubatkin & Veiga, 2008). In addition, transformational must educate employees so that employees have the required knowledge of lean practices and are aware of the operational problems if lean practices are not implemented. Nevertheless, the leader should stimulate employees in new and creative ways of solving problem, provide feedback and encourage to achieve the job and overcome obstacles and support employee development, then employees are able to solve problems by themselves (Bodla & Nawaz, 2010; Woehl, 2011; Vinodh & Joy, 2012)

Sustainable leaders encourage lean level by respect employees and customers. Heizer and Render (2014) proposed that lean production respects employees by giving them the opportunity to enrich both jobs and their lives. Company recognizes

that employees know more about their jobs than anyone else. Employees are empowered to make improvements. Lean production begins externally with a focus on the external customer including end users and society. Understanding what the external customer wants and ensuring they input and feedback are starting points for lean production. Lean operations means identifying external customer value by analyzing all the activity required to produce the product and then optimizing the entire process from the external customer's perspective.

In addition, the results revealed that the relationship between lean manufacturing and sustainability performance is no difference in terms of both industry type and length of lean adoption. This confirms the concept that lean can be applied in any industry, any size, or anyplace (White et al., 1999; Shah & Ward, 2003; Anand & Kodali, 2008). Since the managers informed that they realized that lean practices are appropriate for automotive industry, though less attention and implementation in other industries. Moreover, qualitative results reported that two companies informed that fully success which come from electric and plastic industry. Due to fully success companies do not come from automotive industry which supported quantitative results that lean practices can apply in any industry. The first thing to do before launching lean program to all process is that the company should buy-in the understanding of managers about lean concept and implementation. Willingness with well understanding and realizing importance of lean program will lead to superior results, especially operational (Hallgren & Olhanger, 2009; Alsmadi, Almani & Jerisat, 2012; Arawati & Mohd, 2012; Marynell, 2013; Chanegrih & Creusier, 2016), economic (Taj & Morosan, 2011; Hibadullah et al., 2013; Hong, Yang & Dobrzykowski, 2014; Sharma, Dixit & Qadri,

2015), and environmental and social performance (Curkovic et al., 2000; King & Lenox, 2001; Burawat, 2017).

Finally, the results reported that the relationship between transformational leadership and sustainability performance, and the relationship between sustainable leadership and sustainability performance are no difference in terms of both industry type and length of lean adoption. Concept of transformational leadership is universal so can apply and get superior results in any industry and any situation. Even though, the concept of sustainable leadership and environmental and social performance is novel; however, the results confirmed that both of them appropriate for all companies and all industries. Consistent with Gurr (2007) proposed sustainable leadership takes into deliberation a comprehensive scope of complex interconnections among personals, the business community, worldwide demands and the natural environment, with the essential objective that a company accomplishes well-being by concerning social values, obtaining success in long-term based on strategic decision-making value and preservation the ecosystem, of which we all form an integral part. In addition, sustainable leadership creates communities, encourages cooperation among stakeholders and fosters value in long-term. The relevance of sustainable leadership for chargeable strategic decision making in sustainable companies is obvious in the method it directs the sustainable leaders attentions with regard to four fields of deliberation when making decisions. It requires that top executives adopts a macro view of the company (Avery & Bergsteiner, 2011) due to sustainability associates with a variety dimensions of development and performance (Casserley & Critchley, 2010): (1) on a individual level: keeping physical health and individual psychological; (2) at the business level: keeping a workplace surrounding that permits workers to improve manifold knowledge with the

goal of accomplishing the company's purposes, which are linked up with the goals of stakeholders; (3) at the social level: socially-responsible handling in the broader community; and (4) on the ecological level: preservation and sustainable environmental change.

5.3 Recommendations

5.3.1 Managerial implication

The findings provide some implications for the practitioners and entrepreneurs. The results show that lean manufacturing will result in high level of operational, financial, social and environmental performance, which is worth taking more attention. In addition, Thai managers tend to understand that lean manufacturing is suitable for only automotive industry. Nevertheless, the results confirmed that it can be applied for any manufacturing as well as any company size. Moreover, at present, there are many studies asserting that it can also be applied in service industry.

This research indicates that both transformational and sustainable leadership styles have significant positive influences on lean practice and sustainability performance. Based on this result, organizational managers should consider applying leadership style appropriately to working situations and characteristics of their employees. When a leader appropriately applies leadership characteristics, he is creating an atmosphere of motivated workforce and a competitive enterprise. From this positive atmosphere, the leader will be able to drive lean practice implementation and the organization will achieve superior performance and will be able to survive and grow in the current era of fiercely competitive business environment and economic fluctuations.

The resulting firm will have more opportunities and more profitability operation processes and motivated and inspired employees.

Successful lean production requires serious cooperation and attentions of all employees across company; thus, managers should create the good two-way relationship, sharing, caring, bottom up communication, and free-rein culture with their employees. Effective supply chain management is imperative by close communications and relations with suppliers, distributors, and customers.

5.3.2 Implications for future research

The results offer several implications for scholarly researchers. First, due to the scarce studies of sustainable leadership and sustainability performance, the future study should augment knowledge by investigating the antecedent and consequence of these two variables. Second, the future study would be to examine other potential independent and dependent factors of lean manufacturing practice. According to the fact, the relationship between a variety of independent factors and lean manufacturing practice incline to be more robust for leadership style, followership style, size of company, competition level, and degree of technology and innovation. As a consequence, the research in the future would be to investigate the moderate and/or mediate influences of these factors on the relationship between independent variables and lean production. In addition, the future investigation might examine the magnitude to which interventions could create a lean manufacturing practice for leading higher organizational performance. Finally, the successful lean production required cooperation across all members of supply chain, which takes time and thus requires longitudinal study.

5.4 Limitations of the Study

There are some expected potential limitations. Firstly, there are some effects of external factors, which may involve transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance, such as political issues, macroeconomics, microeconomics, and economic crisis. Secondly, as the study applied self-report and cross-sectional data, the summarizations could not only make causal extrapolations but also increase some effects about common bias. Thus, a study in long term is necessary so as to offer greater definitive summarization. Thirdly, the results explain the small and medium manufacturing firms' circumstances and activities which may not be consistent with the service companies as well as large companies. Lastly, the results describe situations and activities of firms operating in Thailand, which may not be compatible with international and multinational corporations.

5.5 Conclusions

This study fulfills the vague knowledge by confirming the relationships among transformational leadership, sustainable leadership, lean manufacturing, and sustainability performance. In addition, this study augments the comprehension that lean manufacturing can be applied in any industry. Accomplished lean implementation requires serious and much attention from all members across company, suppliers, distributors, and customers. Successful lean managers need insight comprehension about lean concept and implementation before persuading their employees to do with higher willingness and cooperation. Referring to the scarcity of lean manufacturing success at recent time (Pay, 2006), it is possibly to be a challenge for the coming research to discover antecedent, consequent, and intervention factors, which will result

in superior understanding of the lean production notions and utilizations. Successful lean implementation will generate better financial outcomes and lower cost, thanks to the willingness of all employees and efficient processes, which leads to all of sustainable competitiveness, including operational, financial, social, and environmental performance.

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APPENDICES

APPENDIX A

Experts Invitation Letter

ที่ ศธ 0578.06/ 184

คณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี
ตำบลคลองหก อำเภอธัญบุรี
จังหวัดปทุมธานี 12110

30 มีนาคม 2559

เรื่อง ขอความอนุเคราะห์ในการวิเคราะห์เนื้อหาและตรวจสอบความน่าเชื่อถือของข้อมูลงานวิจัย

เรียน ดร.ศุภกร พรหิรัญกุล

ด้วย ดร.ปิยฉัตร บูระวัฒน์ อาจารย์ประจำสาขาวิชาการจัดการ สังกัดคณะบริหารธุรกิจ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี กำลังดำเนินการโครงการวิจัย เรื่อง "The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry" ซึ่งขณะนี้อยู่ในขั้นตอนการเก็บข้อมูลงานวิจัย

ในการนี้ คณะบริหารธุรกิจ จึงขอความอนุเคราะห์จากท่านในการวิเคราะห์เนื้อหาและตรวจสอบความน่าเชื่อถือของข้อมูลงานวิจัย เพื่อใช้เป็นข้อมูลประกอบการทำวิจัยดังกล่าว ทั้งนี้สามารถติดต่อผู้ประสานงานวิจัยได้ที่ เบอร์โทรศัพท์ 091-7411818

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ด้วย จะขอบพระคุณยิ่ง

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.นาถรพี ชัยมงคล)
คณบดีคณะบริหารธุรกิจ

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ที่ ศธ 0578.06/ 1862

คณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี
ตำบลคลองหก อำเภอธัญบุรี
จังหวัดปทุมธานี 12110

30 มีนาคม 2559

เรื่อง ขอความอนุเคราะห์ในการวิเคราะห์เนื้อหาและตรวจสอบความน่าเชื่อถือของข้อมูลงานวิจัย

เรียน ดร.ฤทธิพล ไชยบุรี

ด้วย ดร.ปิยฉัตร บูระวัฒน์ อาจารย์ประจำสาขาวิชาการจัดการ สังกัดคณะบริหารธุรกิจ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี กำลังดำเนินการโครงการวิจัย เรื่อง "The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry" ซึ่งขณะนี้อยู่ในขั้นตอนการเก็บข้อมูลงานวิจัย

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คณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี
ตำบลคลองหก อำเภอธัญบุรี
จังหวัดปทุมธานี 12110

๓๐ มีนาคม 2559

เรื่อง ขอความอนุเคราะห์ในการวิเคราะห์เนื้อหาและตรวจสอบความน่าเชื่อถือของข้อมูลงานวิจัย

เรียน คุณวุฒิพงษ์ ปะวะสาร

ด้วย ดร.ปิยฉัตร บูระวัฒน์ อาจารย์ประจำสาขาวิชาการจัดการ สังกัดคณะบริหารธุรกิจ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี กำลังดำเนินการโครงการวิจัย เรื่อง "The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry" ซึ่งขณะนี้อยู่ในขั้นตอนการเก็บข้อมูลงานวิจัย

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APPENDIX B

Semi-Structural In-depth Interview

ชื่อโครงการวิจัย ความสัมพันธ์ระหว่างภาวะผู้นำ การผลิตแบบลีน ประสิทธิภาพการดำเนินงาน ประสิทธิภาพการเงิน และสภาพแวดล้อมที่ยั่งยืน (The relationships among leadership style, lean manufacturing practice, operational performance, financial performance, and sustainability environment)

ผู้ให้สัมภาษณ์.....ตำแหน่ง.....

วันที่สัมภาษณ์.....เวลา.....

ชื่อบริษัท.....ประเภทอุตสาหกรรม.....

ที่อยู่บริษัท

.....

.....

1. ประวัติบริษัทโดยสังเขป

.....

.....

2. ปัจจุบันบริษัทมีการประยุกต์ใช้ระบบการผลิตแบบลีนในรูปแบบใดบ้าง และระดับเท่าใด

.....

.....

3. ในฐานะที่ท่านซึ่งทำงานในหน้าที่ผู้จัดการหรือสูงกว่า ท่านคิดว่าตัวผู้นำหรือพฤติกรรมของผู้นำส่งผลต่อความสำเร็จของการประยุกต์ลีน หรือไม่ อย่างไร

.....

.....

.....

4. ในฐานะที่ท่านซึ่งทำงานในหน้าที่ผู้จัดการหรือสูงกว่า ท่านคิดว่าตัวผู้นำหรือพฤติกรรมของผู้นำส่งผลต่อความประสิทธิภาพองค์การ หรือไม่ อย่างไร

.....

.....

5. ประโยชน์ของการประยุกต์ใช้ลีน คืออะไรบ้าง มีปัจจัยอื่นๆ ที่ท่านคิดว่าส่งผลต่อความสำเร็จหรือความสำเร็จของลีนหรือไม่อย่างไร

.....

.....

6. ข้อเสนอแนะเพิ่มเติม

.....

APPENDIX C

Questionnaire Consent and Permission

Lean Manufacturing of Shah & Ward

MLQ5X of Avolio & Bass

Ask permission to use 10 dimensions of Lean Manufacturing Survey for Academic Research

Piyachatbu <piyachatbu@gmail.com>

2 June: To rshah <rshah@csom.umn.edu>, , ward.1 <ward.1@osu.edu>

Dear Sir/Madam: Rachna Shah, Peter T. Ward

My name is Dr. Piyachat Burawat. I am a lecturer worked for faculty of business administration at Rajamangala University of Technology Thanyaburi Thailand (RMUTT).

My research topic involves the Relationships among Transformational Leadership Style, Lean Manufacturing, and Organizational Performance in the Manufacturing Industry in Thailand . I plan to use 10 dimensions survey of Lean manufacturing to measure the Lean Manufacturing in my research. The current study initially targeted a sample 500 of current managers or above.

I am currently writing the methodology section of my research (proposal). At present, I am considering with structural equation model (SEM) analysis to test framework model.

I would like to confirm that my study is for non-commercial educational research propose only also I agree to share my data (SPSS) with you.

Thank you so much for all the research you've done on dimensions of lean manufacturing, and for allowing the use of the Lean Manufacturing Scale for education research.

Best regards,

Dr. Piyachat Burawat
Faculty of Business administration
The Rajamangala University of Technology Thanyaburi, Thailand
piyachatbu@gmail.com
Cell (66)894865461

Rachna Shah <shahx024@umn.edu>

2 June: To me, Rachna, Peter

Dear Dr. Piyachat,

You have our permission to use the scales for your academic research. We would greatly appreciate if you can share the data with us.

Please let me know if you have any additional questions related to method and/or other ideas -- I would be happy to help. Sincerely,

rachna

Professor Rachna Shah
Associate Professor
Supply Chain and Operations Department
3-215 Carlson School of Management
University of Minnesota

Multifactor Leadership Questionnaire™

Instrument (Leader and Rater Form)

and Scoring Guide (Form 5X-Short)

by Bruce Avolio and Bernard Bass

Published by Mind Garden, Inc.

info@mindgarden.com
www.mindgarden.com

Ref. No.0578.06/๓๑๕๐

Faculty of Business Administration
Rajamangala University of Technology Thanyaburi
Klong Hok, Pathum Thani, Thailand 12110

10 June ,2016

Dear Managing Director/ Factory Manager/ Manager

Subject Request for assistance about the research information

As Dr.Piyachat Burawat, a lecturer working for Faculty of Business Administration, Rajamangala University of Technology Thanyaburi, is conducting a research on "The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry".

Therefore, Faculty of Business Administration, Rajamangala University of Technology Thanyaburi would like to ask for your assistance to complete a questionnaire that will ask about your thoughts and experiences in your workplace. The data collected from individual questionnaires will be treated confidentially and will not be identifiable to any particular participant. Your participation is voluntary, so you may refuse to participate or feel free to withdraw your participation at any time without fear of penalty. All of the information in this consent form will be reviewed with you verbally, and the individual presenting this information to you will be able to answer any question that you may have via the contact number 0894865461 or piyachat_b@rmutt.ac.th.

Thank you for your cooperation in this project.

Yours sincerely,

Nartraphee Chaimongkol

Nartraphee Chaimongkol, Ph.D.
Assistant Professor of Economics
Dean of Faculty of Business Administration
Rajamangala University of Technology Thanyaburi

Faculty of Business Administration, Rajamangala
University of Technology Thanyaburi
Dr.Piyachat Burawat
Tel+669 1741 1818

ที่ คธ 0578.06/ 2010

คณะบริหารธุรกิจ
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ตำบลคลองหก อำเภอธัญบุรี
จังหวัดปทุมธานี 12110

8 เมษายน 2559

เรื่อง ขอความอนุเคราะห์ขอข้อมูลสำหรับงานวิจัย

เรียน กรรมการผู้จัดการ/ผู้จัดการโรงงาน/ผู้จัดการแผนกผลิต

ด้วย ดร.ปิยฉัตร บูระวัฒน์ อาจารย์ประจำสาขาวิชาการจัดการ สังกัดคณะบริหารธุรกิจ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี กำลังดำเนินการโครงการวิจัย เรื่อง "The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry"

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จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ด้วย จะขอบพระคุณยิ่ง

ขอแสดงความนับถือ

(ผู้ช่วยศาสตราจารย์ ดร.กุสุมา ตำพิทักษ์)
รองคณบดีฝ่ายวิชาการและวิจัย รักษาราชการแทน
คณบดีคณะบริหารธุรกิจ

สำนักงานคณบดี
โทร.0 2549 3243
โทรสาร.0 2549 3243
http://www.bus.rmutt.ac.th

เรียน ท่านผู้ตอบแบบสอบถาม

แบบสอบถามนี้เป็นส่วนหนึ่งของการวิจัยของมหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี ในหัวข้อวิจัยเรื่อง “The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry” ข้อมูลที่เก็บรวบรวมจากแบบสอบถามของแต่ละบุคคลจะถูกเก็บไว้เป็นความลับและไม่สามารถระบุตัวตนของผู้ตอบแบบสอบถามแต่ละคนได้ ข้อมูลที่เก็บรวบรวมได้จะถูกนำไปศึกษาแนวโน้มที่เกี่ยวข้องกับหัวข้องานวิจัยของผู้วิจัย ขอบคุณสำหรับความร่วมมือและการมีส่วนร่วมในหัวข้อวิจัยนี้

ดร. ปิยฉัตร บูระวัฒน์

089-4865461, 091-7411818, piyachatbu@gmail.com

คณะบริหารธุรกิจ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

<u>ส่วนที่ 1: ข้อมูลทั่วไป</u>

1. ชื่อบริษัท……..
2. ตำแหน่ง/หน้าที่……
3. เพศ ☐ 1) ชาย ☐ 2) หญิง
4. อายุ (ปี) ☐ 1) น้อยกว่า 30 ปี ☐ 2) 30 - 35 ☐ 3) 36-40 ☐ 4) สูงกว่า 40 ปี
5. การศึกษา ☐ 1) ต่ำกว่าปริญญาตรี ☐ 2) ปริญญาตรี ☐ 3) ปริญญาโท ☐ 4) ปริญญาเอก
6. อุตสาหกรรม ☐ 1) เคมีภัณฑ์ ☐ 2) ปิโตรเคมี ☐ 3) ไฟฟ้า/อิเล็กทรอนิกส์ ☐ 4) เหล็ก/เหล็กกล้า ☐ 5) ยานยนต์/ชิ้นส่วน ☐ 6) พลาสติก ☐ 7) รองเท้า/หนัง ☐ 8) อาหาร ☐ 9) ไม้/เครื่องเรือน ☐ 10) ยาง ☐ 11) กระดาษ/สิ่งพิมพ์ ☐ 12) สิ่งทอ/เครื่องนุ่งห่ม ☐ 13) ยา ☐ 14) ปูนซีเมนต์ ☐ 15) ……
7. อายุบริษัท ☐ 1) น้อยกว่า 1 ปี ☐ 2) 1-3 ปี ☐ 3) 4-5 ปี ☐ 4) 6-10 ปี ☐ 5) 11-15 ปี ☐ 6) สูงกว่า 15 ปี
8. จำนวนพนักงาน ☐ 1) น้อยกว่า 50 คน ☐ 2) 51 – 200 คน ☐ 3) สูงกว่า 200 คน
9. สหภาพแรงงาน ☐ 1) มี ☐ 2) ไม่มี
10. ระยะเวลาที่ประยุกต์ใช้การผลิตแบบลีน ☐ 1) น้อยกว่า 1 ปี ☐ 2) 1-3 ปี ☐ 3) 4-5 ปี ☐ 4) 6-10 ปี ☐ 5) 11-15 ปี ☐ 6) สูงกว่า 15 ปี
11. ประเภทการผลิต ☐ 1) ต่อเนื่อง (Mass) ☐ 2) ตามคำสั่ง (Job shop)
12. สินค้าคงคลังประเภทวัตถุดิบ (Raw Material Inventory) รวมทั้งหมด……..……..……..วัน
13. สินค้าคงคลังประเภทงานระหว่างทำ (Work in Process Inventory) รวมทั้งหมด……..วัน
14. สินค้าคงคลังประเภทสินค้าสำเร็จรูป (Finished Goods Inventory) รวมทั้งหมด……..วัน
15. อัตราของเสีย (Defect Rate)……%
16. ประสิทธิภาพโดยรวมของแผนกผลิต (Overall Efficiency)……%
17. อัตราผลตอบแทนต่อสินทรัพย์ (ROA) ……..……%

