

**ความสัมพันธ์ระหว่างภาวะผู้นำ ผลการปฏิบัติด้านการผลิต  
แบบลีน การดำเนินงาน การเงิน และสภาพแวดล้อมที่ยั่งยืน**

## **THE RELATIONSHIPS AMONG LEADERSHIPSTYLE, LEAN MANUFACTURING PRACTICE, OPERATIONAL PERFORMANCE, FINANCIAL PERFORMANCE, AND SUSTAINABLE ENVIRONMENT**

ปิยฉัตร บุระวัฒน์\*

Piyachat Burawat\*

---

\* อาจารย์ประจำ คณะบริหารธุรกิจ มหาวิทยาลัยเทคโนโลยีราชมงคลธัญบุรี

\* Lecturer, Faculty of Business Administration, Rajamangala University of Technology Thanyaburi

\* Email: piyachat\_b@rmutt.ac.th

## บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อทดสอบความสัมพันธ์ระหว่างภาวะผู้นำ ระบบการผลิตแบบลีน ประสิทธิภาพการดำเนินงาน ประสิทธิภาพทางการเงิน และประสิทธิภาพที่ยั่งยืน ซึ่งใช้วิธีการศึกษาแบบผสมระหว่างวิธีการเชิงปริมาณและวิธีการเชิงคุณภาพ วิธีการเชิงปริมาณใช้การวิจัยเชิงสำรวจโดยทำการเก็บรวบรวมข้อมูลจากพนักงานปัจจุบันซึ่งดำรงตำแหน่งผู้จัดการระดับกลางและระดับสูงในอุตสาหกรรมการผลิตในประเทศไทยจำนวน 293 คน การวิเคราะห์ข้อมูลประชากรด้วยสถิติเชิงพรรณนา การวิเคราะห์ความสัมพันธ์ระหว่างตัวแปรและความสัมพันธ์ระดับโครงสร้างด้วยเทคนิคการสร้างสมการโครงสร้าง และผลการศึกษาพบว่า ระดับการประยุกต์ใช้ลีนในบริษัทขนาดกลางและเล็กกับบริษัทขนาดใหญ่มีความแตกต่างกันอย่างมีนัยสำคัญ โดยที่บริษัทขนาดกลางและเล็กมีการประยุกต์ใช้ระบบการผลิตแบบลีนในระดับปานกลางในขณะที่บริษัทขนาดใหญ่มีการประยุกต์ใช้ระบบการผลิตแบบลีนในระดับค่อนข้างมาก ยิ่งไปกว่านั้น การศึกษายังพบว่า มีความสัมพันธ์เชิงบวกระหว่างภาวะผู้นำแบบแลกเปลี่ยนภาวะผู้นำแบบยั่งยืน และภาวะผู้นำแบบหลีกเลี่ยงกับระบบการผลิตแบบลีน และพบว่ามีความสัมพันธ์เชิงบวกระหว่างระบบการผลิตแบบลีนกับผลตอบแทนต่อผู้ถือหุ้น ผลการปฏิบัติด้านการดำเนินงานด้านการเงิน ด้านสิ่งแวดล้อม และสังคม นอกจากนี้ผลการศึกษาพบว่า ประสิทธิภาพของอุตสาหกรรมและขนาดของบริษัทไม่ส่งผลกระทบต่อความสัมพันธ์ของโมเดลทั้งในระดับโครงสร้างและระดับเส้นทาง ในด้านการศึกษาเชิงคุณภาพทำการเก็บข้อมูลด้วยวิธีการสัมภาษณ์เชิงลึกกับผู้จัดการในระดับกลางและระดับสูงที่ทำงานในอุตสาหกรรมการผลิตทั้งบริษัทขนาดเล็ก ขนาดกลาง และขนาดใหญ่ จำนวน 40 คน ผลการศึกษา พบว่า บริษัทขนาดใหญ่ให้ความสำคัญกับการประยุกต์ใช้ระบบการผลิตแบบลีนมากกว่าบริษัทขนาดเล็ก ซึ่งสนับสนุนผลการศึกษาที่ได้จากการศึกษาเชิงปริมาณ และผลการศึกษาพบว่า ความซับซ้อนทางการแข่งขันทางธุรกิจส่งผลให้บริษัทไม่ต้องการให้เกิดการเปลี่ยนแปลง ดังนั้นผู้จัดการเลือกใช้วิธีการแลกเปลี่ยนความคิดเห็นและการให้รางวัลกับพนักงานมากกว่าการไปสร้างแรงบันดาลใจหรือกระตุ้นให้พนักงานต้องการมีการเปลี่ยนแปลง