<u>ส่วนที่ 2: กรุณาประเมินว่าบริษัทที่ท่านทำงานอยู่นี้มีคุณลักษณะต่อไปนี้มากน้อยเพียงใด</u> (กรุณาทำเครื่องหมาย ✓ลงในช่องที่ตรงกับความคิดเห็นของท่าน โดยใช้สเกลต่อไปนี้)

(1) = มีการประยุกต์ใช้ระบบการผลิตแบบลีนในระดับน้อย

(2) = มีการประยุกต์ใช้ระบบการผลิตแบบลีนในระดับค่อนข้างน้อย

(3) = มีการประยุกต์ใช้ระบบการผลิตแบบลีนในระดับปานกลาง

(4) = คือ มีการประยุกต์ใช้ระบบการผลิตแบบลีนค่อนข้างมาก

(5) = คือ มีการประยุกต์ใช้ระบบการผลิตแบบลีนในระดับมาก

1. บริษัทของท่านมีการติดต่ออย่างใกล้ชิดกับบริษัทผู้จัดหาวัตถุดิบ	(1) (2) (3) (4) (5)
2. บริษัทผู้จัดหาวัตถุดิบมีการเข้าเยี่ยมชมบริษัทของท่านเป็นประจำอย่างต่อเนื่อง	(1) (2) (3) (4) (5)
3. บริษัทของท่านมีการเข้าเยี่ยมชมบริษัทผู้จัดหาวัตถุดิบเป็นประจำอย่างต่อเนื่อง	(1) (2) (3) (4) (5)
4. บริษัทของท่านมีการสะท้อนกลับบริษัทผู้จัดหาวัตถุดิบในเรื่องคุณภาพและประสิทธิภาพการส่งมอบ	(1) (2) (3) (4) (5)
5. บริษัทของท่านมีการสร้างความสัมพันธ์ระยะยาวกับผู้จัดหาวัตถุดิบ	(1) (2) (3) (4) (5)
6. บริษัทของท่านเปิดโอกาสให้บริษัทผู้จัดหาวัตถุดิบมีส่วนร่วมในการพัฒนาผลิตภัณฑ์ใหม่	(1) (2) (3) (4) (5)
7. บริษัทผู้จัดหาวัตถุดิบให้ความสำคัญกับระยะเวลาการส่งมอบวัตถุดิบ ใช้ส่งมอบแบบทันเวลาพอดี (JIT)	(1) (2) (3) (4) (5)
8. บริษัทของท่านมีการมอบใบประกาศให้กับบริษัทผู้จัดหาวัตถุดิบที่ผ่านเกณฑ์มาตรฐานที่บริษัทตั้งไว้	(1) (2) (3) (4) (5)
9. บริษัทผู้จัดหาวัตถุดิบให้ความสำคัญและมีข้อผูกพันกับบริษัทของท่าน เกี่ยวกับการลดต้นทุน	(1) (2) (3) (4) (5)
10. ตำแหน่งของบริษัทผู้จัดหาวัตถุดิบ ตั้งอยู่ใกล้กับบริษัทของท่าน	(1) (2) (3) (4) (5)
11. ในสถานการณ์ที่มีความสำคัญ บริษัทของท่านมีการสื่อสารในระดับองค์การกับบริษัทผู้จัดหาวัตถุดิบ	(1) (2) (3) (4) (5)
12. บริษัทของท่านมีขั้นตอนที่มีมาตรฐานและเป็นระบบ สำหรับการพิจารณาลดจำนวนบริษัทผู้จัดหาวัตถุดิบ	(1) (2) (3) (4) (5)
13. บริษัทผู้จัดหาวัตถุดิบให้ความสำคัญกับการบริหารสินค้าคงคลัง	(1) (2) (3) (4) (5)
14. บริษัทของท่านประเมินบริษัทผู้จัดหาวัตถุดิบจากต้นทุนรวม (ไม่ใช่การประเมินจากต้นทุนต่อหน่วย)	(1) (2) (3) (4) (5)
15. บริษัทของท่านมีการติดต่อกับลูกค้าอย่างใกล้ชิด	(1) (2) (3) (4) (5)
16. ลูกค้ามีการเข้าเยี่ยมชมบริษัทของท่านเป็นประจำอย่างต่อเนื่อง	(1) (2) (3) (4) (5)
17. ลูกค้ามีการสะท้อนกลับบริษัทผู้จัดหาวัตถุดิบในเรื่องคุณภาพและประสิทธิภาพการส่งมอบ	(1) (2) (3) (4) (5)
18. บริษัทของท่านเปิดโอกาสให้ลูกค้ามีส่วนร่วมในการพัฒนาผลิตภัณฑ์ใหม่และผลิตภัณฑ์ในอนาคต	(1) (2) (3) (4) (5)
19. บริษัทของท่านเปิดโอกาสให้ลูกค้ามีส่วนร่วมในการพัฒนาผลิตภัณฑ์ใหม่และผลิตภัณฑ์ในอนาคต เป็นประจำอย่างต่อเนื่อง	(1) (2) (3) (4) (5)
20. บริษัทของท่านเปิดโอกาสให้ลูกค้ามีส่วนร่วมในการ ให้ข้อมูลกับฝ่ายตลาด เกี่ยวกับความต้องการในปัจจุบันและอนาคต	(1) (2) (3) (4) (5)
21. บริษัทของท่านมีการสำรวจความพึงพอใจของลูกค้าอย่างจริงจังต่อเนื่อง	(1) (2) (3) (4) (5)
22. บริษัทของท่านใช้ระบบการผลิตแบบดึง (Pull System) สำหรับการส่งมอบสินค้าสำเร็จรูป	(1) (2) (3) (4) (5)

23. บริษัทของท่านใช้ระบบการผลิตแบบดึงในแต่ละสถานีงาน เกี่ยวกับความต้องการปัจจุบัน (1) (2) (3) (4) (5)
และความต้องการที่แท้จริงของสถานีงานถัดไป

24. บริษัทของท่านใช้ระบบการผลิตแบบดึง (Pull System) (1) (2) (3) (4) (5)

25. บริษัทของท่านมีการควบคุมการผลิตโดยใช้บัตรคัมบัง (Kamban) พื้นที่ใช้สอย และตู้คอนเทนเนอร์ (1) (2) (3) (4) (5)

26.บริษัทของท่าน มีการจำแนกผลิตภัณฑ์ตามกระบวนการทำงานที่เหมือนกัน (1) (2) (3) (4) (5)

27. บริษัทของท่าน มีการจำแนกผลิตภัณฑ์ตามเส้นทางการเดินผลิตภัณฑ์ที่เหมือนกัน (1) (2) (3) (4) (5)

28. บริษัทของท่าน มีการจัดกลุ่มเครื่องจักรอุปกรณ์ ให้สอดคล้องกับกระบวนการการผลิตแบบต่อเนื่อง (1) (2) (3) (4) (5)

29. บริษัทของท่าน มีการวางผังโรงงาน ผังเครื่องจักร ให้สอดคล้องกับแต่ละกลุ่มผลิตภัณฑ์ (1) (2) (3) (4) (5)

30. บริษัทของท่าน มีการวางแผนการผลิตตามอัตราความต้องการของลูกค้า (1) (2) (3) (4) (5)

31. บริษัทของท่าน มีการวางแผนการปฏิบัติงานของพนักงาน ที่สามารถลดเวลาในการทำงาน (1) (2) (3) (4) (5)

32. บริษัทของท่าน ใช้เวลาน้อย/สั้น ในการเตรียมตัวของพนักงาน ก่อนเริ่มปฏิบัติงาน (1) (2) (3) (4) (5)

33. บริษัทของท่าน ใช้เวลาน้อย/สั้น ในการปรับตั้งเครื่องจักร อุปกรณ์ ก่อนเริ่มปฏิบัติงาน (1) (2) (3) (4) (5)

34. บริษัทของท่าน มีรอบการผลิตที่ใช้เวลานาน เพื่อป้องกันการเปลี่ยนแปลงความต้องการที่รวดเร็วได้ (R) (1) (2) (3) (4) (5)

35. บริษัทของท่าน มีรอบการจัดหาที่ใช้เวลานาน เพื่อป้องกันการเปลี่ยนแปลงความต้องการที่รวดเร็วได้ (R) (1) (2) (3) (4) (5)

36. บริษัทของท่าน มีการใช้เครื่องจักร/กระบวนการ ทั้งจำนวนและคุณภาพ อยู่ภายใต้การควบคุมทางสถิติ (1) (2) (3) (4) (5)

37. บริษัทของท่าน มีการใช้เทคนิคทางสถิติอย่างเข้มงวด เพื่อลดความแปรปรวนของกระบวนการ (1) (2) (3) (4) (5)

38. บริษัทของท่าน มีการใช้แผนภาพ/กราฟ เพื่อช่วยอธิบายอัตราของเสียให้กับหน่วยปฏิบัติการ (1) (2) (3) (4) (5)

39. บริษัทของท่าน มีการใช้แผนภูมิก้างปลา เพื่อช่วยหาสาเหตุ ที่เกี่ยวกับปัญหาด้านคุณภาพ (1) (2) (3) (4) (5)

40. บริษัทของท่าน มีการศึกษาความสามารถของกระบวนการก่อนทำการผลิตจริง (1) (2) (3) (4) (5)

41. บริษัทของท่าน เปิดโอกาสให้พนักงานระดับปฏิบัติการ มีส่วนร่วมและทำหน้าที่หลักในทีมแก้ไขปัญหา (1) (2) (3) (4) (5)

42. บริษัทของท่าน เปิดโอกาสให้พนักงานระดับปฏิบัติการ ได้เสนอแนะแนวคิดเพื่อการปรับปรุง/พัฒนา (1) (2) (3) (4) (5)

43. บริษัทของท่าน เปิดโอกาสให้พนักงานระดับปฏิบัติการ ทำหน้าที่หลักในการพัฒนาการผลิต/กระบวนการ (1) (2) (3) (4) (5)

44. บริษัทของท่าน เปิดโอกาสให้พนักงานระดับปฏิบัติการ ได้รับการอบรมเพื่อให้ทำงานข้ามสายการผลิตได้ (1) (2) (3) (4) (5)

45. บริษัทของท่าน มีการวางแผนการบำรุงรักษาเครื่องจักร/อุปกรณ์ทุกวัน สอดคล้องกับกิจกรรมการทำงาน (1) (2) (3) (4) (5)

46. บริษัทของท่าน มีการบำรุงรักษาเครื่องจักร/อุปกรณ์ ให้สามารถทำงานได้อย่างเป็นปกติ สม่ำเสมอ (1) (2) (3) (4) (5)

47. บริษัทของท่าน มีการบันทึกข้อมูลทั้งหมดของเครื่องจักร/อุปกรณ์ ซึ่งสอดคล้องกับกิจกรรมการทำงาน (1) (2) (3) (4) (5)

48. บริษัทของท่าน มีการบันทึกข้อมูลการใช้งานเครื่องจักร/อุปกรณ์ หลังจากที่มีการซ่อมบำรุงแล้ว (1) (2) (3) (4) (5)
โดยพนักงานระดับปฏิบัติการเป็นผู้ให้ข้อมูลสะท้อนกลับ

<u>ส่วนที่ 3: กรุณาประเมินว่าท่านมีลักษณะต่อไปนี้มากน้อยเพียงใด</u> (กรุณาทำเครื่องหมาย ✓ลงในช่องที่ตรงกับความคิดเห็นของท่าน โดยใช้สเกลต่อไปนี้)

(1) = ไม่เห็นด้วยอย่างมาก, (2) = ไม่เห็นด้วย, (3) = เฉยๆ, (4) = เห็นด้วย, (5) = เห็นด้วยอย่างมาก

1. ท่านให้การสนับสนุน ให้ความช่วยเหลือผู้ใต้บังคับบัญชา	(1) (2) (3) (4) (5)
2. ท่านมีการตรวจสอบข้อสันนิษฐาน/แนวทางในการแก้ไขปัญหาของผู้ใต้บังคับบัญชา	(1) (2) (3) (4) (5)
3. ท่านจะไม่เข้าไปก้าวก่าย/แทรกแซงการทำงานของผู้ใต้บังคับบัญชา ยกเว้นกรณีที่เป็นปัญหาที่รุนแรง	(1) (2) (3) (4) (5)
4. ท่านให้ความสนใจกับการไม่ปฏิบัติตามกฎระเบียบ ความผิดพลาด ข้อยกเว้น และการเบี่ยงเบนจากค่าปกติ	(1) (2) (3) (4) (5)
5. ท่านหลีกเลี่ยงในการมีส่วนร่วม เมื่อเห็นว่าปัญหามีความสำคัญเพิ่มขึ้น	(1) (2) (3) (4) (5)
6. ท่านให้ความสำคัญเกี่ยวกับคุณค่าและความเชื่อ	(1) (2) (3) (4) (5)
7. ท่านไม่ได้อยู่ด้วย เมื่อผู้ใต้บังคับบัญชาต้องการท่าน	(1) (2) (3) (4) (5)
8. ท่านมองหามุมมองที่แตกต่างในการหาทางแก้ไขปัญหา	(1) (2) (3) (4) (5)
9. ท่านมีมุมมองในทิศทางที่ดี/ทิศทางบวก เกี่ยวกับสถานการณ์ในอนาคต	(1) (2) (3) (4) (5)
10. ท่านมีความภาคภูมิใจในผู้ใต้บังคับบัญชา สำหรับการให้ความช่วยเหลือการทำงานของท่าน	(1) (2) (3) (4) (5)
11. ท่านมีการอภิปรายร่วมกันกับผู้มีส่วนรับผิดชอบ ที่ทำให้บรรลุตามเป้าหมายที่ตั้งไว้	(1) (2) (3) (4) (5)
12. ท่านรอให้เกิดความผิดพลาดก่อน แล้วค่อยเข้าไปทำการแก้ไขปัญหา	(1) (2) (3) (4) (5)
13. ท่านกระตือรือร้นในการกล่าวถึงสิ่งที่จำเป็น เพื่อให้การทำงานสามารถบรรลุเป้าหมายที่ตั้งไว้	(1) (2) (3) (4) (5)
14. ท่านให้ความสำคัญโดยเฉพาะกับวัตถุประสงค์ที่สามารถเป็นจริงได้	(1) (2) (3) (4) (5)
15. ท่านใช้เวลาในการสอนและการให้คำแนะนำ	(1) (2) (3) (4) (5)
16. ท่านให้ความชัดเจนเกี่ยวกับสิ่งที่คาดหวังและสิ่งที่จะได้รับ ถ้าการทำงานมีประสิทธิภาพ บรรลุเป้าหมาย	(1) (2) (3) (4) (5)
17. ท่านมีความเชื่อว่า “ถ้าไม่เกิดปัญหา อย่าเข้าไปร่วมหาทางแก้ไข”	(1) (2) (3) (4) (5)
18. เมื่อท่านพิจารณา การทำงานเป็นกลุ่มที่ดี ท่านได้มองข้ามความรู้สึก/ความสนใจส่วนตัวของท่าน	(1) (2) (3) (4) (5)
19. ท่านให้คำแนะนำ/ข้อเสนอแนะ กับผู้ใต้บังคับบัญชาอย่างเป็นกันเอง/ส่วนบุคคล ไม่ใช่การทำเพราะหน้าที่	(1) (2) (3) (4) (5)
20. ท่านแสดงให้เห็นว่า ต้องเป็นปัญหาที่รุนแรงเท่านั้น จึงจะเข้าไปร่วมแก้ไข	(1) (2) (3) (4) (5)
21. แนวทางการทำงานของท่าน เป็นไปในทิศทางที่ทำให้ผู้ใต้บังคับบัญชาเคารพนับถือ	(1) (2) (3) (4) (5)
22. ท่านให้ความสนใจทั้งหมดในการแก้ไขความผิดพลาด ข้อร้องเรียน และ ข้อบกพร่อง	(1) (2) (3) (4) (5)
23. ท่านให้ความสำคัญกับขวัญ กำลังใจและ การตัดสินใจด้านจริยธรรม	(1) (2) (3) (4) (5)
24. ท่านให้ความสนใจ และติดตามความผิดพลาดทั้งหมด	(1) (2) (3) (4) (5)
25. ท่านรู้สึกว่าท่านมีอำนาจและความมั่นใจในตนเอง	(1) (2) (3) (4) (5)
26.ท่านให้ความสนใจกับเรื่องของสถานการณ์ในอนาคต	(1) (2) (3) (4) (5)
27. ท่านให้ความสนใจไปยังข้อบกพร่อง และการปฏิบัติงานที่ทำให้ได้ตามมาตรฐาน	(1) (2) (3) (4) (5)

28. ท่านหลีกเลี่ยงการเป็นผู้ตัดสินใจ (1) (2) (3) (4) (5)

29. ท่านเชื่อว่าผู้ใต้บังคับบัญชาแต่ละคนมีความต้องการ ความสามารถ และแรงบันดาลใจที่แตกต่างกัน (1) (2) (3) (4) (5)

30. ท่านสนับสนุนให้ผู้ใต้บังคับบัญชา มองเห็นปัญหาในมุมมองที่แตกต่าง หลากหลาย (1) (2) (3) (4) (5)

31. ท่านสนับสนุนให้ผู้ใต้บังคับบัญชา สามารถพัฒนาจุดแข็งของตนเองได้ (1) (2) (3) (4) (5)

32. ท่านชี้แนะแนวทางใหม่ๆ เพื่อให้ผู้ใต้บังคับบัญชา มองเห็นวิธีการทำงานที่สามารถบรรลุผลสำเร็จได้ (1) (2) (3) (4) (5)