**คำสำคัญ:** ภาวะผู้นำระบบการผลิตแบบลีน ประสิทธิภาพการดำเนินงาน ประสิทธิภาพการเงิน ประสิทธิภาพด้านสิ่งแวดล้อมและสังคม

## Abstract

The objective of this study is to investigate the relationships among leadership style, lean manufacturing practice, operational performance, financial performance, and sustainable performance; thereby, the study was conducted and accomplished by means of mixed methods. Considering the quantitative approach, a survey was conducted with 293 current middle and top managers working in Thai manufacturing industry. Demographic data was analyzed by descriptive statistics while relationships among variables were tested by structural equation modeling. The findings reported that there was a significant different level of lean manufacturing practice between the small and medium companies and the large companies. The small and medium firms applied lean manufacturing practice at some extent whereas the large ones applied lean manufacturing practice at extensive extent. In addition, the findings revealed that there were positive relationships between transactional leadership and lean manufacturing practice, sustainable leadership and lean manufacturing practice, passive avoidant and lean manufacturing practice, lean manufacturing practice and return on equity, lean manufacturing practice and operational performance, lean manufacturing practice and financial performance, and lean manufacturing practice and environmental and social performance. The result further revealed that both structural and path level were not different across the types of industry and sizes of company. Qualitative approach was carried out by in-depth interview with 40 current middle and top managers working in small, medium, and large manufacturing companies. According to the complexity of business competition; thus, organization did not need to be changed. Therefore, the managers were interested in exchanging opinion and providing rewards with employees and rather than inspiring them to be changed. Moreover, the large companies focused more on lean manufacturing practice rather than smaller companies, which confirmed the quantitative result.

**Keywords:** Leadership, Lean Manufacturing, Operational Performance, Financial Performance, Environmental and Social Performance

## Introduction

Currently, globalization makes communication free without borders. In addition, as a consequence of an establishment of ASEAN Economic Community (AEC) in 2015, there has been a fierce competition in both domestic and international markets. Therefore, manufacturing firms need to explore strategies that can increase level of productivity and quality while decreasing costs and delivery lead time to consumers, all of which require the cooperation of all parties from suppliers, subcontractors, employees, and management teams. The majority of production makers have chosen continuous improvement programs as their principal strategic initiatives to increase level of customer service, quality, and overall total value that deliver to their consumers. Presently, strategies of continuous improvement have initially evolved from the Toyota production system (TPS), which is the combination of the quality theories of United States origins by Juran, Deming, and others (Womack & Jones, 1996; Lathin & Mitchell, 2001; Marynell, 2013). The success of TPS is based on the efficient management of relationships, both top-down and bottom-up, resulting in organizational changes. TPS is composed of various programs such as Total Quality Management (TQM), six-sigma, lean manufacturing, just in time, and other theory of limitations (Marynell, 2013).

Manufacturers are climbing on the lean bandwagon in droves. The Industry Week/MPI Census shows that nearly 70% of all plants are currently employing lean manufacturing as an improvement methodology; however, only 2% of establishments answering the survey have completely accomplished their goals and 24% presented accomplishing significant results. The remains, 74%, accepted that they are not doing well with lean. More recently, the results showed that many companies that won the excellent lean manufacturing awards provided by the Shingo Prize committee, after winning the award, had not maintained their success (Pay, 2006).