33. ท่านมีการตอบสนองที่ล่าช้า ในกรณีที่เป็นคำถามที่มีความเร่งด่วน (1) (2) (3) (4) (5)

34. ท่านเน้นและให้ความสำคัญกับพันธกิจ (1) (2) (3) (4) (5)

35. ท่านมีความพึงพอใจ เมื่อผู้ใต้บังคับบัญชาสามารถปฏิบัติงานได้ตามที่คาดหวังไว้ (1) (2) (3) (4) (5)

36. ท่านมีความเชื่อมั่นว่าเป้าหมายที่ตั้งไว้ สามารถประสบความสำเร็จได้ (1) (2) (3) (4) (5)

37. ท่านมีความสามารถในการมอบหมายงานให้ตรงกับความต้องการของผู้ใต้บังคับบัญชา (1) (2) (3) (4) (5)

38. ท่านสามารถใช้กระบวนการของภาวะผู้นำได้ และอยู่ในระดับที่น่าพึงพอใจ (1) (2) (3) (4) (5)

39. ท่านมอบหมายงานให้ผู้ใต้บังคับบัญชาในระดับที่สูงกว่าระดับที่ผู้ใต้บังคับบัญชาคาดหวังว่าสามารถทำได้ (1) (2) (3) (4) (5)

40. ท่านมีความสามารถในการเป็นตัวแทน สำหรับผู้มีอำนาจที่สูงกว่าท่านได้ (1) (2) (3) (4) (5)

41. ผู้ใต้บังคับบัญชาทำงานร่วมกับท่านด้วยความพึงพอใจ (1) (2) (3) (4) (5)

42. ท่านปรารถนาให้ผู้ใต้บังคับบัญชาประสบความสำเร็จ (1) (2) (3) (4) (5)

43. ท่านสามารถปฏิบัติตามความต้องการขององค์การได้ (1) (2) (3) (4) (5)

44. ท่านสามารถจูงใจให้ผู้ใต้บังคับบัญชา สามารถทำงานที่หนัก/ยาก ได้ด้วยความเต็มใจ (1) (2) (3) (4) (5)

45. ท่านสามารถนำทีมของท่าน ให้เป็นทีมที่มีความสามารถ (1) (2) (3) (4) (5)

<u>ส่วนที่ 4: กรุณาประเมินว่าท่านมีลักษณะต่อไปนี้มากน้อยเพียงใด</u> (กรุณาทำเครื่องหมาย ✓ลงในช่องที่ตรงกับความคิดเห็นของท่าน โดยใช้สเกลต่อไปนี้) (1) = ไม่เห็นด้วยอย่างมาก, (2) = ไม่เห็นด้วย, (3) = เฉยๆ, (4) = เห็นด้วย, (5) = เห็นด้วยอย่างมาก

1. ท่านให้การสนับสนุน เพื่อพัฒนาศักยภาพของผู้ใต้บังคับบัญชา	(1) (2) (3) (4) (5)
2. ท่านมีความสัมพันธ์ที่ดีกับผู้ใต้บังคับบัญชา	(1) (2) (3) (4) (5)
3. ท่านให้ความสำคัญกับการธำรงรักษาพนักงานที่มีในปัจจุบัน	(1) (2) (3) (4) (5)
4. ท่านให้ความสำคัญกับความสำเร็จที่เกิดจากการวางแผนที่ดี	(1) (2) (3) (4) (5)
5. ท่านเห็นคุณค่าของผู้ใต้บังคับบัญชา	(1) (2) (3) (4) (5)
6. ท่านมีความสัมพันธ์ที่ดีกับผู้บริหารระดับสูง	(1) (2) (3) (4) (5)
7. ท่านให้ความสำคัญกับจริยธรรมในการบริหารทั้งต่อองค์การและต่อผู้ใต้บังคับบัญชา	(1) (2) (3) (4) (5)
8. ท่านให้ความสำคัญกับการวางแผนทั้งในระยะสั้นและระยะยาว	(1) (2) (3) (4) (5)
9. ท่านให้ความสำคัญกับการเปลี่ยนแปลงขององค์การ	(1) (2) (3) (4) (5)
10. ท่านให้ความสำคัญกับผลประกอบการและส่วนแบ่งการตลาด	(1) (2) (3) (4) (5)
11. ท่านให้ความสำคัญกับการมีส่วนร่วมรับผิดชอบต่อสิ่งแวดล้อม	(1) (2) (3) (4) (5)
12. ท่านให้ความสำคัญกับการมีส่วนร่วมรับผิดชอบต่อสังคม (CSR)	(1) (2) (3) (4) (5)
13. ท่านวิสัยทัศน์เกี่ยวกับการบริหารงานทางธุรกิจ	(1) (2) (3) (4) (5)
14. ท่านให้ความสำคัญกับผู้มีส่วนได้ส่วนเสียทุกระดับ	(1) (2) (3) (4) (5)
15. ท่านมีความสามารถในการตัดสินใจได้	(1) (2) (3) (4) (5)
16. ท่านสามารถบริหารตัวท่านเองได้	(1) (2) (3) (4) (5)
17. ท่านสามารถบริหารทีมงานของท่านได้	(1) (2) (3) (4) (5)
18. ท่านสามารถสร้างวัฒนธรรมให้กับองค์กรได้	(1) (2) (3) (4) (5)
19. ท่านให้ความสำคัญกับการถ่ายทอดความรู้ และธำรงรักษาความรู้เหล่านี้ได้	(1) (2) (3) (4) (5)
20. ท่านเชื่อมั่นในผู้ใต้บังคับบัญชาของท่าน	(1) (2) (3) (4) (5)
21. ท่านให้ความสำคัญกับการสร้างสรรค์นวัตกรรม	(1) (2) (3) (4) (5)
22. ท่านให้ความสำคัญกับการสร้างความผูกพันในงานและองค์การ	(1) (2) (3) (4) (5)
23. ท่านให้ความสำคัญกับคุณภาพของงาน	(1) (2) (3) (4) (5)

<u>ส่วนที่ 5: กรุณาประเมินว่าท่านมีลักษณะต่อไปนี้มากน้อยเพียงใด</u> (กรุณาทำเครื่องหมาย ✓ลงในช่องที่ตรงกับความคิดเห็นของท่าน โดยใช้สเกลต่อไปนี้) (1) = ไม่เห็นด้วยอย่างมาก, (2) = ไม่เห็นด้วย, (3) = เฉยๆ, (4) = เห็นด้วย, (5) = เห็นด้วยอย่างมาก

1. บริษัทของท่าน สามารถส่งมอบผลิตภัณฑ์ได้เร็วกว่าบริษัทคู่แข่ง	(1) (2) (3) (4) (5)
2. บริษัทของท่าน มีต้นทุนการผลิตต่อหน่วย ต่ำกว่าบริษัทคู่แข่ง	(1) (2) (3) (4) (5)
3. บริษัทของท่าน มีประสิทธิภาพการปฏิบัติการโดยรวม สูงกว่าบริษัทคู่แข่ง	(1) (2) (3) (4) (5)
4. บริษัทของท่าน มีระดับความพึงพอใจของลูกค้า สูงกว่าบริษัทคู่แข่ง	(1) (2) (3) (4) (5)
5. บริษัทของท่าน มีอัตราผลประกอบการ สูงกว่าบริษัทคู่แข่ง	(1) (2) (3) (4) (5)

<u>ส่วนที่ 6: กรุณาประเมินว่าท่านมีลักษณะต่อไปนี้มากน้อยเพียงใด</u> (กรุณาทำเครื่องหมาย ✓ลงในช่องที่ตรงกับความคิดเห็นของท่าน โดยใช้สเกลต่อไปนี้)

(1) = เพิ่มขึ้นในระดับต่ำกว่า 0 % (ลดลง) (2) = เพิ่มขึ้นในระดับ 0 % (เท่าเดิม)

(3) = เพิ่มขึ้นในระดับ 1-10 % (4) = เพิ่มขึ้นในระดับ 11-20 % (5) = เพิ่มขึ้นในระดับสูงกว่า 21 %

1. บริษัทของท่าน มีผลกำไรในระดับใดเมื่อเทียบกับ 3 ปีที่แล้ว	(1) (2) (3) (4) (5)
2. บริษัทของท่าน มีส่วนแบ่งการตลาดเพิ่มขึ้นในระดับใดเมื่อเทียบกับ 3 ปีที่แล้ว	(1) (2) (3) (4) (5)
3. บริษัทของท่าน มีแนวโน้มยอดขายเพิ่มขึ้นเพิ่มขึ้นในระดับใดเมื่อเทียบกับ 3 ปีที่แล้ว	(1) (2) (3) (4) (5)
4. บริษัทของท่าน มีอัตราผลตอบแทนต่อสินทรัพย์เพิ่มขึ้นในระดับใดเมื่อเทียบกับ 3 ปีที่แล้ว	(1) (2) (3) (4) (5)

<u>ส่วนที่ 7: กรุณาประเมินว่าท่านมีลักษณะต่อไปนี้มากน้อยเพียงใด</u> (กรุณาทำเครื่องหมาย ✓ลงในช่องที่ตรงกับความคิดเห็นของท่าน โดยใช้สเกลต่อไปนี้) (1) = ไม่เห็นด้วยอย่างมาก, (2) = ไม่เห็นด้วย, (3) = เฉยๆ, (4) = เห็นด้วย, (5) = เห็นด้วยอย่างมาก

1. บริษัทของท่าน มีการจ้างงานพนักงานที่หลากหลาย เช่น หลากหลายสัญชาติ ศาสนา วัฒนธรรม	(1) (2) (3) (4) (5)
2. นอกจากการวัดผลด้านการเงินแล้ว บริษัทของท่านให้ความสำคัญกับประสิทธิภาพด้านอื่นๆ ด้วย	(1) (2) (3) (4) (5)
3. บริษัทของท่านให้ความสำคัญกับสุขภาพและความปลอดภัยของพนักงาน	(1) (2) (3) (4) (5)
4. บริษัทของท่าน ให้ความสำคัญกับการมีส่วนร่วมของผู้มีส่วนได้ส่วนเสียในชุมชน สังคม และผลกระทบด้านสิ่งแวดล้อม	(1) (2) (3) (4) (5)
5. บริษัทของท่าน ให้ความสำคัญกับความสัมพันธ์กับชุมชน	(1) (2) (3) (4) (5)
6. บริษัทของท่าน ให้ความสำคัญกับความพึงพอใจของพนักงาน	(1) (2) (3) (4) (5)
7. บริษัทของท่านให้ความสำคัญกับปัญหาด้านอื่นๆที่เกิดกับชุมชน จริยธรรม สังคมและสิ่งแวดล้อม	(1) (2) (3) (4) (5)
8. บริษัทของท่าน ให้ความสำคัญกับการอนุรักษ์ทรัพยากรและระดับการปล่อยของเสียสู่สิ่งแวดล้อม	(1) (2) (3) (4) (5)

โปรดกรุณากรอกข้อมูล ชื่อ-สกุล เบอร์โทรศัพท์หรืออีเมล์ **<u>ซึ่งข้อมูลที่เก็บในส่วนนี้จะถูกปกปิดเป็นความลับ</u>** จะใช้เพื่อผู้วิจัยทำการสุ่มตรวจสอบว่าพนักงานเก็บข้อมูล ได้ทำการเก็บข้อมูลจริงเท่านั้น

ชื่อ-สกุล……..……..……**เบอร์โทร**……..……..

อีเมล์…….

Part 1: Demographic information

1. Company name……..
2. Position……
3. Gender ☐ 1) Male ☐ 2) Female
4. Age ☐ 1) < 30 ☐ 2) 30-35 ☐ 3) 36-40 ☐ 3) > 40
5. Education ☐ 1) Below bachelor ☐ 2) Bachelor's degree
   ☐ 3) Master's degree ☐ 4) Doctor's degree
6. Industry ☐ 1) Chemical ☐ 2) Petroleum ☐ 3) Electronics
   ☐ 4) Steel ☐ 5) Automotive ☐ 6) Plastic
   ☐ 7) Shoes ☐ 8) Food ☐ 9) Furniture
   ☐ 10) Tire ☐ 11) Paper ☐ 12) Garment
   ☐ 13) Pharmaceutical ☐ 14) Cement ☐ 15)……
7. Age of company ☐ 1) < 1 year ☐ 2) 1-3 year ☐ 3) 4-5 year
   ☐ 4) 6-10 year ☐ 5) 11-15 year ☐ 6) > 15 year
8. Size of employee ☐ 1) < 50 ☐ 2) 51-200 ☐ 3) > 200
9. Any labor union in the company? ☐ 1) Yes ☐ 2) No
10. How long does the company ☐ 1) < 1 year ☐ 2) 1-3 year
    apply lean manufacturing ? ☐ 3) 4-5 year ☐ 4) 6-10 year
    ☐ 5) 11-15 year ☐ 6) > 15 year
11. Type of process in the company? ☐ 1) Mass/Continuous ☐ 2) Job shop
12. How many inventory come from raw material?.....day
13. How many inventory come from work in process?.....day
14. How many inventory come from finish goods?.....day
15. Defect rate ……..%
16. Overall efficiency (OEE)……%
17. Return on asset (ROA)……%

Part 2: Please indicate the extent of implementation of the following practices in your plant. (1) no implementation; (2) little implementation; (3) some implementation; (4) extensive implementation; (5) complete implementation.

Item Label	Scale				
	1	2	3	4	5
Supplier Feedback:					
1. We frequently are in close contact with our suppliers					
2. Our suppliers seldom visit our plants (reverse code)					
3. We seldom visit our supplier's plants (reverse code)					
4. We give our suppliers feedback on quality and delivery performance					
5. We strive to establish long-term relationship with our suppliers					
Just in Time Delivery by Suppliers:					
6. Suppliers are directly involve in the new product development process					
7. Our key suppliers deliver to plant on JIT basis					
8. We have a formal supplier certification program					
Supplier Development:					
9. Our suppliers are contractually committed to annual cost reductions					
10. Our key suppliers are located in close proximity to our plants					
11. We have corporate level communication on important issues with key suppliers					
12. We take active steps to reduce the number of suppliers in each category					
13. Our key suppliers manage our inventory					
14. We evaluate suppliers on the basis of total cost and not per unit price					
Customer Involvement:					
15. We frequently are in close contact with our customers					
16. Our customers seldom visit our plants (reverse code)					
17. Our customers give us feedback on quality and delivery performance					
18. Our customers are actively involved in current and future product offerings					
19. Our customers are directly involved in current and future product offerings					

Item Label	Scale				
	1	2	3	4	5
Customer Involvement (Cont'):					
20. Our customers are frequently share current and future demand information with marketing department					
21. We regularly conduct customer satisfaction surveys					
Pull System:					
22. Production is "pulled" by the shipment of finished goods					
23. Production at stations is "pulled" by the current demand of the next station					
24. We use a "pull" production system					
25. We use Kanban, squares, or containers of signals for production control					
Continuous Flow:					
26. Products are classified into groups with similar processing requirements					
27. Products are classified into groups with similar routing requirements					
28. Equipment is grouped to produce a continuous flow of families of products					
29. Families of products determine our factory layout					
30. Pace of production is directly linked with the rate of customer demand					
Set up Time Reduction:					
31. Our employees practice setups to reduce the time required					
32. We are working to lower set up times in our plant					
33. We have low set up times of equipment in our plant					
34. Long production cycle times prevent responding quickly to customer requests (reverse coded)					
35. Long supply lead times prevent responding quickly to customer requests (reverse coded)					

Item Label	Scale				
	1	2	3	4	5
Statistical Process Control:					
36. Large number of equipment/processes on shop floor are currently under SPC					
37. Extensive use of statistical techniques to reduce process variance					
38. Charts showing defect rates are used as tools on the shop-floor					
39. We use fishbone type diagrams to identify causes of quality problems					
40. We conduct process capability studies before product lunch					
Total Productive/Preventive Maintenance:					
41. Quick deliver compare competitor					
42. Unit cost of product relative to customer					
43. Overall productivity					
44. Overall customer satisfaction					
Employee Involvement:					
45. We dedicate a portion of everyday to planned equipment maintenance related activities					
46. We maintain all our equipment regularly					
47. We maintain excellent records of all equipment maintenance related activities					
48. We post equipment maintenance records on shop floor for active sharing with employees					

Part 3: Please indicate the extent of multi-factor leadership as you perceive it.

(1) no extent; (2) little extent; (3) some extent; (4) extensive extent; (5) great extent.

Item Label	Scale				
	1	2	3	4	5
1. I provide others with assistance in exchange for their efforts					
2. I re-examine critical assumptions to question whether they are appropriate					
3. I fail to interfere until problems become serious					
4. I focus attention on irregularities, mistakes, exceptions, and deviations from standards					
5. I avoid getting involved when important issues arise					
6. I talk about my most important values and beliefs					
7. I am absent when needed					
8. I seek differing perspectives when solving problems					
9. I talk optimistically about the future					
10. I instill pride in others for being associated with me					
11. I discuss in specific terms who is responsible for achieving performance targets					
12. I wait for things to go wrong before taking action					
13. I talk enthusiastically about what needs to be accomplished					
14. I specify the importance of having a strong sense of purpose					
15. I spend time teaching and coaching					
16. I make clear what one can expect to receive when performance goals are achieved					
17. I show that I am a firm believer in "If it ain't broke, don't fix it"					
18. I go beyond self-interest for the good of the group					
19. I treat others as individuals rather than just as a member of a group					
20. I demonstrate that problems must become chronic before I take action					
21. I act in ways that build others' respect for me					
22. I concentrate my full attention on dealing with mistakes, complaints, and failures					
23. I consider the moral and ethical consequences and decisions					
24. I keep track of all mistakes					

Item Label	Scale				
	1	2	3	4	5
25. I display a sense of power and confidence					
26. I articulate a compelling vision of the future					
27. I direct my attention towards my failures to meet standards					
28. I avoid making decisions					
29. I consider an individual as having different needs, abilities, and aspirations from others					
30. I get others to look at problems from many different angles					
31. I help others to develop their strengths					
32. I suggest new ways of looking at how to complete assignments					
33. I delay responding to urgent questions					
34. I emphasize the importance of having a collective sense of mission					
35. I express satisfaction when others meet expectations					
36. I express confidence that goals will be achieved					
37. I am effective in meeting others' job-related needs					
38. I use methods of leadership that are satisfying					
39. I get others to do more than they expected to do					
40. I am effective in representing others to higher authority					
41. I work with others in a satisfactory way					
42. I heighten others' desire to succeed					
43. I am effective in meeting organizational requirements					
44. I increase others' willingness to try harder					
45. I lead a group that is effective					

Part 4: Please indicate the extent of sustainability leadership as you perceive it.

(1) no extent; (2) little extent; (3) some extent; (4) extensive extent; (5) great extent.

Item Label	Scale				
	1	2	3	4	5
Foundation practices					
1. Developing people					
2. Labor relations					
3. Retaining staff					
4. Succession planning					
5. Valuing staff					
6. CEO and top team					
7. Ethical behavior					
8. Long-term or short-term perspective					
9. Organizational change					
10. Financial markets orientation					
11. Responsibility for environment					
12. Social responsibility (CSR)					
13. Stakeholders					
14. Vision's role in the business					
Higher-level practices					
15. Decision making					
16. Self-management					
17. Team orientation					
18. Culture					
19. Knowledge sharing and retention					
20. Trust					
Key performance drivers					
21. Innovation					
22. Staff engagement					
23. Quality					

Part 5: Please indicate the level of your company's operational performance compare to your competitors in 5 point likert scale whereby, (1) is the worst in industry, (3) is the moderate in industry, and (5) is the best in industry.

Item Label	Scale				
	1	2	3	4	5
1. Quick deliver compare competitor					
2. Unit cost of product relative to competitors					
3. Overall productivity					
4. Overall customer satisfactions					
5. Higher return on asset compare competitor					

Part 6: Please indicate the financial performance has changed in the past 3 years in 5 point likert scale whereby, (1) is less than 0%, (2) is equal 0%, (3) is increased 1-10%, (4) is increased 11-20%, and (5) is increased higher than 21%.

Item Label	Scale				
	1	2	3	4	5
1. Our profitability has changed in the past 3 years					
2. Our market share has changed in the past 3 years					
3. Our sales volume has changed in the past 3 years					
4. Our return on asset (ROA) has changed in the past 3 years					

Part 7: Please indicate the extent of environmental and social performance in your plant.

(1) no extent; (2) little extent; (3) some extent; (4) extensive extent; (5) great extent.

Item Label	Scale				
	1	2	3	4	5
1. Employee diversity					
2. Economics impacts (excluding financial measures used in financial accounts)					
3. Occupation health and safety					
4. Stakeholder involvement in community, social and environmental issues					
5. Community relations					
6. Employee satisfaction					
7. Other community, ethical, social and environmental issues					
8. Natural resource conservation and emission levels					

Data collected from individual questionnaires will be treated confidentially and will not be identifiable to any particular participant. Your participation is voluntary that you may refuse to participate or feel free to withdraw your participation at any time without fear of penalty. All of the information may be reviewed with you verbally, and the individual presenting this information to you will be able to answer any question that you may have.

Participant's name……

Contact number…….…….email……..……..

APPENDIX D

Article Manuscript

1. **Thammasat Review**
2. **International Journal of Applied Engineering Research (Scopus)**

The Mediate Effect of Lean Manufacturing on the Relationship between Sustainable Leadership and Sustainability Performance

Piyachat Burawat
Rajamangala University of Technology Thanyaburi, Business Administration, 39 Moo1 Klong6 Thanyaburi, 12110, Pathumthani, Thailand, piyachat_b@gmail.com

Abstract

This study proposes to examine the structural relationship model among sustainable leadership, lean manufacturing practices, and sustainability performance. In addition, this study is aimed to explore the relationship between sustainable leadership and sustainability performance through lean manufacturing. Moreover, this study is intended to explore the moderate effect of type of industry and length of lean adoption on the simultaneous relationships among sustainable leadership, lean manufacturing, and sustainability performance. The research design is based on the mixed method gathering data from middle and senior managers working in small and medium enterprises of Thai manufacturing industry. Regarding the quantitative approach, the data were collected from 598 respondents by means of survey. Considering the proposed theoretical model, the results reported that sustainable leadership associated with lean manufacturing and sustainability performance, and lean manufacturing related to sustainability performance. In addition, the results further reported that lean manufacturing has a partial mediated effect on the relationship between sustainable leadership and sustainability performance. Moreover, the results showed that the relationship between sustainable leadership and lean manufacturing is difference in terms of both industry type and length of lean adoption. The results further presented that the relationships between lean manufacturing and sustainability performance, and between sustainable leadership and sustainability performance are no difference in terms of both type of industry and length of lean adoption. Qualitative approach was employ to collect data from 40 participants who informed that lean practices were appropriate for automotive industry, though less attention and implementation in other industries. The company takes the most attention on customer involvement, some attention on employee and supplier involvement, which is consistent with quantitative results. Managers tend to give advices and exchange ideas with their followers rather than inspire and give them opportunities to make decision. The first thing to do before launching lean program to all process is that the company should buy-in the understanding of managers about lean concept and implementation. Willingness with well understanding and realizing importance of lean program will lead to superior results, especially operational, economic, and sustainability performance.

Keywords: Sustainable Leadership, Lean Manufacturing, Sustainability Performance, Manufacturing Industry

Introduction

Currently, globalization leads to free communication without borders; this results in high competition in both national and global markets. In addition, labor wages of Thai labors are nearby Malaysian workers; however, Malaysian productivity is of double value compared to Thailand's. Meanwhile, Thai employee wage is 5 times higher than that of Vietnamese workers but Thai productivity is only twice compared to Vietnam's. Meanwhile, Singapore wage is double of Thai wage but Singapore productivity is 5 times higher than Thailand's (Burawat, 2016). In addition, Thailand's labor productivity is raised by 2% per year, which is very poor once compared to other nations such as China and Vietnam, with the increase by 10% and 4%, respectively (Tansakul & Sutthiwatanaruputh, 2014). The unit labor costs of Thailand increased by 3% while Indonesia fell by 12% (Tansakul & Sutthiwatanaruputh, 2014). Inventory is one of the most expensive assets of many firms, representing as much as 50% of total invested capital. Therefore, managers have long recognized that good inventory management is

important. Furthermore, a firm can decrease costs by decreasing inventory. On the contrary, production may stop and consumers become discontented when a product is not enough. (Heizer & Render, 2014).

According to high competition, low productivity, and high inventory, firms operating in manufacturing industry are imperative to explore strategies to raise profit, productivity and quality while decreasing costs, defects, and lead time delivery to end users, all of which need the mutual support of all supply chain members from suppliers, subcontractors, employees, management teams, distributors, and customers. Although 70% of all manufacturing firms take much attention on lean manufacturing, only 26% are significant success (Pay, 2006). Successful lean program is associated with management attention, clarifying goals and directions, seriously involvements and practices of all members, employees' empowering, clear measurement criteria, obvious plan for improved process (Smalley, 2005; Longenecker, Moore, Petty & Palich, 2006).

The existing researches place an emphasis on the relation of leadership behaviors and practices that leads to successful lean implementations. The research literature falls short of considering that one leadership model might be more appropriate for success within lean implementations. The new kind of paradigm in leadership could be called sustainable leadership characterized by three core processes including learning through doing, having a clear sense of personal purpose and awareness of personal assumptions and motivations, and effective management of stress and sufficient self-care (Casserley & Crichley, 2010). Since sustainable leadership is lacking in scholarly field, the theoretical foundation has not been fully developed. In addition, according to the author's knowledge, it is the first time that the relationship between sustainable leadership and lean manufacturing as well as the influence of lean manufacturing on the relationship between sustainable leadership and sustainability performance has been described, which are the added contributions to research in academic field.

The most regularly cited advantages associated with lean manufacturing are development in labor productivity and quality, along with the decrease in lead time to customer, cycle time, and production costs (White, Pearson & Wilson, 1999; Marynell, 2013). However, some studies presented that some lean manufacturing aspects were connected organizational performance. Moreover, some studies revealed that there is no connection between lean manufacturing and performance (Kaplan & Norton, 1992; Hibadullah, Fuzi, Chiek Desa & Zamri, 2013). In addition, some studies reported that lean manufacturing has an effect on financial performance through operational performance (Fullerton & Wempe, 2009; Burawat, 2017).

Regarding the above concepts, the relationships among leadership style, lean manufacturing, and performance are equivocal. Thus, this study intends to investigate the simultaneous relationships among sustainable leadership, lean manufacturing practices, and sustainability performance in Thai manufacturing industry. Furthermore, this study intends to examine the relationship between sustainable leadership and sustainability performance through lean manufacturing. In addition, this study aims to investigate the moderate effect of type of industry and length of lean adoption. The results of this study provide insight information in an efficient form for a company's operational system, which in turn will create sustainable development despite sudden or severe changes in the international competitive environment.

Literature Review

Sustainable leadership

The new kind of paradigm in leadership could be called sustainable leadership. McCann and Holt (2011) defined that the sustainability is concerning with the creation of current and future profits for a firm while improving the lives of all concerned. Meanwhile,

Kiewiet and Vos (2007) stated that the topic of sustainable leadership is found in the business definitions of sustainability and becoming more influential in business today. The triple bottom line (TBL) perspective is the prevailing idea when considering the notion of sustainability and sustainable leadership. This concept focuses on leadership in organizations on balancing people, profits, and planet for a sustainable future (Elkington, 1997). Casserley and Crichley (2010) proposed that sustainable leadership is characterized by three core processes, i.e. learning through doing, having a clear sense of personal purpose and awareness of personal assumptions and motivations, and effective management of states and sufficient self-care.

Peterlin, Pearse, and Dimovski (2015) explained that transformational leadership and sustainable leadership are similar to each other in the following main four ideas, i.e. their dedication to understanding all demands of stakeholders, intellectual stimulation of stakeholders, motivation by inspiration action, and individualized treatment of stakeholders (Bass, Avolio, Jung & Berson, 2003). Looking at the difference, transformational leadership focuses more on personal charisma or idealized influence in influencing current followers (House, Spangler & Woycke, 1991) whereas sustainable leadership focuses on pursuing the value of sustainability at the individual, organizational, social and ecological levels for both current and future generations (Peterlin et al., 2015). Gurr (2007) stated that sustainability is at the first phase of being introduced on the scale of introduction-evaluation-consolidation of the concept into a big theory, and further explained that it is still not at the level of a mature theoretical concept. Since sustainable leadership is scarce in academic area, the theoretical foundation has not been fully developed. This study is the incremental contributions to sustainable leadership research.

Lean manufacturing

Lean production or lean manufacturing, frequently conceived as Toyota production system (TPS) in scholarly publications, began in Toyota Motor Manufacturing Company after the 2nd World War when almost all Japanese companies which include Toyota Manufacturing Company were encountered with the challenge of tackling production resources with restricted assets and facilities (Liker, 1998; Pavnaskar, Gersheenson & Jambekar, 2003). This challenge inspired managers worked for Toyota to initiate a variety of TPS's elements purposed at eliminating waste. Therefore, lean manufacturing is about manufacturing the same product quantity with lower resources (working hours, working area, machine hours, material, instruments, and equipment). Recently, lean practice has advocated Toyota accomplish the difference of being the best manufacturer in the world who produce car (Stewart & Raman, 2007).

Lean manufacturing is a strategy used to improve the manufacture and delivery of a product (to a customer's expectation) by means of a purpose-designed facility and process, utilizing an interconnected array of supply chains. Lean production is classified by the academician community mostly into three levels. The first level associates with wasted elimination from the production process (Ohno, 1988; Womack & Jones, 1996) and the efficiency to make the excellent quality products that can fulfill the need of final buyers. For the second level, some researchers construe lean as a rule controlling production process (Spear & Bowen, 1999). The final level is seen as a combination of techniques and means (Shah & Ward, 2003; Basu, 2009) intended to remove waste. Regarding well-known study, Shah and Ward (2007) separated lean production into ten aspects, including supplier feedback, just in time delivery by suppliers, supplier development, customer involvement, pull system, continuous flow, set up time reduction, total productive/preventive maintenance, and employee involvement.

Sustainability performance

Since the expanding attention of all kinds of stakeholders in company activities in recent rivalry situation, there have been crowded studies in area of corporate

sustainability performance evaluation. Firms are struggling to succeed long-term benefits by applying sustainability activities as principal organizational strategy (Chabowski, Mena & Gonzalez-Padron, 2011). The firms, whose aim is outstandingly seen as being one of economic return, might be greater readily excused for separately reporting voluntary sustainability assesses.

Takala and Pallab (2000) proposed that corporate sustainability performance generally focuses on the environmental, social, and economic performance of sustainable development. Meanwhile, sustainability performance is described by Schaltegger and Wagner (2006) as the performance of a firm in all aspects and for all corporate sustainability drivers. Fiksel, Mcdaniel & Mendenhall (1999) mentioned that it extends beyond the single organization boundaries and typically addresses the performance of both upstream suppliers and downstream consumers in the value chain. To sum up, sustainability performance involves performance in related with: level of emission and natural resource saving; other environmental activities and initiatives; employment features; occupational health and safety; relationships with society and community; involvement of stakeholder; and economic impacts of the organization other than those financial assesses applied in the financial accounts. The previous study presents the scarcity of accountability for environmental and social performance. Although there has been a gush of studies in corporate sustainability performance evaluation area, there is still no concurred universal guideline or standard. Generally, there are some measures commonly mentioned or applied by companies in opting sustainability performance assesses.

Hypothesis Development

Almost every scholar and practitioner publications mentioned that leadership enables or inhibits of success of lean implementation (Suárez-Barraza & Ramis-Pujol, 2010). However, there are indications to recommend that some efforts of lean implementation disappointed even with commitment of top management. The research literature falls short of regarding that one leadership model might be better suitable for achieve within lean implementations (Herkness, 2005) such as transformational leadership (Holm, 2010; Woehl, 2011; Cheerawit, Napompech & Panjakhajornsak, 2014), transactional leadership (Howell & Hall-Merenda, 1999, Burawat, 2017), lean leadership (Aij & Rapsaniotis, 2017), and servant leadership (Aij & Rapsaniotis, 2017). However, there is no actual attempts has been developed to determine what actively leadership actually is (Suárez-Barraza & Ramis-Pujol, 2010).

According to the novel leadership paradigm could be entitled sustainable leadership is almost similar to transformational notion (Peterlin et al., 2015); thus, assume that sustainable leadership encourage lean program.

Based on the above concept, there is lack of empirical study on the relationship between sustainable leadership and lean manufacturing practices. Accordingly, there is ambiguity on what is the suitable leadership style on lean manufacturing successful. Therefore, this paper intends to study the sustainable leadership; so the below hypothesis was thus examined.

H1: There is a positive relationship between sustainable leadership and lean manufacturing.

More presently, Avery and Bergsteiner (2010) suggested the Honeybee leadership concept associating with a humanistic and resilient viewpoint to collaborative sustainability that generates on the sustainable Rhineland leadership executes that Avery (2005) and others have analyzed. Avery and Bergsteiner (2011) reveal an evidence-based view of how 23 leadership practices that interact to build Honeybee leadership encourage results that move apart from the triple bottom line including environmental sustainability, collaborative social responsibility and financial effectiveness. In addition, Kantabutra and Avery (2013) conducted practices from

Thailand's biggest corporation, Siam Cement Group (SCG) and revealed that all six series of executions, which absolutely differ from the widespread business model of maximization short-term profitability but corresponding with the 23 sustainable leadership executions, were found to use in varying degrees to SCG. A total of 19 applied strongly, with three others moderately strong, given that sustainable leadership foundations are related to advocate brand and prominence, employee and customer satisfaction, and financial successfulness. The authors further suggested that even a publicly-listed organization can counteract pressures to correspond to business-as-usual executions and adopt the long-term, socially responsible principles of Honeybee sustainable leadership. In brief, Honeybee practices demonstrably drive organizations towards excellent business operations and superior performance; consequently supporting to the sustainability of an organization (Albert, 1992; Avery & Bergsteiner, 2010).

Meanwhile, Kantabutra and Saratun (2013) adopted a multi-data gathering means, researchers supplied case study data with participant observations, and reference to documentation and information provided by, or published about the university. Semi-structured interviews were conducted with various stakeholders in Thailand's oldest university. Six main series of executions correspond with 21 sustainable leadership practices are indicated: an interested on a long-term viewpoint, employee improvement, a vigorous innovation, organizational culture, social and environmental responsibility and ethical actions. According to sustainable leadership concepts relate to advocate brand and prominence, employee and customer satisfaction, and financial effectiveness, the sustainable leadership grid offers educational leaders with a productive checklist for this objective. Although most studies confirmed that sustainable leadership led to sustainability performance, some studies revealed the opposite results. For example, McCann and Sweet (2012) collected data from leaders in mortgage loan originator organizations. The survey revealed that high levels of both ethical and sustainable leadership were yielded. However, correlations between the perceived leadership survey and sustainable leadership questionnaire did not prove to be dependent or closely correlate. So there is vague to identify that sustainable leadership lead to sustainability performance. In addition, the relevance of sustainable leadership principles to enterprises in less developed economies remains to be investigated. This study attempts to uncover this unknown. Regarding the above notion, the below hypothesis was thus investigated.

H2: There is a positive relationship between sustainable leadership and sustainability performance.

Considering the relationship between lean manufacturing and performance, Ravet (2012) conducted a literature review and concluded that lean manufacturing have long been linked to improved operational performance. And there is evidence that these process improvement philosophies and their associated tools improve environmental performance as well (Curkovic, Melnyk, Hanfield & Calantone, 2000; King & Lenox, 2001). Laohavichien and Wanarat (2013) investigated the relationship between lean manufacturing and organizational performance derived data from 119 Thai manufacturing firms. The results show that lean practices have a direct and significant impact on organizational and innovation performance. This is in compliance with Ruangchoengchum (2015), who revealed that there is significance between performance related to lean manufacturing that affects net profit of SMEs in the manufacturing sector in Thailand. Moreover, the interview and survey of Kiatcharoenpol, Laosirihongthong, Chaiyawong & Glincha-em (2015) with lean experts experienced in Thai SMEs consultant confirmed that lean practices lead to high level of organizational performance.

Moori, Pescarmona and Kimura (2013) conducted research from 68 executives in Brazil and indicated that there is a positive correlation between lean manufacturing and financial effectiveness result in return on asset, return on investment, profit before tax and interest, profit from operation, and incremental sale volume. This corresponds to

Agus and Iteng (2013), who studied 205 executives from Malaysia and revealed that there is a positive correlation between lean manufacturing and financial effectiveness result in return on sale, and return on investment.

Although, some studies found that some dimensions of lean manufacturing related to firm performance. However, other studies found that there is no relationship between lean manufacturing and performance (Kaplan & Norton, 1992; Hibadullah et al., 2013). Jayaram, Vickery and Droge (2008) studied in the automotive supplier industry in North America and reported that there is no relationship between lean manufacturing practice and overall firm performance. Meanwhile, Oslen (2004) studied the relationship between lean manufacturing, operational performance, and financial performance from 48 companies which operated in computer, electronics and electronic parts, measurement equipment, and medical equipment industry. The results found that the operational performance did not differ significantly when comparing the companies that use and do not use lean system. However, the companies that apply lean system have higher performance in return on equity than the companies that do not apply lean system. In addition, Fullerton and Wempe (2009) reported that there is a relationship between operational performance and financial performance. The results further revealed that there is no relationship between lean manufacturing and financial performance. Researchers further concluded that there is a connection between lean manufacturing and financial effectiveness through operational performance. Regarding the above concept, this study intend to confirmed the relationship by empirical study; so the below hypotheses were thus conducted.

H3: There is a positive relationship between lean manufacturing and sustainability performance.