Considering the accomplished lean executions research, the important attributes for achievement depend on the top management's commitment, the empowering of workers, evaluating successful activities, having an obviously plan for improvement process, establishing explicit direction, focus, and targets (Forrester, 1995; Leitner, 2005; Spector & West, 2006). These achievement attributes are related to responsibilities and roles of leaders for organizational change, which are respected as important basic pillars of lean manufacturing. The accomplishment of lean initiatives and development of a continuous improvement culture depends upon the leadership deportations and executes within the organization (Found & Harvey, 2007; Heymans, 2002).

The existing researches place an emphasis on the relation of leadership behaviors and practices that leads to successful lean executions. The research publications fails to consider that one leadership model might not be suitable for achievement within lean practices. Consistent with Herkness (2005), it reveals that transformational leadership enlarges transactional leadership by developing on the interchanges and reciprocations 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. 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 still lacking. Therefore, this study intends to study the influence of transformational, transactional, and passive avoidant leadership on lean manufacturing practices.

The new category of leadership paradigm could be entitled sustainable leadership featured by three essential processes, i.e. learning through doing and having an obvious awareness of individual goal, sensing of individual motivations and expectations, and successful in stress management and adequate self-care (Casserley & Crichley, 2010). Since sustainable leadership is insufficient in academic field, the theoretical premise has not been completely developed. Therefore, this study intends to examine the influence of sustainable leadership on lean manufacturing executions, which are the incremental contributions to academic research.

Labor productivity is critical to the competition. In addition, it can also increase sustainable revenue. Company with higher costs will result in lower competitiveness, leading to loss and withdrawal from the business. Thailand labor productivity increases by 2% per year, which is very low compared to other countries, such as Vietnam and China, with the increase by 4% and 10%, respectively (Tansakul & Sutthiwatanaruputh, 2014). The unit labor costs of Thailand have increased by 3% while Indonesia fell by 12% (Tansakul & Sutthiwatanaruputh, 2014). According to both low level of productivity and high level of unit labor costs, the competitiveness of Thailand is reduced.

Meanwhile, inventory is one of the most expensive assets of many firms, presenting as much as 50% of total invested capital. Employers have long acknowledged that well management in inventory is important. In addition, a company can deduct costs by decreasing inventory. On the other hand, production may stop and customers become dissatisfied when an item is out of stock (Heizer & Render, 2011).

According to low level of productivity, higher labor cost, high level of inventory as well as advances in technology and science, business leaders and managers need to find strategies that can add value to their products and reduce losses as much as possible (Barney & Hesterly, 2010). Since Toyota applied lean manufacturing successfully, within two decades it has gained much attention. Overall, the review of related researches presents that execution of lean manufacturing is usually related to increases in operational performance measures. The most regularly cited advantages associated with lean implementations are increasing in employee productivity and quality of product, decreasing in lead time deliver to customer, cycle time, and manufacturing costs (Marynell, 2013; Sakakibara, Flynn, Schroeder, & Morris, 1997). However, some studies found that some dimensions of lean manufacturing are related to firm performance. In addition, some studies found that there is no relationship between lean manufacturing and performance (Hibadullah, Fuzi, Chiek Desa, & Zamri, 2013; Kaplan & Norton, 1992) Meanwhile, Fullerton and Wempe (2009) reported that there is relationship between lean manufacturing and financial performance through operational performance.

Regarding the above concepts, the relationships among leadership style, lean manufacturing, and performance are ambiguous. Thus, this study proposes to examine the simultaneous relationships among transformational leadership, transactional leadership, passive avoidant leadership, sustainable leadership, lean manufacturing practices, return on equity, overall efficiency, profit, and sustainability performance (operational, financial, and environmental and social performance) in Thai manufacturing industry. The results of this study provide enlightenment information in an efficient form for a firm's operational system, which leads to sustainable improvement in the global competitiveness.