Although there are many papers paying attention to leadership and lean practices, there is ambiguity on what is the suitable leadership style on lean manufacturing successful as a result of the lack of empirical study on the relationship between sustainable leadership and sustainability through lean manufacturing practices. Cheerawit et al. (2014) conducted research from 540 managers in Thailand's automotive part industry. The results found that there is a relationship between leadership and firm performance through lean manufacturing practices. This is corresponding to Masood (2015), who conducted survey from five different manufacturing organizations and revealed that for successful implementation of lean concept and to enjoy the benefits of lean system, deployment of transformational leaders can play a key role for achieving lean status. According to notion of sustainable leadership is almost similar to transformational leadership (Peterlin et al., 2015); thus, assume that there is mediate effect of lean manufacturing on the relationship between sustainable leadership and sustainability performance. Thus, the below hypothesis was thus investigated.

H4: There is a relationship between sustainable leadership and sustainability performance through lean manufacturing.

Still, the interest taken in lean by the western manufacturing community was limited until the performance gaps between Toyota and other carmakers were highlighted by the book The Machine that Changed the World, which also coined the term lean production (or lean manufacturing) (Womack, Jones & Roos, 1990). The exploration of the enterprise model, the infrastructure and practices that support lean production, promoted explicitly a thesis of transference and the ability of non-automotive and non-Japanese emulation based upon the premise that manufacturing problems and technologies were universal problems facing management (Womack et al., 1990). Lean utilization is not narrow to only the automotive industry, but, it has also obtained acceptance in a comprehensive scope of manufacturing industries conducting under non-unionized or unionized situation in the United State (Shah & Ward, 2003) or somewhere else (Cua, McKone & Schroeder, 2001; Anand & Kodali, 2008), and is being

implemented in large as well as little companies (White et al., 1999). Thus, the below hypotheses were thus investigated.

H5: There is a moderate effect of type of industry on the simultaneous relationships among sustainable leadership, lean manufacturing, and sustainability performance.

H6: There is a moderate effect of length of lean adoption on the simultaneous relationships among sustainable leadership, lean manufacturing, and sustainability performance.

Research Methodology

The objective of this study is to examine the structural relationship model among sustainable leadership, lean manufacturing practices, and sustainability performance, and to explore the relationship between sustainable leadership and sustainability performance through lean manufacturing in SMEs of Thai manufacturing industry. The study was investigated for eighteen months from May 2016 to October 2017 which conducted procedure of gathering and analyzing data from July 2016 to March 2017.

Bentler and Chou (1987) recommended that under theory of normal distribution, the proportion of sample size to amount of free parameters should be at least 5:1 to achieve trust worthy parameter estimates and in order to obtain reasonable significances tests although a proportion of 10:1 would be preferred (Bentler & Chou, 1987; Salkind, 2010; Kline, 2015). The amount of free parameters for this study equals 43. Accordingly, the proportion of sample size to amount of free parameters preferred at 10:1; and the lowest sample size for this study is 430.

Considering quantitative approach, the study was conducted and accomplished by using random sampling and snowball sampling from 598 current middle and top managers. The large scale study was performed by three techniques. The first technique is formal, in which the president, managing director, general manager, factory manager, and middle level managers of the firms were communicated accompanied with the letters authorized by the university to explain the objective, the significance, and the advantages of the study. Authorizations to distribute the paper or online questionnaire to their employees who worked for managers and above were certainly asked. The second technique is formal, in which the operators who manage the seminar topic concerning manufacturing industry were communicated accompanied with the letters authorized by the university to explain the objective, the significance, and the advantages of the study. Authorizations to distribute the paper questionnaire to their participants in this seminar who worked for manager position and above were certainly asked. The last technique is formal, in which the dean of business administration faculty and engineering faculty of both government and private university were communicated accompanied with the letters authorized by the university to explain the objective, the significance, and the advantages of the study. Authorizations to distribute the paper questionnaire to their graduate student studying in business administration major and engineering major while working for manager position and above were certainly asked.

As to the review of the literatures, the researcher has some comprehension about the amount of factors which are suitable to clarify the interrelationships among a set of questions (Spicer, 2005). Therefore, in this study, confirmatory factor analysis (CFA) was applied to assert the structure of factors by both validity and reliability analysis. This study is proposed to explain overall information, and the first order factor analysis was applied to examine the structure of factors of sustainable leadership, lean manufacturing, and sustainability performance.

The instrument is composed of four parts. The first part is demographic information of respondents and information of the companies. The second part is sustainable leadership which was created by Avery and Bergsteiner (2010). Next, lean

manufacturing was created by Shah and Ward (2007). The last part is sustainability performance separated into three dimensions; operational performance scale taken from Rahman, Laosirihongthong, & Sohal (2010), financial performance scale developed from Griffith, Huergo, Mairesse, & Peters (2006), Wiklund and Shepherd (2005), and Hung, Lien, Fang, and McLean (2010), and environmental and social performance developed from Global Reporting Initiative (2014) index. After the respondents gave back the questionnaires, the outcomes were analyzed by using confirm factor analysis (CFA) and structure equation model (SEM).

The qualitative data were collect by three methods from 40 participants. First, the data were collected by participant observation, whereby the researcher joined and worked as employees at company A and company B for 15 days from September to October 2016 which supported program that cooperation between faculty and private company. Second, the data were collected by non-participant observation in which the researcher walked, asked employees, and toured around the production line from 8 companies. Third, the data were collected from 30 participants by in-depth interviewed using semi-structure questions composed of four parts. First, demographic information of the companies such as type of industry, age of company, size of plant, number of employees, and union representation. In addition, this part includes the location, date, and time of the interview. The second part is the current situation of lean implementation. The third part is the current situation of leadership, relationship among leader and all company's members, solving problem, team, culture, and innovation. The last part is the organizational success due to apply lean practice and the overview and recommendations for manufacturing industry in Thailand. The study used a snowball sampling method to collect more participants. After observing and interviewing the initial participants, the researcher requested for assistance from the initial participants to assist explore participant with an identical attribute of attentiveness. Content analysis was done by means of content analysis by 3 professionals working for industrial management and industrial engineer in order to analyze the current situation, the problems, and to suggest solutions and guidance for organizational success related to lean implementation.

Table 1

The Minimum Criterion of Reliability and Validity Analysis

Analysis detail	Threshold/Minimum criterion
Reliability Analysis	
- Cronbach's alpha	- is above 0.70 (Nunnally & Bernstein, 1994; Kline, 2000; George & Mallery, 2003; DeVellis, 2012)
- Composite reliability	- is above 0.70 (Nunnally & Bernstein, 1994; Kifle, Mbarika, & Tan, 2007; Rodriguez, Perez, & Gutierrez, 2007; Kim & Malhotra, 2005)
Validity Analysis	
- IOC	- was tested by minimum three raters, all items of questionnaire that the IOC score was less than 0.5 were eliminated (Rovinelli & Hambleton, 1977; Hambleton, 1980; Thaveerat, 1997)
- *p*-value	- *p*-value associated with each loading should be significant (Nunnally & Bernstein, 1994; Awang, 2012)
- Factor loading	- is above 0.6 (Nunnally & Bernstein, 1994) - is above 0.5 for a newly developed items and is above 0.6 for an established items (Awang, 2012)
- Average variance extracted (AVE)	- is above 0.5 (Pavlou & Gefen, 2004; Rodriguez et al., 2007; Wang & Wang, 2012) - is above 0.4 is acceptable (Diamantopoulos & Siguaw, 2000)
- Discriminant validity (DV)	- AVE for each construct is greater than its shared variance with any other construct (Kim & Malhotra, 2005; Bhattacherjee & Sanford, 2006) or - factor loadings of each item must be greater than the cross loadings of items of other constructs (Pavlou & Gefen 2004; Bhattacherjee & Sanford, 2006)

Table 2

The Minimum Criterion of Model Fit Indices

Model fit index	Acceptable threshold levels	Comments
$\chi 2$ or CMIN	- should not be significant at a 0.05 threshold (p>0.05) (Awang, 2012) - should not be significant above 0.05 and 1.00 threshold to judge good fit (0.05<p≤1.00) and between 0.01 and 0.05 threshold to judge acceptable fit (0.01≤p≤0.05) (Schermelleh-Engel & Moosbrugger, 2003)	- adjusts for sample size (Hair, Anderson, Tatham & Black 2010; Hooper, Coughlan & Mullen, 2008) - sensitive to sample size (Byrne, 2001; Schermelleh-Engel & Moosbrugger, 2003) - sensitive to sample size > 200 (Wheaton, Muthen, Alwin & Summers, 1997)
$\chi 2$/df or CMIN/df	- should be between 2 and 3 to judge acceptable fit and between 0 and 2 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be less than 5.0 to judge the reasonable fit (Marsh & Hocevar, 1985; Bentler, 1989; Awang, 2012)	- the $\chi 2$ value will be greater when the number observed variables increases (Hair et al., 2010) thus has recommended using ratio high as 5 indicate a reasonable fit (Marsh & Hocevar, 1985; Awang, 2012)
NFI	- should be greater than 0.95 to judge the good fit (Schermelleh-Engel & Moosbrugger, 2003; Hooper et al., 2008) and between 0.90 and 0.95 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003 - should be greater than 0.90 to judge satisfactory fit (Awang, 2012) - should be between 0.80 and 0.90 to judge acceptable fit (Forza & Filippini,1998)	
CFI	- should be greater than 0.97 to judge the good fit and between 0.95 and 0.97 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be greater than 0.95 to judge good fit (Hooper et al., 2008) - should be greater than 0.90 to judge satisfactory fit (Awang, 2012) - should be between 0.80 and 0.90 to judge acceptable fit (Forza & Filippini,1998)	
TLI	- Should be greater than 0.95 to judge good fit (Hooper et al., 2008) - Should be greater than 0.90 to judge satisfactory fit (Awang, 2012)	
AGFI	- should be greater than 0.90 to judge the good fit and between 0.85 and 0.90 to judge acceptable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be greater than 0.95 to judge good fit (Hooper et al., 2008) - should be greater than 0.90 to judge satisfactory fit (Hair et al., 2010; Awang, 2012) - should be between 0.80 and 0.90 to judge acceptable fit (Forza & Filippini,1998)	
PGFI	- Should be greater than 0.5 to judge acceptable fit (Hair et al., 2010)	
RMSEA	- should be less than 0.05 to judge good fit and between 0.05 and 0.08 to judge reasonable fit (Schermelleh-Engel & Moosbrugger, 2003) - should be less than 0.07 to judge acceptable fit (Steiger, 2007) - should be less than 0.08 to judge acceptable fit (Awang, 2012)	
AIC	- smaller than AIC for comparison model (Schermelleh-Engel & Moosbrugger, 2003)	
CAIC	- smaller than CAIC for comparison model (Schermelleh-Engel & Moosbrugger, 2003)	
ECVI	- smaller than ECVI for comparison model (Schermelleh-Engel & Moosbrugger, 2003)	

Results

The 598 of total 1740 questionnaires (response rate 34.4%) were obtained to do analysis. The majority of respondents were male (56.2%) of the age above 40 years old (31.4%), factory/production manager (38.8%), bachelor's degree (75.6%), working in nonautomotive (63.9%), and company age above 15 years (46.2%).

Before conducting any statistical analysis, the rule of normal distribution of collected responses should be examined. The skewness and kurtosis values, which evaluate the normal distribution, should vary from -3 to +3 (Stuart & Ord, 1994; Decarlo, 1997). The results presented that the skewness values vary from -0.902 to 0.415, and the kurtosis values vary from -1.210 to 2.554. Meanwhile, the Pearson's bivariate correlations of all relationships were significant. Therefore, it could be summarized that the normal distribution and linearity principle were accepted.

The Chi-square is important statistics; however, a statistical significance test is responsive to sample size (Byrne, 2001; Schermelleh-Engel & Moosbrugger, 2003), which presents that when the large samples are applied, the Chi-square statistic nearly always denies the framework (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1996; Kenny, 2015). Therefore, several academicians mentioned that a framework could also be accepted if most of the fit indices report good evaluation results and only a few quantities of indices are less than the lowest threshold (Bagozzi & Yi, 1988; Browne & Cudeck, 1993; Mueller; 1996). Although there are no well-established guidelines for what minimal conditions constitute an adequate fit some rules of thumb exist. Table 2 provides an overview over some rule of thumb for goodness-of-fit indices.

Reliability and validity testing

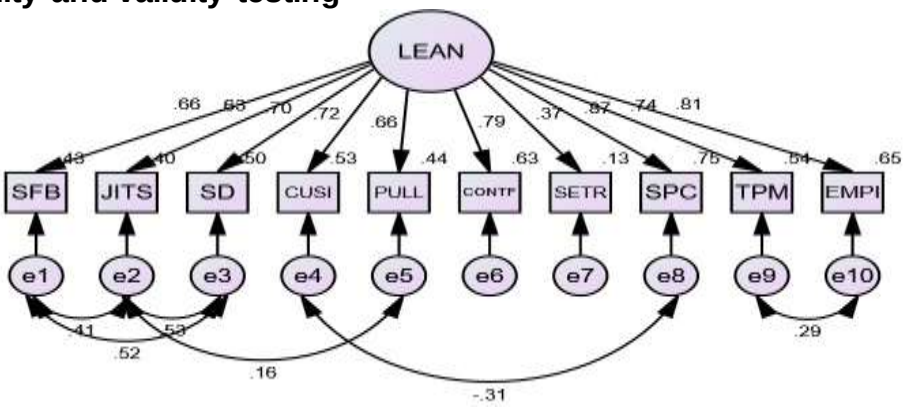

Figure 1. Measurement model of the first order CFA of lean manufacturing

Table 3

Model Fit Indexes of the Lean Manufacturing Model

Model	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	PGFI	TLI	RMSEA
Lean manufacturing	138.70	0.000	29	4.783	0.969	0.969	0.909	0.961	0.502	0.952	0.080

Model	AIC (Independent model)	AIC (Default model)	CAIC (Independent model)	CAIC (Default model)
Lean manufacturing	3613.101	190.701	3667.037	330.904

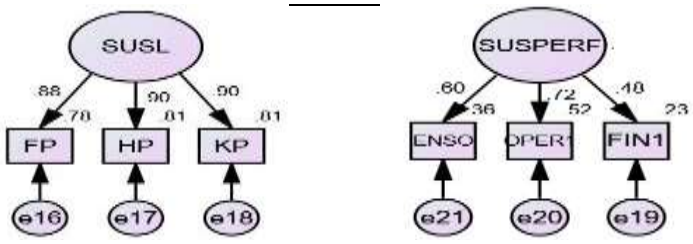

Figure 2. Measurement model of the first order CFA of sustainable leadership (left) and sustainability performance (right)

The first finding shows that all *p*-values related to each loading are lower than 0.05. The second outcome shows that almost values of factor loading are greater than 0.6. Only setup time reduction dimension equal 0.37 and financial performance dimension equal 0.48. Although, the factor loading of both dimensions are less than 0.6; however, the IOC from both 3 experts who work for manufacturing company advisor position, are higher than 0.5 as well as many studies confirmed that the setup time reduction is benefit of lean practice and the financial performance is important to evaluate organizational success. Thus, this study will remain this aspect. For the third ones, all scales of average variance extracted (AVE) and discriminant validity (DV) are greater than minimum criterion. Therefore, it can be supported that the structure of lean manufacturing survey, sustainable leadership, and sustainability are suitable for assessment.

Table 4

Results of Reliability and Validity Measurement

Factor	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)	Highest Correlation^2	Discriminant Validity (DV)
Sustainability leadership	0.962	0.922	0.798	0.653	1.222
Lean manufacturing	0.960	0.908	0.505	0.504	1.002
Sustainability performance	0.828	0.631	0.370	0.197	1.878

CR = composite reliability = $(\Sigma \text{ of standardized loading})^2/[(\Sigma \text{ of standardized loading})^2 + \Sigma \text{ of } \varepsilon_j]$;

AVE = Σ of $(\text{standardized loading})^2/[(\Sigma \text{ of } (\text{standardized loading})^2) + \Sigma \text{ of } \varepsilon_j]$;

DV = discriminant validity = $\text{AVE}/(\text{corr.})^2 > 1$; $(\text{corr.})^2$ = highest $(\text{correlation})^2$ between factors of interest and remaining factors.

Model fit testing

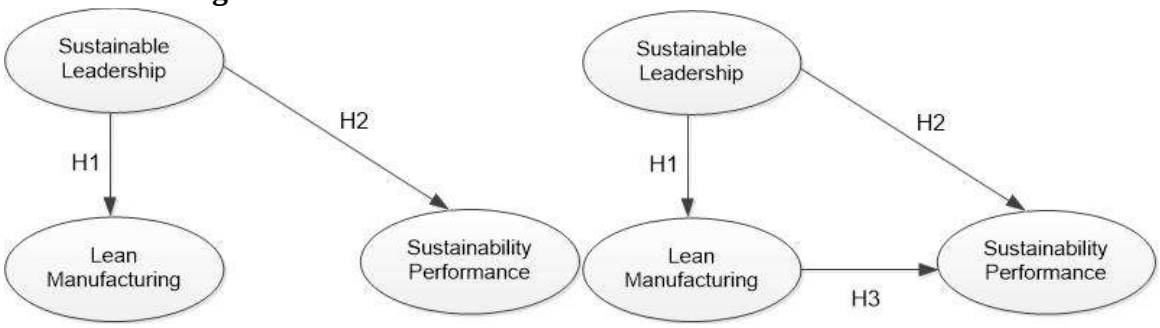

Figure 3. The competing model.

Figure 4. The proposed theoretical model.

Although the finding of Chi-square statistics of the proposed theoretical model showed significance at 0.05 level, the remained results were higher than the minimum criteria displayed in table 5. Thus, it could be claimed that the structure of sustainable leadership, lean manufacturing, and sustainability performance were reasonable to illustrate the interrelationships among items and latent variables.

Table 5

Model Fit Indexes of the Competing and the Proposed Theoretical Model

Model	CMIN	*p*-value	df	CMIN/df	CFI	IFI	AGFI	NFI	PGFI	TLI	RMSEA
Competing model	503.092	0.000	94	5.352	0.930	0.930	0.866	0.916	0.627	0.911	0.085
Proposed model	419.994	0.000	93	4.516	0.944	0.944	0.886	0.930	0.630	0.928	0.077

Model	AIC (Independent model)	AIC (Default model)	CAIC (Independent model)	CAIC (Default model)
Competing model	5999.337	587.092	6085.674	813.623
Proposed model	5999.337	505.994	6085.674	737.918

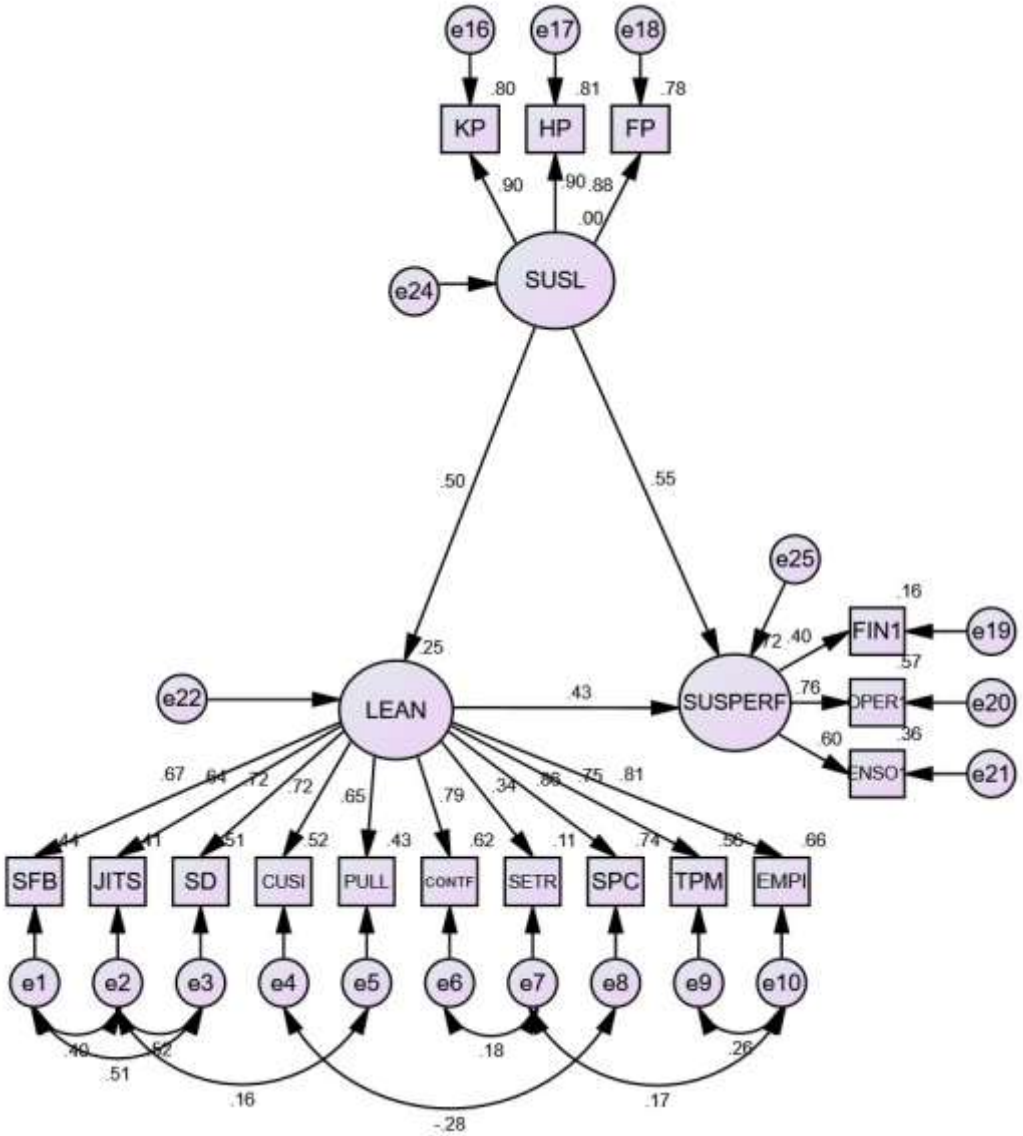

Figure 5. Structural model of the proposed theoretical model

Direct effect testing

The value of t-test depicted in table 6, including the estimated value, standard error (S.E.), critical ratio (C.R.), and *p*-value, indicates that there is a significant positive relationship between sustainable leadership and lean manufacturing, sustainable leadership and sustainability performance, and lean manufacturing and sustainability performance. Thus, it could be summarized that H1, H2, and H3 were supported.

Table 6

Hypotheses Testing Results of the Proposed Theoretical Model

			Estimate	S.E.	C.R.	*p*-value
H1: Sustainable leadership	--->	Lean manufacturing	0.608	0.052	11.620	***
H2: Sustainable leadership	--->	Sustainability performance	0.360	0.047	7.603	***
H3: Lean manufacturing	--->	Sustainability performance	0.234	0.035	6.763	***

****p*-value< 0.001 (*p*-value less than 0.001 was at the significant level of 0.001)

Mediate effect testing

The mediate effected was tested by using Kenny approach (Baron & Kenny, 1986) and comparing model fit indices between competing and proposed theoretical model.

The competing model was to investigate the direct effect of sustainable leadership on lean manufacturing and sustainability performance, which is depicted in figure 3. The proposed model was to investigate the direct effect of sustainable leadership on lean manufacturing and sustainability performance as well as the indirect effect of lean manufacturing on the relationship between sustainable leadership and sustainability performance, which is depicted in figure 4. Comparing the model fit statistics of the competing model and the proposed theoretical model, which is presented in table 5, these results confirmed that the model fit statistics of the proposed theoretical model are greater than those of the competing model. Thus, it could be asserted that the relationships among sustainable leadership, lean manufacturing, and sustainability performance are better described by an effect of sustainable leadership on sustainability performance through lean manufacturing.

Considering Kenny approach, all three direct effects were significance at 0.001 level. Regarding the competing model, the standardized direct effect between sustainable leadership and sustainability performance was 0.774. In contrast, the findings from the proposed theoretical model revealed that standardized direct effect between sustainable leadership and sustainability performance was 0.548 while the standardized indirect effect was 0.217, and standardized total effect was 0.764. Since the standardized direct effect of the proposed theoretical model was less than that of the competing model, it could be summarized that there is an effect of sustainable leadership on sustainability performance through lean manufacturing.

Due to the greater model fit statistics and the low level of the standardized direct effect, it could be summarized that the relationships are better described by a partial effect of sustainable leadership on sustainability performance through lean manufacturing. Thus, H4 was supported.

Table7

Standardized Direct, Indirect, and Total Effects of the Competing Model

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Sustainable leadership	--->	Lean manufacturing	0.524	0.000	0.524
Sustainable leadership	--->	Sustainability performance	0.774	0.000	0.774

Table8

Standardized Direct, Indirect, and Total Effects of the Proposed Theoretical Model

			Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
Sustainable leadership	--->	Lean manufacturing	0.501	0.000	0.501
H4: Sustainable leadership	--->	Sustainability performance	0.548	0.217	0.764
Lean manufacturing	--->	Sustainability performance	0.433	0.000	0.433

Regarding the results in table 8, the equations for the proposed theoretical model were conducted as followed.

$$\hat{Z}_{\text{Lean manufacturing}} = 0.501\ \text{Sustainable leadership} \quad (1)$$

$$\hat{Z}_{\text{Sustainability performance}} = 0.764\ \text{Sustainable leadership} + 0.433\ \text{Lean manufacturing} \quad (2)$$

Moderate effect testing

Considering the moderate effect of automotive and nonautomotive industry, the Chi-square of the unconstrained was 728.446 and degree of freedom was 186, whereas the Chi-square of the fully constrained was 761.239 and degree of freedom was 202. The difference of the Chi-square was 32.793 and degree of freedom was 16. The *p*-value was 0.008 which could be summarized that the model is different across type of industry. After checking each specific path, the results reported that industry has moderate effect on the path from sustainable leadership and lean production at 95% confidence whereas industry has no moderate effect on the rest of all path levels. Thus, it can be concluded that H5 are partial support.

Considering the moderate effect of lean adoption less than 5 years comparing to more than 5 years, the Chi-square of the unconstrained was 609.629 and degree of freedom was 186, whereas the Chi-square of the fully constrained was 645.138 and degree of freedom was 202. The difference of the Chi-square was 35.509 and degree of freedom was 16. The *p*-value was 0.003 which could be confirmed that the model is different across length of lean adoption. After checking each specific path, the results reported that length of lean adoption has moderate effect on the path from sustainable leadership and lean production at 99% confidence whereas length of lean adoption has no moderate effect on the rest of all path levels. Thus, it can be concluded that H6 are partial supported.

Table 9

Summary of Hypotheses Testing

Hypothesis and its description	Results
H1: There is a positive relationship betw een sustainable leadership and lean manufacturing	Supported
H2: There is a positive relationship betw een sustainable leadership and sustainability performance	Supported
H3: There is a positive relationship betw een lean manufacturing and sustainability performance	Supported
H4: There is a relationship betw een sustainable leadership and sustainability performance through lean manufacturing	Supported (Partial effect)
H5: There is a moderate effect of type of industry on the simultaneous relationships among sustainable leadership, lean manufacturing, and sustainability performance	Supported (Partial effect)
H6: There is a moderate effect of length of lean adoption on the simultaneous relationships among sustainable leadership, lean manufacturing, and sustainability performance	Supported (Partial effect)

Table 10

Content Analysis Results from 3 Experts

Dimension/Situation details	Some extent	Moderate extent	Extensive/full extent
Supplier feedbacks and involvements	28	11	1
Customer feedbacks and involvements	6	20	14
Process standardization and working instruction	11	20	9
Employee feedbacks and involvements	27	11	2
Leaderships, management skills, relationships, innovation	16	18	6
Organizational success caused by lean implementation	31	7	2

Qualitative results

Content analysis was done by means of content analysis by 3 experts presented in table 10 and below details.

Supplier feedbacks and involvements

Participants informed that the company takes some attention on supplier involvement, which is consistent with quantitative results. There are many reasons that the relationship between company and suppliers is at low level and suppliers do not encourage just in time policy. First, due to material prices had been changing frequently depending on market prices. Purchasing in bulk raw materials resulted in a risk of loss from the price difference. Second, materials for some industry such as plastic, garment, and OEM industry had to be ordered from suppliers which were determined by customers. Therefore, suppliers had high level of bargaining power to ask maximum purchased volume, leading to high level of raw material inventory. Third, raw materials inventory for some industry such as electric and electronic, automotive, and garment industry was very high because the companies needed to import raw materials from Germany, America, and Japan, the process of which took a long time for transportation. Therefore, the company selected to purchase in bulk raw materials, in order to avoid the shortage of materials.

Customer feedbacks and involvements

Participants informed that the company takes the most attention on customer involvement, which is consistent with quantitative results. Customers are the most important for organization success therefore company need to operate well to meet customers' requirements including superior quality, reasonable cost, and on time delivery. For instance, some companies measured performance based on the measurement by using cycle or takt time received from customers, defect rate for all industry was controlled by customer at 2-3% using 3 stations of quality control points, i.e. incoming point, in-process point, and outgoing point, and some companies were evaluated and received certificate from customers. Most participants work with Japanese customers who often visited manufacturing production line.

Process standardization and work instruction

Participants informed that the company takes the most attention on customer involvement, which is consistent with quantitative results. Due to some companies especially OEM companies must to follow process and work instruction received from customers. In addition, most of companies were ISO 9001 qualified, guaranteeing the productivity control for all processes by using work instructions.

Employee feedbacks and involvements

Participants informed that the company takes some attention on employee involvement, which is consistent with quantitative results. Some managers informed that due to low educational degree of their employees as well as most foreigner employees from Myanmar, Laos, Vietnam, and Cambodia, thus managers do not trust and do not give them opportunity to exchange ideas and potentials. In addition, SMEs companies operating in fierce competition with small number of employees did not have enough resources to encourage lean implementation. Managers do not take more attention and explanations before lunch lean program resulted in misunderstanding with employees. Employees perceived lean practices as extra work without extra pay. In addition, most companies were located in an area with many factories; thus, employees had an opportunity to compare the compensation, welfare, and benefits offered in the companies nearby. Due to managers avoided problem occur from staff turnover rate; therefore, managers do not much force employees to join lean program.

Leadership skills

Most participants informed that they proficient in technical skills, human, and communication skills whereas scarce in conceptual skills. Moreover, most participants informed that they cannot work well in decision making and cannot be representative for

their company. In addition, most participants informed that due to low skill and dedication employees; thus, difficult to create teamwork, culture, and innovation.

Organizational success

Participants informed that lean practices were appropriate for automotive industry though less attention and implementation in other industries. Two companies, get TPS training program from Thailand Automotive Institute, informed that fully success which come from electric and plastic industry. Due to fully success companies do not come from automotive industry which supported quantitative results that lean practices can apply in any industry. Most participants informed that they have some knowledge and skills associate with lean practices; thus, they do not work well for lean implementation. Participants from automotive industry informed that the company implement lean program for long time; however, the program fails due to implement without continuous and serious policy. On the other hand, participations from nonautomotive industry informed that the company implement lean practices due to popular program but do not success due to execute in early stage.

Discussion of Findings

The finding fulfills the ambiguous knowledge about influence of leadership on lean manufacturing and performance. According to the author's knowledge, it is the first time which revealed that the positive relationship between sustainable leadership and lean manufacturing, lean manufacturing and sustainability performance, as well as the partial mediate effect of lean manufacturing on the relationship between sustainable leadership and sustainability performance, which are the added contributions to research in academic field. Due to sustainable leadership comprised of foundation practices, higher-level practices, and key performance drivers. First, foundation practices associated with technical, operational, and human skill. Second, higher-level practices related to conceptual skill, team and culture building. Finally, key performance drivers associated to innovation and employee engagement building. Presently, business cannot survive with only one skill such as technical, operational, human relationship, and conceptual skill; however it requires combination of these skills. Moreover it requires advanced technological, forefront innovation, quick adaptation, as well as employee and all supply chain members engagement (Achanga, Shehab, Roy & Nelder, 2006; Found & Harvey, 2007). These characteristics are necessary factors to enhance of lean manufacturing resulted in sustainability performance (Fullerton & Wempe, 2009; Yang, Hong, & Modi, 2011; Chanegrih & Creusier, 2016).

The quantitative results reported that the model is partial difference between companies which operated in automotive and non-automotive companies, and the model is partial difference between companies which implemented lean program less than 5 years and above 5 years. According to the author's knowledge, it is the first time which revealed that influence of type of industry and length of lean adoption on the simultaneous relationships among sustainable leadership, lean manufacturing, and sustainability which are the added contributions to research in academic field. The results showed that the relationship between sustainable leadership and lean manufacturing is difference in terms of both industry type and length of lean adoption. Automotive companies familiar with lean practices for long time thus leaders can improve lean level easier than nonautomotive which implement lean in early stage which is consistent with qualitative results. Sustainable leaders encourage lean level by respect employees and customers. Heizer and Render (2014) proposed that lean production respects employees by giving them the opportunity to enrich both jobs and their lives. Company recognizes that employees know more about their jobs than anyone else. Employees are empowered to make improvements. Lean production begins externally with a focus on the external customer including end users and society. Understanding what the external customer wants and ensuring they input and feedback are starting

points for lean production. Lean operations means identifying external customer value by analyzing all the activity required to produce the product and then optimizing the entire process from the external customer's perspective.

In addition, the results revealed that the relationship between lean manufacturing and sustainability performance is no difference in terms of both industry type and length of lean adoption. This confirms the concept that lean can be applied in any industry, any size, or anyplace (White et al., 1999; Shah & Ward, 2003; Anand & Kodali, 2008). Since the managers informed that they realized that lean practices are appropriate for automotive industry, though less attention and implementation in other industries. Moreover, qualitative results reported that two companies informed that fully success which come from electric and plastic industry. Due to fully success companies do not come from automotive industry which supported quantitative results that lean practices can apply in any industry. The first thing to do before launching lean program to all process is that the company should buy-in the understanding of managers about lean concept and implementation. Willingness with well understanding and realizing importance of lean program will lead to superior results, especially operational (Hallgren & Olhanger, 2009; Alsmadi, Almani & Jerisat, 2012; Arawati & Mohd, 2012; Marynell, 2013; Chanegrih & Creusier, 2016), economic (Taj & Morosan, 2011; Hibadullah et al., 2013; Hong, Yang & Dobrzykowski, 2014; Sharma, Dixit & Qadri, 2015), and environmental and social performance (Curkovic et al., 2000; King & Lenox, 2001; Burawat, 2017).

Finally, the results reported that the relationship between sustainable leadership and sustainability performance is no difference in terms of both industry type and length of lean adoption. Even though, the concept of sustainable leadership and environmental and social performance is novel; however, the results confirmed that both of them appropriate for all companies and all industries. Consistent with Gurr (2007) proposed sustainable leadership takes into deliberation a comprehensive scope of complex interconnections among personals, the business community, worldwide demands and the natural environment, with the essential objective that a company accomplishes well-being by concerning social values, obtaining success in long-term based on strategic decision-making value and preservation the ecosystem, of which we all form an integral part. In addition, sustainable leadership creates communities, encourages cooperation among stakeholders and fosters value in long-term. The relevance of sustainable leadership for chargeable strategic decision making in sustainable companies is obvious in the method it directs the sustainable leaders attentions with regard to four fields of deliberation when making decisions. It requires that top executives adopts a macro view of the company (Avery & Bergsteiner, 2011) due to sustainability associates with a variety dimensions of development and performance (Casserley & Critchley, 2010): (1) on a individual level: keeping physical health and individual psychological; (2) at the business level: keeping a workplace surrounding that permits workers to improve manifold knowledge with the goal of accomplishing the company's purposes, which are linked up with the goals of stakeholders; (3) at the social level: socially-responsible handling in the broader community; and (4) on the ecological level: preservation and sustainable environmental change.

Managerial Implication

The findings provide some implications for the practitioners and entrepreneurs. The results show that lean manufacturing will result in high level of both operational and financial performance, which is worth taking more attention. In addition, Thai managers tend to understand that lean manufacturing is suitable for only automotive industry. Nevertheless, the results confirmed that it can be applied for any manufacturing as well as any company size. Moreover, at present, there are many studies asserting that it can also be applied in service industry. Successful lean production requires serious

cooperation and attentions of all employees across company; thus, managers should create the good two-way relationship, sharing, caring, bottom up communication, and free-rein culture with their employees. Effective supply chain management is imperative by close communications and relations with suppliers, distributors, and customers.

Suggestions for Future Research

The results offer several implications for scholarly researchers. First, due to the scarce studies of sustainable leadership and sustainability performance, the future study should augment knowledge by investigating the antecedent and consequence of these two variables. Second, the literature on leadership paradigms, organizational performance and corporate sustainability, and key mediating variables, particularly shared vision and values, self-leadership, an organizational team orientation and consensual decision-making, affecting their relationships should be examined. Third, due to leadership have effect on lean practices resulted in higher performance thus the future study should be focused more on effect of other type of leadership. Finally, the successful lean production required cooperation across all members of supply chain, which takes time; thus, it requires longitudinal studies.

Limitations

There are some expected potential limitations. Firstly, the effect of external factors which may involve sustainable leadership, lean manufacturing, and sustainability performance, such as political issues, macroeconomics, microeconomics, and economic crisis. Secondly, as the study applied self-report and cross-sectional data, the summarizations could not only make causal extrapolations but also increase some concerns about common bias. Therefore, a study in long term is required to offer greater definitive summarization. Thirdly, the results explain the small and medium manufacturing firms' situations and activities which may not be corresponding with the service companies as well as large companies. Lastly, the results describe situations and activities of firms operating in Thailand, which may not be compatible with international and multinational corporations.