## Literature Review

Presently, organizations attempt very hard to gain victory in the aggressive rivalry, which is difficult to achieve by only one alternative, e.g. growing orders to get profit. Therefore, to be more competitive or to survive in such fierce competition, the organizations have to resort to the other crucial ways, such as reducing the costs. Accordingly, less than 24% of companies with lean programs are successful (Pay, 2006). Considering research on successful lean implementations, these accomplishment attributes are related to leadership's role and responsibilities for organizational change, which are viewed important within the basic premises of lean practices.

## Leadership style

Over the past 50 years various leadership styles have been created, studied, paralleled, and criticized with the endeavor to describe the leadership conceptual models (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 early 20th century study in leadership areas emphasized on the individual leader characteristics in order to clarify their success (Mann, Gibbard, & Hartman, 1967; Stogdill, 1974). After that, theorists comprehended the requirement for a wider perspective to leadership successfulness and started learning behaviors of leaders. The model of behavioral leadership attempts to comprehend the interaction between leader and labor. Other academicians struggled to elaborate further leadership theory in order to clarify the responsibility that diversified contexts on the leadership situation which is known as contingency leadership theory. More recent researches have emphasized on the success of leaders who perform in an inspirational and visionary ability which is regarded as transformational leadership (Bass, 1988; Burns, 1978). Modern study presents that transformational leaders can enhance the overall organizational success and innovation; therefore, they are perfectly appropriated to conduct changing in company (Northouse, 2004). The new category of leadership paradigm could be entitled sustainable leadership which is relied on the concept of ethical leadership (Brown & Trevino, 2005), but enlarges its application area by asserting that it is ethical that we take into consideration the requirements of a broader stakeholder's scope along with next generations and the natural environment. Comparing to other theories of leadership, sustainable leadership is differentiated by seeking the sustainability value at levels of personal, organizational, social and ecological for both existing and next generations (Olivier, 2012).

## Lean Manufacturing Practice

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, which 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 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).

In academic publications, lean implementation was frequently coined as Toyota production system (TPS), beginning in Toyota Motor Manufacturing Company after the Second World War. Accordingly, the limited resources resulted in challenging in production facilities management which provoked managers working for Toyota to create numerous TPS elements aiming at decreasing waste (Liker, 1998; Pavnaskar, Gersheenson, Jambekar, 2003). Therefore, lean is about the consumption of lower resources (working hour, material, machinery, and production area) to make the same or higher product quantity. Still, the interest from western manufacturing industry was limited in lean manufacturing as long as the performance distinctions between Toyota and other automotive companies were underlined by the book written by Womack, Jones, and Roos (1990), namely "The Machine that Changed the World", which also coined the jargon lean manufacturing (or lean production). Womack et al. (1990) proposed that the practices and infrastructures that encourage lean manufacturing obviously supported a thesis of transference and the capacity of non-Japanese and non-carmaker emulation depended on the assumption that manufacturing technologies and production issues were general management problems. Lean application is not restricted to only carmaker, but it has also been accepted in a broader scope of all production industries, unionized or a non-unionized (Shah and Ward 2003), all countries (Anand & Kodali, 2008; Cua, McKone, & Schroeder 2001), and large, medium, as well as small firms (White et al., 1999).

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 combination of techniques and means (Basu, 2009; Hines, Rich, & Esain, 1999; Shah & Ward, 2003) intended at removing waste.