Conclusion

This study fulfills the vague knowledge by confirming the relationships among sustainable leadership, lean manufacturing, and sustainability performance. In addition, this study augments the comprehension that lean manufacturing can be applied in any industry (White et al., 1999; Shah & Ward 2003; Anand & Kodali 2008). Accomplished lean implementation requires serious and much attention from all members across company, suppliers, distributors, and customers (Achanga et al., 2006; Found & Harvey, 2007). Successful lean managers need insight comprehension about lean concept and implementation before persuading their employees to do with higher willingness and cooperation. Referring to the scarcity of lean manufacturing success at present time (Pay 2006), it is likely to be a challenge for the future research to explore antecedent, consequent, and intervention factors, which will result in superior understanding of the lean production notions and utilizations. Successful lean implementation will generate better financial outcomes and lower cost thanks to the willingness of all employees and efficient processes which lead to all of sustainable competitiveness, including operational (Marynell, 2013; Chanegrih & Creusier, 2016), financial (Hong et al., 2014; Sharma et al., 2015), social and environmental performance (Burawat, 2017).

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The Mediate Effect of Lean Manufacturing on the Relationship between Transaformational Leadership and Sustainability Performance in Thai SMEs

Piyachat Burawat
Rajamangala University of Technology Thanyaburi,
Pathumthani, Thailand
piyachat_b@rmutt.ac.th

***Abstract*—** This study proposes to examine the structural relationship model among transformational leadership, lean manufacturing, and sustainability performance. In addition, this study is aimed to explore the relationship between transformational leadership and sustainability performance through lean manufacturing. Moreover, this study is intended to explore the moderate effect of type of industry and length of lean adoption. The research design is based on the mixed method gathering data from middle and senior managers working in small and medium enterprises of Thai manufacturing industry. Regarding the quantitative approach, the data were collected from 598 respondents by means of survey. Considering the proposed theoretical model, the results reported that transformational leadership associated with lean manufacturing and sustainability performance, and lean manufacturing related to sustainability performance. In addition, the results further reported that lean manufacturing has a partial mediated effect on the relationship between transformational leadership and sustainability performance. Moreover, the results showed that the relationship between transformational leadership and lean manufacturing is difference in terms of type of industry while no difference in term of lean adoption. The results further presented that the relationships between lean manufacturing and sustainability performance, and between transformational leadership and sustainability performance are no difference in terms of both type of industry and length of lean adoption. Qualitative approach was employ to collect data from 40 participants who informed that lean practices were appropriate for automotive industry, though less attention and implementation in other industries. The company takes the most attention on customer involvement, some attention on employee and supplier involvement, which is consistent with quantitative results. Managers tend to give advices and exchange ideas with their followers rather than inspire and give them opportunities to make decision. The first thing to do before launching lean program to all process is that the company should buy-in the understanding of managers about lean concept and implementation. Willingness with well understanding and realizing importance of lean program will lead to superior results, especially operational, economic, and sustainability performance

Keywords—transformational leadership; lean manufacturing; sustainability performance; manufacturing industry; small and medium enterprises

I. INTRODUCTION

Currently, globalization leads to free communication without borders; this results in high competition in both national and global markets. In addition, labor wages of Thai labors are nearby Malaysian workers; however, Malaysian productivity is of double value compared to Thailand's. Meanwhile, Thai employee wage is 5 times higher than that of Vietnamese workers but Thai productivity is only twice compared to Vietnam's. Meanwhile, Singapore wage is double of Thai wage but Singapore productivity is 5 times higher than Thailand's [1]. In addition, Thailand's labor productivity is raised by 2% per year, which is very poor once compared to other nations such as China and Vietnam, with the increase by 10% and 4%, respectively [2]. The unit labor costs of Thailand increased by 3% while Indonesia fell by 12% [2]. Inventory is one of the most expensive assets of many firms, representing as much as 50% of total invested capital. Therefore, managers have long recognized that good inventory management is important. Furthermore, a firm can decrease costs by decreasing inventory. On the contrary, production may stop and consumers become discontented when a product is not enough [3].

According to high competition, low productivity, and high inventory, firms operating in manufacturing industry are imperative to explore strategies to raise profit, productivity and quality while decreasing costs, defects, and lead time delivery to end users, all of which need the mutual support of all supply chain members from suppliers, subcontractors, employees, management teams, distributors, and customers. Although 70% of all manufacturing firms take much attention on lean manufacturing, only 26% are significant success [4]. Successful lean program is associated with management attention, clarifying goals and directions, seriously involvements and practices of all members, employees' empowering, clear measurement criteria, obvious plan for improved process [5,6].

The existing researches place an emphasis on the relation of leadership behaviors and practices that leads to successful lean implementations. The research literature falls short of considering that one leadership model might be more appropriate for success within lean implementations. The

study reveals that transformational leadership augments transactional leadership by building on the exchanges between leaders and followers [7]. In summary, the findings of the study add to the existing empirical data, suggesting that the transformational leadership model is useful when trying to lead change. Although several studies focus on the effect of leadership on lean practice, they pay attention to only one industry; the simultaneous study on overall industry is lacking. Therefore, this study extends current knowledge by examining the influence of transformational leadership on lean manufacturing practices in manufacturing industry.

The most regularly cited advantages associated with lean manufacturing are development in labor productivity and quality, along with the decrease in lead time to customer, cycle time, and production costs [8,9]. However, some studies presented that some lean manufacturing aspects were connected organizational performance. Moreover, some studies revealed that there is no connection between lean manufacturing and performance [10, 11]. In addition, some studies reported that lean manufacturing has an effect on financial performance through operational performance [12, 13]. Furthermore, few investigations studied on relationship between lean practices and social and environmental performance [13].

Regarding the above concepts, the relationships among leadership style, lean manufacturing, and performance are equivocal. Thus, this study intends to investigate the simultaneous relationships among transformational leadership, lean manufacturing, and sustainability performance in Thai SMEs operate in manufacturing industry. Furthermore, this study intends to examine the relationship between transformational leadership and sustainability performance through lean manufacturing. The results of this study provide insight information in an efficient form for a company's operational system, which in turn will create sustainable development despite sudden or severe changes in the international competitive environment.

II. LITERATURE REVIEW

A. *Transformational Leadership*

Over the last 25 years, transformational leadership has occurred as an extremely essential model for organizational leadership academicians [14]. Burns [15] explained that transformational leadership emerges when one or more individuals engage with others in such a way that leaders and followers raise one another to greater motivation and morality levels. Bass [16] suggested four characterized transformational aspects including idealized influence and charisma (strong role models with high ethics), inspirational motivation (high team spirit and shared vision), intellectual stimulation (stresses problem solving and creativity), and individualized consideration (supportive climate and use of delegation). Meanwhile, Northouse [14] explained that transformational leaders have a clear vision of the future state of their company. Transformational leaders are also noted to be social architects who are able to communicate and transform organizations' values. In addition, Northouse [14] defined transformational leadership as the leaders who engage with followers in a cooperative effort to raise their level of motivation and morality. To sum up, transformational leadership's intention is to raise the consciousness of followers' understanding of what is important, and tends to move followers to transcend their own self-interest in favor of what is important to their organization [17]. Transformational leadership theories suggested the importance of visionary goals, ideological values, intellectual stimulation, symbolic behaviors, and intellectual stimulation [18]. Transformational leadership is highly relevant and ideally suited to help transform firms and individuals during lean-system deployments [19].

B. *Lean Manufacturing*

Lean production or lean manufacturing, frequently conceived as Toyota production system (TPS) in scholarly publications, began in Toyota Motor Manufacturing Company after the 2nd World War when almost all Japanese companies which include Toyota Manufacturing Company were encountered with the challenge of tackling production resources with restricted assets and facilities [20]. This challenge inspired managers worked for Toyota to initiate a variety of TPS's elements purposed at eliminating waste. Therefore, lean manufacturing is about manufacturing the same product quantity with lower resources (working hours, working area, machine hours, material, instruments, and equipment). Recently, lean practice has advocated Toyota accomplish the difference of being the best manufacturer in the world who produce car [21].

Lean manufacturing is a strategy used to improve the manufacture and delivery of a product (to a customer's expectation) by means of a purpose-designed facility and process, utilizing an interconnected array of supply chains. Lean production is classified by the academician community mostly into three levels. The first level associates with wasted elimination from the production process [22,23] and the efficiency to make the excellent quality products that can fulfill the need of final buyers. For the second level, some researchers construe lean as a rule controlling production process [24]. The final level is seen as a combination of techniques and means [25,26] intended to remove waste. Regarding well-known study, Shah and Ward [27] separated lean production into ten aspects, including supplier feedback, just in time delivery by suppliers, supplier development, customer involvement, pull system, continuous flow, set up time reduction, total productive/preventive maintenance, and employee involvement.

C. *Sustainability Performance*

Since the expanding attention of all kinds of stakeholders in company activities in recent rivalry situation, there have been crowded studies in area of corporate sustainability performance evaluation. Firms are struggling to succeed long-term benefits by applying sustainability activities as principal organizational strategy [28]. The firms, whose aim is outstandingly seen as being one of economic return, might be greater readily excused for separately reporting voluntary sustainability assesses.

Takala and Pallab [29] proposed that corporate sustainability performance generally focuses on the

environmental, social, and economic performance of sustainable development. Meanwhile, sustainability performance is described by Schaltegger and Wagner [30] as the performance of a firm in all aspects and for all corporate sustainability drivers. Fiksel, Mcdaniel & Mendenhall [31] mentioned that it extends beyond the single organization boundaries and typically addresses the performance of both upstream suppliers and downstream consumers in the value chain. To sum up, sustainability performance involves performance in related with: level of emission and natural resource saving; other environmental activities and initiatives; employment features; occupational health and safety; relationships with society and community; involvement of stakeholder; and economic impacts of the organization other than those financial assesses applied in the financial accounts. The previous study presents the scarcity of accountability for environmental and social performance. Although there has been a gush of studies in corporate sustainability performance evaluation area, there is still no concurred universal guideline or standard. Generally, there are some measures commonly mentioned or applied by companies in opting sustainability performance assesses.

III. RESEARCH METHODOLOGY

The objective of this study is to examine the structural relationship model among transformational leadership, lean manufacturing practices, and sustainability performance, to explore the mediate effect of lean practice on the relationship between transformational leadership and sustainability performance, and to explore the moderate effect of type of industry and length of lean adoption, which was conducted from Thai SMEs operated in manufacturing industry. The study was conducted and accomplished by quantitative method using random sampling and snowball sampling from 598 current middle and top managers together with qualitative method using in-depth interview from 40 current middle and top managers. The results were analyzed by descriptive statistics, confirmatory factor analysis, and the structural equation modeling by using statistical software programs.

The instrument is composed of five parts. The first part is demographic information of respondents and information of the companies. The latter two parts are transformational leadership which was created by Bass and Avolio [32], and sustainable leadership which was created by Avery and Bergsteiner [33]. Next, lean manufacturing was created by Shah and Ward [27]. The last part is sustainability performance separated into three dimensions; operational performance scale taken from Rahman, Laosirihongthong and Sohal [34], financial performance scale developed from Griffin, Huergo, Mairesse and Peters [35], Wiklund and Shepherd [36], and Hung, Lien, Fang and McLean [37], and environmental and social performance developed from Global Reporting Initiative [38] index. Qualitative e information was gathered by semi-structural in-depth interview.

IV. RESULTS

The 598 of total 1740 questionnaires (response rate 34.4%) were obtained to do analysis. The majority of respondents were male (56.2%) of the age above 40 years old (31.4%), factory/production manager (38.8%), bachelor's degree (75.6%), working in nonautomotive (63.9%), and company age above 15 years (46.2%).

Before conducting any statistical analysis, the rule of normal distribution of collected responses should be examined. The skewness and kurtosis values, which evaluate the normal distribution, should vary from -3 to +3 [39, 40]. The results presented that the skewness values vary from -0.972 to 0.603, and the kurtosis values vary from -1.857 to 1.870. Meanwhile, the Pearson's bivariate correlations of all relationships were significant. Therefore, it could be summarized that the normal distribution and linearity principle were accepted.

The Chi-square is important statistics; however, a statistical significance test is responsive to sample size [41, 42], which presents that when the large samples are applied, the Chi-square statistic nearly always denies the framework [43, 44]. Therefore, several academicians mentioned that a framework could also be accepted if most of the fit indices report good evaluation results and only a few quantities of indices are less than the lowest threshold [45, 46].

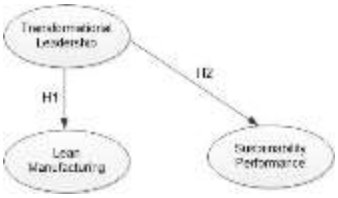

Fig. 1. The Competing model.

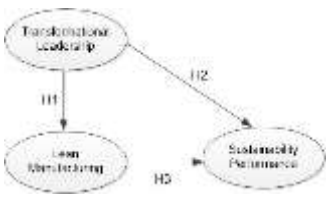

Fig. 2. The proposed theoretical model.

A. Model Fit Testing

Although the finding of Chi-square statistics of the proposed theoretical model showed significance at 0.05 level, the remained results were higher than the minimum criteria displayed in table I. Thus, it could be claimed that the structure of sustainable leadership, lean manufacturing, and sustainability performance were reasonable to illustrate the interrelationships among items and latent variables.

TABLE I. MODEL FIT INDEXES OF THE COMPETING AND THE PROPOSED THEORETICAL MODEL

Model	CMIN	*p*-value	df	CMIN/df	CFI	IFI
Competing	674.318	0.000	127	5.310	0.918	0.918
Proposed	583.957	0.000	126	4.635	0.931	0.931

Model	AGFI	NFI	PGFI	TLI	RMSEA	AIC (default)
Competing	0.849	0.901	0.660	0.901	0.085	762.318
Proposed	0.866	0.914	0.664	0.916	0.078	673.957

B. Direct Effect Testing

The value of *t*-test including the estimated value, standard error (S.E.), critical ratio (C.R.), and *p*-value, indicates that there is a significant positive relationship between transformational leadership and lean manufacturing, transformational leadership and sustainability performance, and lean manufacturing and sustainability performance. Thus, it could be summarized that H1, H2, and H3 were supported.

TABLE II. HYPOTHESES TESTING RESULTS OF THE PROPOSED MODEL

Relationship			Estimate	S.E.	C.R.	*p*-value
H1: Transformational leadership	-->	Lean manufacturing	0.928	0.071	13.036	***
H2: Transformational leadership	-->	Sustainability performance	0.263	0.055	4.820	***
H3: Lean manufacturing	-->	Sustainability performance	0.306	0.043	7.030	***

***p-VALUE< 0.001 (p-VALUE LESS THAN 0.001 WAS AT THE SIGNIFICANT LEVEL OF 0.001)

C. *Mediate Effect Test*

The mediate effected was tested by using Kenny approach [47] and comparing model fit indices between competing and proposed theoretical model.

The competing model was to investigate the direct effect of transformational leadership on lean manufacturing and sustainability performance, which is depicted in figure 1. The proposed model was to investigate the direct effect of transformational leadership on lean manufacturing and sustainability performance as well as the indirect effect of lean manufacturing on the relationship between transformational leadership and sustainability performance, which is depicted in figure 2. Comparing the model fit statistics of the competing model and the proposed theoretical model, which is presented in table II, these results confirmed that the model fit statistics of the proposed theoretical model are greater than those of the competing model. Thus, it could be asserted that the relationships among transformational leadership, lean manufacturing, and sustainability performance are better described by an effect of transformational leadership on sustainability performance through lean manufacturing.

TABLE III. STANDARDIZED DIRECT, INDIRECT, AND TOTAL EFFECTS OF THE COMPETING MODEL

Relationship			Standardized Direct Effect	Standardized Indirect Effect	Standardized Total Effect
Transformational leadership	-->	Lean manufacturing	0.610	0.000	0.610
Transformational leadership	-->	Sustainability performance	0.641	0.000	0.641

TABLE IV. STANDARDIZED DIRECT, INDIRECT, AND TOTAL EFFECTS OF THE PROPOSED MODEL

Relationship			Standardized Direct Effect	Standardized Indirect Effect	Standardized Total Effect
Transformational leadership	-->	Lean manufacturing	0.593	0.000	0.593
H4 Transformational leadership	-->	Sustainability performance	0.301	0.324	0.625
Lean manufacturing	-->	Sustainability performance	0.547	0.000	0.547

Considering Kenny approach, all three direct effects were significance at 0.001 level. Regarding the competing model, the standardized direct effect between transformational leadership and sustainability performance was 0.641. In contrast, the findings from the proposed theoretical model revealed that standardized direct effect between transformational leadership and sustainability performance was 0.301 while the standardized indirect effect was 0.324, and standardized total effect was 0.625. Since the standardized direct effect of the proposed theoretical model was less than that of the competing model, it could be summarized that there is an effect of transformational leadership on sustainability performance through lean manufacturing.

Due to the greater model fit statistics and the low level of the standardized direct effect, it could be summarized that the relationships are better described by a partial effect of transformational leadership on sustainability performance through lean manufacturing. Thus, H4 was supported.

Regarding the results in table IV, the equations for the proposed theoretical model were conducted as followed.

$$\hat{Z}\,\text{Lean manufacturing} = 0.593\ \text{Transformational leadership} \quad (1)$$

$$\hat{Z}\,\text{Sustainability performance} = 0.625\ \text{Transformational leadership} + 0.547\ \text{Lean manufacturing} \quad (2)$$

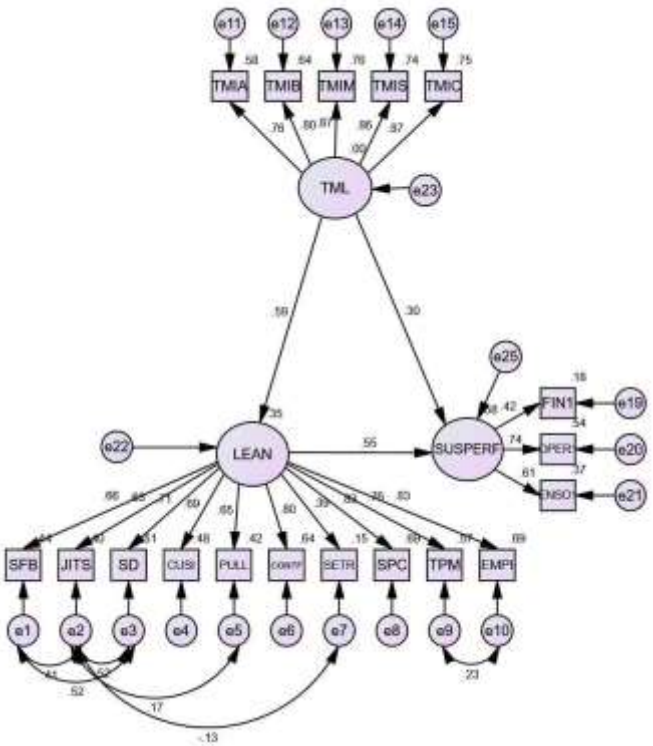

Fig. 3. Structural model of the proposed theoretical model

D. *Moderate Effect Testing*

Considering the moderate effect of automotive and nonautomotive industry, the Chi-square of the unconstrained

was 952.664 and degree of freedom was 252, whereas the Chi-square of the fully constrained was 995.450 and degree of freedom was 270. The difference of the Chi-square was 42.786 and degree of freedom was 18. The *p*-value was 0.001 which could be summarized that the model is different across type of industry. After checking each specific path, the results reported that industry has moderate effect on the path from transformational leadership and lean production at 95% confidence whereas industry has no moderate effect on the rest of all path levels. Thus, it can be concluded that H5 are partial support.