Shah and Ward (2003) examined the implementation of 22 lean executions and separated them into four categories, i.e. just-in-time (JIT), total quality management (TQM), total productive management (TPM), and human resource management (HRM). In addition, Shah and Ward (2007) further stated that lean is a multi-dimensional attribute and they created ten divergent attributes/aspects to characterize lean manufacturing system, i.e. (1) supplier feedback, regarding the company that has profound communication with suppliers and provides feedback to their supplier on delivery and quality, (2) just in time delivery by suppliers, or key suppliers delivering on a time basis, (3) supplier development, meaning the organization keeps transmission on essential problems with suppliers in corporate-level; suppliers become engaged to reduce annual cost and delivery time, and improve product quality, (4) customer involvement, referring to the organization having intimate communication with buyers, (5) pull system, meaning that manufacturers will produce only required quantity ordered by the purchaser, (6) continuous flow, or equipment being divided to produce a continuous flow of families of goods; the production speed is directly related to the buyer requirement ratio, (7) set up time reduction, respecting to the organization that has a short time of changing from one product type to other type, (8) total productive/preventive maintenance, or

regular schedules for equipment maintenance, (9) statistical process control, or most processes/tools on the production line are controlled by statistical process, and (10) employee involvement, referring to operating workers who are essential in the teams to suggest and solve production problem.

Study has been proceeded to discover the crucial accomplishment factors of lean production so as to fulfill the space between successful and unsuccessful lean implementation. Within the research studies discovering the important accomplishment factors related to lean program, one regular factor which continues to be the most important is the top management commitment and leadership (Soriano-Meier & Forrester, 2002; Spector & West, 2006). The recent research literatures about the relationship between leadership and lean practices are rather scarce. Besides, the said researches mostly focus on only one type of leadership contributing to the successful application of lean practice. Consistent with Herkness (2005), the research revealed that transformational leadership adds transactional leadership by creating the exchanges between leaders and followers and it further suggested that the transformational leadership model is useful when trying to lead change. Therefore, this study is intended to study the influence of leadership on lean manufacturing.

### **Sustainable Performance**

According to the increasing attention of all kinds of stakeholders in company activities in recent rivalry situation, there have been crowded researches in field of corporate sustainability performance evaluation from both practitioners and academicians. Firms are struggling to accomplish long-term benefits by applying sustainability activities as principal organizational strategy (Chabowski, Mena, & Gonzalez-Padron, 2011; Cruz, Pedrozo, & Estivaleta, 2006).

During positive enlargement of corporate sustainability performance, organizational performance follows the same path, or vice versa, requiring a good quantity of study. Takala and Pallab (2000) proposed that corporate sustainability performance generally emphasizes on the environmental, social, and economic performance of sustainable development. Meanwhile, sustainability performance is defined by Schaltegger and Wagner (2006) as the performance of a firm in all aspects and for all driver of corporate sustainability. 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.

Where sustainability performance assesses are informed by private sector companies, there is a tendency to align these with the Global Reporting Initiative (GRI) index (Adams, Muir, & Hoque, 2014) with a combination of stand-alone sustainability reports and mixed annual/financial reports with sustainability reporting. The study of KPMG (2007) reported that 83 percent of top 500 Australian firms in 2006 presented stand alone sustainability reports; however, more presently, an increasing quantity of organizations are presenting their sustainability performance with the measurement of sustainability performance financial to demonstrate, or at least to provide the impression, that sustainability is integrated in decision-making, a notion becoming known as integrated reporting (Economist Intelligence Unit, 2010). The organizations, whose aim is outstandingly seen (at least by themselves) as being one of economic return, might be greater readily excused for separately reporting voluntary sustainability assesses.

In conclusion, sustainability performance embraces 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 demonstrates the scarcity of accountability for environmental and social performance. Although there has been a gush of studies in the field of corporate sustainability performance evaluation from both practitioners and academicians, there is still no concurred universal guideline or standard. Generally, there are some measures usually mentioned or used by organizations in choosing sustainability performance evaluates.

## Theoretical Framework

The proposed framework is to investigate the simultaneous relationships among leadership style, lean manufacturing practice, operational performance, financial performance, and sustainable performance.

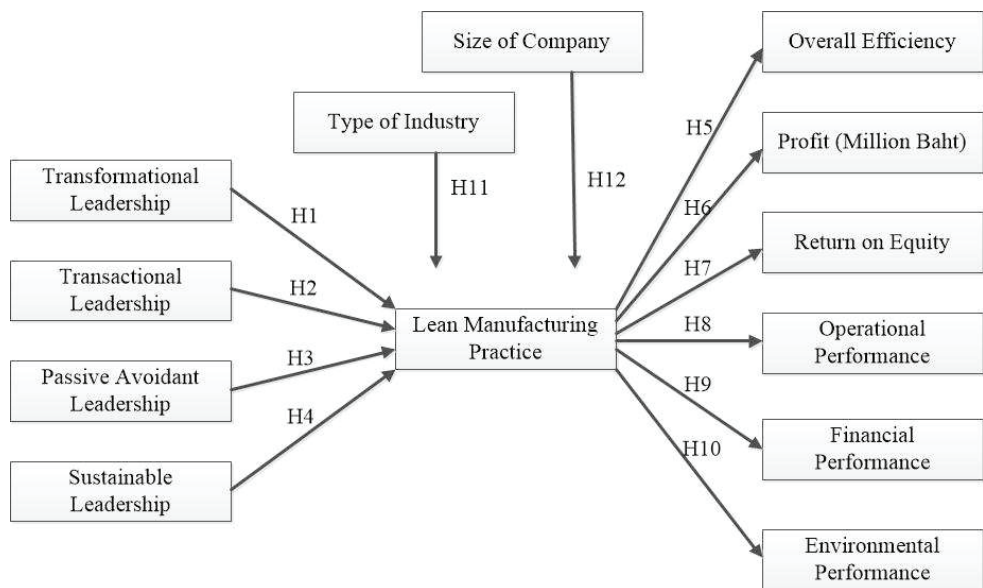


Figure 1 The theoretical framework

## Research Methodology

### Samples and Procedures

The population for the study enclosed middle management and top management executives of companies running in Thai manufacturing industry. Bentler and Chou (1987) mentioned that, under the theory of normal distribution, the proportion of sample size to amount of free parameters should be at least 5:1 in order to obtain trustworthy parameter forecasts. The amount of free parameters is 43; therefore, the lowest sample size equals 215. A total of 293 samples (165 respondents from small and medium companies, 128 respondents from large companies) were

gathered in 2016 between April and November by means of simple random sampling together with snowball sampling. The simple random sampling was performed by three techniques. First, the letters authorized by the university to ask permissions to send the paper or online survey together with paper or online survey were sent to companies listed in the Federation of Thai Industry. Second, 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. Finally, the dean of business administration 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 graduated student studying in manufacturing and related major while working for manager position and above were certainly asked. Considering snowball sampling method, the respondents were interviewed and asked by highly experienced interviewers. After observing the initial respondent, the researcher asked for assistance from the initial respondents to help identify people with an identical attribute of attentiveness. In qualitative method, in-depth interview was conducted from 20 participants of small and medium companies and 20 participants from large companies who worked for middle and top management position.

### **Instruments**

A mixed method was used to investigate the simultaneous relationships model. Quantitative method was conducted by means of questionnaires consisting of seven parts. The first part is demographic information of respondents and information of the companies. The latter three parts are transformational leadership, transactional leadership, and passive avoidant which were evaluated by MLQ Form 5X model. The rest include sustainable leadership which was developed by Avery and Bergsteiner (2011), lean manufacturing which was developed by Shah and Ward (2007), and sustainable performance index which was developed by Global Reporting Initiative (GRI) (2014). On the other hand, qualitative information was collected by in-depth interview composed of current situation of companies' lean manufacturing practice, operational and financial performance, overview, suggestions, discussions, and desired consequences of lean manufacturing execution.

### **Structure Equation Model (SEM)**

Wright (1921) described that SEM is a statistical technique for examining and forecasting causal relations, applying a combination of statistical data and qualitative causal assumptions. This study is extensive with twelve hypotheses presented in figure 1. Seven indicators were used to determine the suitable theoretical framework presented in table 1. The associations among factors were measured by t-test related to critical ratios (C.R.) and p-value.