Considering the moderate effect of lean adoption less than 5 years comparing to more than 5 years, the Chi-square of the unconstrained was 833.552 and degree of freedom was 252, whereas the Chi-square of the fully constrained was 864.683 and degree of freedom was 270. The difference of the Chi-square was 31.131 and degree of freedom was 18. The *p*-value was 0.028 which could be confirmed that the model is different across length of lean adoption on the structural relationships. After checking each specific path, the results reported that length of lean adoption has no moderate effect on the all path levels. Thus, it can be concluded that H6 are partial supported.

E. Qualitative Results

1) Supplier feedbacks and involvements : Participants informed that the company takes some attention on supplier involvement, which is consistent with quantitative results. There are many reasons that the relationship between company and suppliers is at low level and suppliers do not encourage just in time policy. First, due to material prices had been changing frequently depending on market prices. Purchasing in bulk raw materials resulted in a risk of loss from the price difference. Second, materials for some industry such as plastic, garment, and OEM industry had to be ordered from suppliers which were determined by customers. Therefore, suppliers had high level of bargaining power to ask maximum purchased volume, leading to high level of raw material inventory. Third, raw materials inventory for some industry such as electric and electronic, automotive, and garment industry was very high because the companies needed to import raw materials from Germany, America, and Japan, the process of which took a long time for transportation. Therefore, the company selected to purchase in bulk raw materials, in order to avoid the shortage of materials.

2) Customer feedbacks and involvements: Participants informed that the company takes the most attention on customer involvement, which is consistent with quantitative results. Customers are the most important for organization success therefore company need to operate well to meet customers' requirements including superior quality, reasonable cost, and on time delivery. For instance, some companies measured performance based on the measurement by using cycle or takt time received from customers, defect rate for all industry was controlled by customer at 2-3% using 3 stations of quality control points, i.e. incoming point, in-process point, and outgoing point, and some companies were evaluated and received certificate from customers. Most participants work with Japanese customers who often visited manufacturing production line.

3) Process standardization and work instruction: Participants informed that the company takes the most attention on customer involvement, which is consistent with quantitative results. Due to some companies especially OEM companies must to follow process and work instruction received from customers. In addition, most of companies were ISO 9001 qualified, guaranteeing the productivity control for all processes by using work instructions.

4) Employee feedbacks and involvements: Participants informed that the company takes some attention on employee involvement, which is consistent with quantitative results. Some managers informed that due to low educational degree of their employees as well as most foreigner employees from Myanmar, Laos, Vietnam, and Cambodia, thus managers do not trust and do not give them opportunity to exchange ideas and potentials. In addition, SMEs companies operating in fierce competition with small number of employees did not have enough resources to encourage lean implementation. Managers do not take more attention and explanations before lunch lean program resulted in misunderstanding with employees. Employees perceived lean practices as extra work without extra pay. In addition, most companies were located in an area with many factories; thus, employees had an opportunity to compare the compensation, welfare, and benefits offered in the companies nearby. Due to managers avoided problem occur from staff turnover rate; therefore, managers do not much force employees to join lean program.

5) Leadership skills: Most participants informed that they proficient in technical skills, human, and communication skills whereas scarce in conceptual skills. Moreover, most participants informed that they cannot work well in decision making and cannot be representative for their company. In addition, most participants informed that due to low skill and dedication employees; thus, difficult to create teamwork, culture, and innovation.

6) Organizational success: Participants informed that lean practices were appropriate for automotive industry though less attention and implementation in other industries. Two companies, get TPS training program from Thailand Automotive Institute, informed that fully success which come from electric and plastic industry. Due to fully success companies do not come from automotive industry which supported quantitative results that lean practices can apply in any industry. Most participants informed that they have some knowledge and skills associate with lean practices; thus, they do not work well for lean implementation. Participants from automotive industry informed that the company implement lean program for long time; however, the program fails due to implement without continuous and serious policy. On the other hand, participations from nonautomotive industry informed that the company implement lean practices due to popular program but do not success due to execute in early stage.

V. DISCUSSIONS AND CONCLUSIONS

After the data has been analyzed, the paper is ready for the discussions and conclusions.

A. Discussions of Findings

The finding fulfills the ambiguous knowledge about influence of leadership on lean manufacturing and performance. Due to transformational leadership comprised of idealized influence and charisma (strong role models with high ethics), inspirational motivation (high team spirit and shared vision), intellectual stimulation (stresses problem solving and creativity), and individualized consideration (supportive climate and use of delegation). Presently, business cannot survive with only one skill such as technical, operational, human relationship, and conceptual skill; however it requires combination of these skills. Moreover it requires advanced technological, forefront innovation, quick adaptation, as well as employee and all supply chain members engagement [48, 49]. These characteristics are necessary factors to enhance of lean manufacturing resulted in organizational performance. According to lean practice relates to elimination of wastes; thus, the results confirms connection between lean and sustainability performance including operational, economic, and social and environmental performance [12, 50, 51].

The quantitative results reported that the model is partial difference between companies which operated in automotive and non-automotive companies, and the model is partial difference between companies which implemented lean program less than 5 years and above 5 years. The results showed that the relationship between transformational leadership and lean manufacturing is difference in terms of industry type. Automotive companies familiar with lean practices for long time thus leaders can improve lean level easier than nonautomotive which implement lean in early stage which is consistent with qualitative results. transformational leaders encourage lean level by respect employees and customers. Heizer and Render [3] proposed that lean production respects employees by giving them the opportunity to enrich both jobs and their lives. Company recognizes that employees know more about their jobs than anyone else. Employees are empowered to make improvements. Lean production begins externally with a focus on the external customer including end users and society. Understanding what the external customer wants and ensuring they input and feedback are starting points for lean production. Lean operations means identifying external customer value by analyzing all the activity required to produce the product and then optimizing the entire process from the external customer's perspective.

In addition, the results revealed that the relationship between lean manufacturing and sustainability performance is no difference in terms of both industry type and length of lean adoption. This confirms the concept that lean can be applied in any industry, any size, or anyplace [8, 25, 52]. Since the managers informed that they realized that lean practices are appropriate for automotive industry, though less attention and implementation in other industries. Moreover, qualitative results reported that two companies informed that fully success which come from electric and plastic industry. Due to fully success companies do not come from automotive industry which supported quantitative results that lean practices can apply in any industry. The first thing to do before launching lean program to all process is that the company should buy-in the understanding of managers about lean concept and implementation. Willingness with well understanding and realizing importance of lean program will lead to superior results, especially operational [53, 54, 55, 9], economic [56, 11, 57, 58], and environmental and social performance [59, 60, 13].

Finally, the results reported that the relationship between transformational leadership and sustainability performance is no difference in terms of both industry type and length of lean adoption. The results confirmed that both of them appropriate for all companies and all industries. Consistent with Gurr [61] proposed sustainable leadership takes into deliberation a comprehensive scope of complex interconnections among personals, the business community, worldwide demands and the natural environment, with the essential objective that a company accomplishes well-being by concerning social values, obtaining success in long-term based on strategic decision-making value and preservation the ecosystem, of which we all form an integral part. In addition, sustainable leadership creates communities, encourages cooperation among stakeholders and fosters value in long-term. The relevance of sustainable leadership for chargeable strategic decision making in sustainable companies is obvious in the method it directs the sustainable leaders attentions with regard to four fields of deliberation when making decisions. It requires that top executives adopts a macro view of the company [62] due to sustainability associates with a variety dimensions of development and performance [63]: (1) on a individual level: keeping physical health and individual psychological; (2) at the business level: keeping a workplace surrounding that permits workers to improve manifold knowledge with the goal of accomplishing the company's purposes, which are linked up with the goals of stakeholders; (3) at the social level: socially-responsible handling in the broader community; and (4) on the ecological level: preservation and sustainable environmental change.

B. Managerial Implications

The findings provide some implications for the practitioners and entrepreneurs. The results show that lean manufacturing will result in high level of both operational and financial performance, which is worth taking more attention. In addition, Thai managers tend to understand that lean manufacturing is suitable for only automotive industry. Nevertheless, the results confirmed that it can be applied for any manufacturing as well as any company size. Moreover, at present, there are many studies asserting that it can also be applied in service industry. Successful lean production requires serious cooperation and attentions of all employees across company; thus, managers should create the good two-way relationship, sharing, caring, bottom up communication, and free-rein culture with their employees. Effective supply chain management is imperative by close communications and relations with suppliers, distributors, and customers.

C. Suggestions for Future Research

The results offer several implications for scholarly researchers. First, due to the scarce studies of sustainability performance, the future study should augment knowledge by investigating the antecedent and consequence of this variable. Second, the literature on leadership paradigms, organizational performance and corporate sustainability, and key mediating variables, particularly shared vision and values, self-leadership, an organizational team orientation and consensual decision-making, affecting their relationships should be examined. Third, due to leadership have effect on lean practices resulted in higher performance thus the future study should be focused more on effect of other type of leadership. Finally, the successful lean production required cooperation across all members of supply chain, which takes time; thus, it requires longitudinal studies.

D. Limitations

There are some expected potential limitations. Firstly, the effect of external factors which may involve sustainable leadership, lean manufacturing, and sustainability performance, such as political issues, macroeconomics, microeconomics, and economic crisis. Secondly, as the study applied self-report and cross-sectional data, the summarizations could not only make causal extrapolations but also increase some concerns about common bias. Therefore, a study in long term is required to offer greater definitive summarization. Thirdly, the results explain the small and medium manufacturing firms' situations and activities which may not be corresponding with the service companies as well as large companies. Lastly, the results describe situations and activities of firms operating in Thailand, which may not be compatible with international and multinational corporations.

E. Conclusions

This study fulfills the vague knowledge by confirming the relationships among sustainable leadership, lean manufacturing, and sustainability performance. In addition, this study augments the comprehension that lean manufacturing can be applied in any industry [8, 25, 52]. Accomplished lean implementation requires serious and much attention from all members across company, suppliers, distributors, and customers [48, 49]. Successful lean managers need insight comprehension about lean concept and implementation before persuading their employees to do with higher willingness and cooperation. Referring to the scarcity of lean manufacturing success at present time [4], it is likely to be a challenge for the future research to explore antecedent, consequent, and intervention factors, which will result in superior understanding of the lean production notions and utilizations. Successful lean implementation will generate better financial outcomes and lower cost thanks to the willingness of all employees and efficient processes which lead to all of sustainable competitiveness, including operational [9, 51], financial [57, 58], social and environmental performance [13].

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APPENDIX E

Certificate of Utilization

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....บริษัท ไทยทราโฟแมนูแฟคเจอริ่ง จำกัด.....
ที่อยู่หน่วยงานที่รับรอง .....115 อาคารปรีดาวิว ถนน พระราม3(53) แขวงบางโพงพาง เขตยานนาวา กทม... 10120.....
.....
ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ).....
.....

THAI TRAFO MANUFACTURING CO., LTD.

ลงชื่อ .....
(ชื่อ-สกุล ...นายประภาส ตันติวราภรณ์.....)
ตำแหน่ง ..ผู้จัดการฝ่ายขายและการตลาดเอกชนในประเทศ.....
วัน เดือน ปี ที่ให้การรับรอง ...24/10/2560.....

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....บริษัท เอ.เค.พี เทคโนโลยี จำกัด.....
ที่อยู่หน่วยงานที่รับรอง .....17/25 ถนนวัชรพล แขวงคลองถนน เขตสายไหม กรุงเทพมหานคร 10220.....
.....

ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ).....
.....

ลงชื่อ ....
(ชื่อ-สกุล ...ดร.พิษณุ วิชยโยธิน.....)
ตำแหน่ง ..ประธานบริษัท.....
วัน เดือน ปี ที่ให้การรับรอง ...30/10/2560.....

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....บริษัท ซีพีเอส ออโตเมชั่นแอนด์เอ็นจิเนียริ่ง จำกัด.....
ที่อยู่หน่วยงานที่รับรอง .....888/151 หมู่ 3 ถ.สุขุมวิท ต.บางปูใหม่ อ. เมือง จ.สมุทรปราการ 10280 โทร 02-0058202 .....
.....

ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ).....
.....

บริษัท ซีพีเอส ออโตเมชั่นแอนด์เอ็นจิเนียริ่ง จำกัด
CPS Automation & Engineering Co., Ltd

ลงชื่อ .....
(ชื่อ-สกุล ...นายชัชวาล คูณขุนทด.....)
ตำแหน่ง ..กรรมการผู้จัดการ.....
วัน เดือน ปี ที่ให้การรับรอง ...12/10/2560.....

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....บริษัท โอเอ็กซีส จำกัด .....
ที่อยู่หน่วยงานที่รับรอง .....35/7 หมู่ แขวงหนองค้างพลู เขตหนองแขม กรุงเทพมหานคร 10160 .....
.....

ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ).....
.....

ลงชื่อ .....
(ชื่อ-สกุล ...นายเอก เอี่ยมลือนาม.....)
ตำแหน่ง .....ผู้จัดการ.....
วัน เดือน ปี ที่ให้การรับรอง ...21/10/2560.....

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....บริษัท เอส.โปร. เอ็นจิเนียริ่ง เวิร์ค จำกัด .....
ที่อยู่หน่วยงานที่รับรอง .....357/38 ถ.เคหะร่มเกล้า แขวงคลองสองต้นนุ่น เขตลาดกระบัง กรุงเทพมหานคร 10520 .....
.....

ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ). .....
....

S.Pro
S. PRO ENGINEERING WORK CO.,LTD.

ลงชื่อ ....
(ชื่อ-สกุล นายศิริชัย ศักดิ์อรุณชัย.....)
ตำแหน่ง กรรมการผู้จัดการ.....
วัน เดือน ปี ที่ให้การรับรอง ...18/10/2560.....

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....บริษัท เซฟตี้ โซลูชั่น จำกัด .....
ที่อยู่หน่วยงานที่รับรอง .....609 ถ.กาญจนาภิเษก 8 แขวงบางแค เขตบางแค กรุงเทพมหานคร 10160 .....
.....

ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ).....
.....

บริษัท เซฟตี้ โซลูชั่น จำกัด

ลงชื่อ .....
(ชื่อ-สกุล ...นายดนัย อุดมพุฒิกิจ.....)
ตำแหน่ง .....ผู้จัดการ.....
วัน เดือน ปี ที่ให้การรับรอง ...18/10/2560.....

หนังสือรับรองการใช้ประโยชน์
จาก งานวิจัย / งานสร้างสรรค์ / นวัตกรรม ของคณะบริหารธุรกิจ
มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

ชื่อหน่วยงานที่รับรอง .....ห้างหุ้นส่วนจำกัดธีรพัตร์ โยธากิจ .....
ที่อยู่หน่วยงานที่รับรอง .....176 ถ. วิฑูรอุทิศ 1 ต. สะเตง อ. เมือง จ. ยะลา 95000 โทร 084-6255500 .....
.....

ขอรับรองว่าหน่วยงาน ได้มีการนำ งานวิจัย/งานสร้างสรรค์/นวัตกรรม ในหัวข้อเรื่อง.....ความสัมพันธ์ระหว่างภาวะผู้นำแบบการเปลี่ยนแปลง ภาวะผู้นำที่ยั่งยืน ระบบการผลิตแบบลีน และประสิทธิภาพที่ยั่งยืนในอุตสาหกรรมการผลิตไทย (The Relationships among Transformational Leadership, Sustainable Leadership, Lean Manufacturing Practices, and Sustainability Performance in Thai Manufacturing Industry)
หัวหน้าโครงการ.....ดร.ปิยฉัตร บูระวัฒน์.....คณะบริหารธุรกิจ.....
ไปใช้ประโยชน์ ดังนี้
.....ประยุกต์ใช้กับการเพิ่มผลผลิต ปรับปรุงประสิทธิภาพ ลดต้นทุนการผลิต และเพิ่มผลกำไรให้กับธุรกิจขนาดกลางและขนาดย่อม.....
.....

☐ 1. การใช้ประโยชน์ในด้านการบริหารจัดการ
- ⊘ ด้านการบริหารจัดการสำหรับวิสาหกิจขนาดกลางและขนาดย่อม (SMEs)
- ○ ด้านการบริหารจัดการสำหรับองค์การธุรกิจขนาดใหญ่
- ○ ด้านการบริหารจัดการสำหรับองค์กรในภาครัฐ
- ○ ด้านการบริหารจัดการองค์กรในภาคประชาสังคม

☐ 2. การใช้ประโยชน์ในเชิงนโยบาย
- ○ นำไปประกอบเป็นข้อมูลสำหรับการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยองค์กร
- ○ นำไปประกอบเป็นข้อมูลในการประกาศใช้กฎหมายหรือกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาครัฐ
- ○ นำไปประกอบเป็นข้อมูลในการกำหนดมาตรการ กฎเกณฑ์ต่างๆ โดยหน่วยงานภาคเอกชน
- ⊘ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาองค์กร
- ○ นำไปใช้เป็นแนวทางในการกำหนดนโยบายเพื่อพัฒนาทรัพยากรมนุษย์

☐ 3. การใช้ประโยชน์เชิงพาณิชย์
- ○ นำไปพัฒนาผลิตภัณฑ์/นวัตกรรม ซึ่งสร้างรายได้ให้แก่องค์กร
- ⊘ นำไปสู่การเพิ่มประสิทธิภาพการผลิต (ลดต้นทุนในกระบวนการ/ลดของเสีย/ลดเวลา/ลดค่าใช้จ่าย)

☐ 4. การใช้ประโยชน์โดยอ้อมหรือการใช้ประโยชน์ในลักษณะอื่น (กรุณาระบุ).....
.....

ห้างหุ้นส่วนจำกัด T.R.P ธีระพัตร์โยธากิจ

ลงชื่อ .....
(ชื่อ-สกุล ...นายธีรพัฒร์ ศรีสุวรรณ.....)
ตำแหน่ง .....ผู้จัดการห้างหุ้นส่วน.....
วัน เดือน ปี ที่ให้การรับรอง ...24/10/2560.....

Biography

Name – Surname	Dr. Piyachat Burawat
Date of Birth	July 21, 1979
Address	Faculty of Business Administration, Rajamangala University of Technology Thanyaburi, Pathumthani, 12110
Education	Ph.D. of Business Administration (Management) (2014)
Experience Work	Faculty of Business Administration, Rajamangala University of Technology Thanyaburi (2014-Present)
Telephone Number	(66)894865461
Email Address	piyachat_b@rmutt.ac.th