**Table 1** The Lowest Threshold of Each Seven Indices to Determine Appropriate Model Fit

Model fit index	Threshold/Minimum criterion
$\chi^2$ or CMIN	- should not be significant at a 0.05 threshold ( $p > 0.05$ ) (Hu & Bentler, 1999)
$\chi^2/df$ or CMIN/df	- should be less than 5.0 to judge the fitness of the model (Bentler, 1989)
CFI	- should be greater than 0.9 to judge the good fit (Bentler & Bonett, 1980)
IFI	- should be greater than 0.9 to judge the good fit (Bentler & Bonett, 1980)
AGFI	- should be greater than 0.9 to judge the good fit (Jöreskog & Sörbom, 1996) - AGFI of 0.8 is sometimes proposed as sufficient as recommended cut-off (Chau & Hu, 2001)
PGFI	- should be greater than 0.5 to judge acceptable fit (Hair, Anderson, Tatham, & Black, 1998)
RMSEA	- should be less than 0.05 to judge good fit, and between 0.05 and 0.08 to judge reasonable fit (Browne & Cudeck, 1993)

Source: Burawat, Kuntonbutr, & Mechinda (2014).

## Results

### Quantitative Results

The entire 293 of 900 questionnaires (response rate 32.56%) were applied to do analysis. The majority of the respondents were male, accounting for 55.6%, with age above 40 years old accounting for 32.1%. The working position thereof was general/factory/production manager, which accounted for 38.23%. Most of them had Bachelor's degree, which accounted for 74.1%. Mostly, the age of company was above 15 years, accounting for 50.2%, small and medium size, accounting for 56.3%, operating in non-automotive/part industry, accounting for 78.8%, without union of labor, accounting for 76.1%, and length of lean application less than 3 years, accounting for 70.6%.

The skewness and kurtosis values which determine the normal distribution should vary from -3 to +3 (Decarlo, 1997; Stuart & Ord, 1994). The findings reported that the skewness values vary from -1.234 to 1.894, and the kurtosis values vary from -1.905 to 2.720. Meanwhile, the Pearson's bivariate correlations of all relationships were significant. Therefore, it could be summarized that the principle of normal distribution and linearity was accepted.

Considering an overview, respondents evaluated all factors, i.e. transformational leadership, transactional leadership, sustainable leadership, lean manufacturing, operational performance, and environmental and social performance, at extensive extent. Meanwhile, the passive avoidant leadership was evaluated at little extent. In addition, financial performance was evaluated at some extent with 1-10% increase in financial number.

### Model Fit and Hypothesis Testing

The Chi-square is important statistics; however, a test of statistical significance is responsive to size of sample, which indicates that when the huge samples are employed, the Chi-square statistic nearly always denies the framework (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1996). Thus, many researchers suggested that a framework could also be satisfied if the most of fit indices report good adoption assesses and only a small numbers of indices are lower than the minimum criterion (Bagozzi & Yi, 1988; Fornell & Larcker, 1981). Even though the result of Chi-square statistics of the revised proposed theoretical model reported a significant at a 0.05 level, the left overfindings were greater than the lowest threshold presented in table 2. Therefore, it could be summarized that the structure of leadership style, lean manufacturing practice, operational performance, financial performance, and environmental and social performance were suitable to explain the interrelationships among items and latent variables.

**Table 2** Model Fit Indexes of the Revised Proposed Theoretical Model

CMIN	p-value	df	CMIN/df	CFI	IFI	NFI	TLI	AGFI	PGFI	RMSEA
271.837	0.000	110	2.471	0.936	0.937	0.898	0.921	0.869	0.651	0.071

AIC (Default model)	BCC (Saturated model)	BIC (Independence model)
357.837	363.486	516.084

After model fit was tested, the hypothesis was examined, starting with examine of regression weight significance. Regarding overall group, the p-value of regression weights are less than 0.05, except that the influence of transformational leadership on lean manufacturing practice, effect of lean manufacturing practice on overall efficiency and profit are above 0.05. The findings are consistent with both small and medium, and large companies as well as both automotive/part and non-automotive/part industry. Therefore, it can be summarized that H2, H3, H4, H7, H8, H9, and H10 are supported whereas H1, H5 and H6 are rejected. Consequently regression weights of three hypotheses were removed from the structural model. The revised model is showed in figure 2 and 3.

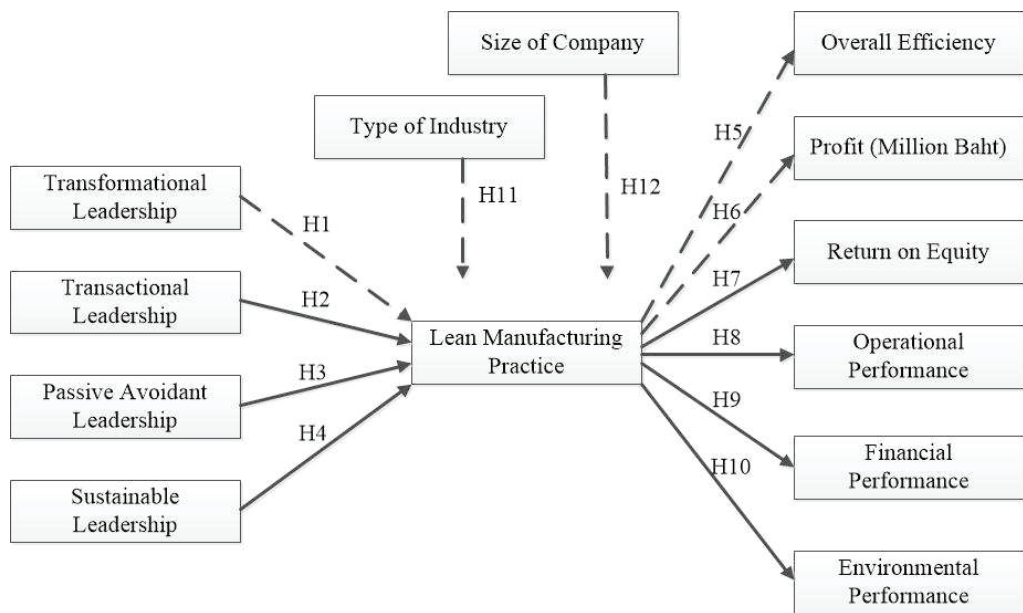


Figure 2 Results of test of significance of regression weight

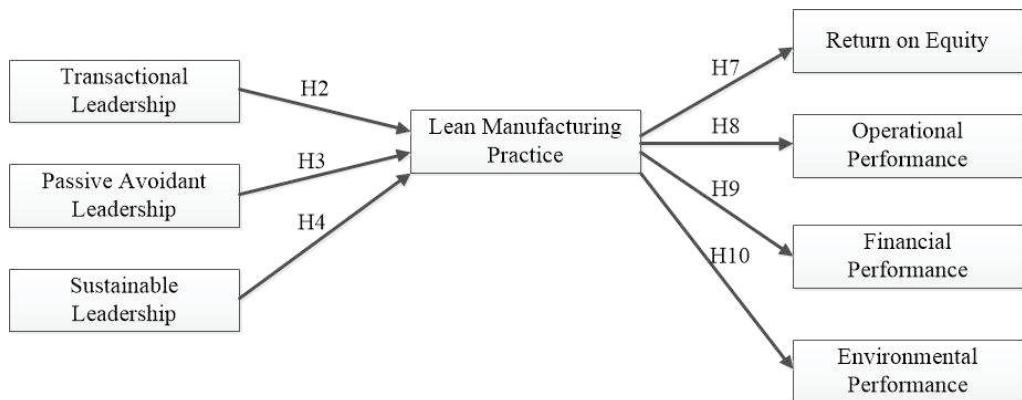


Figure 3 Revised theoretical model

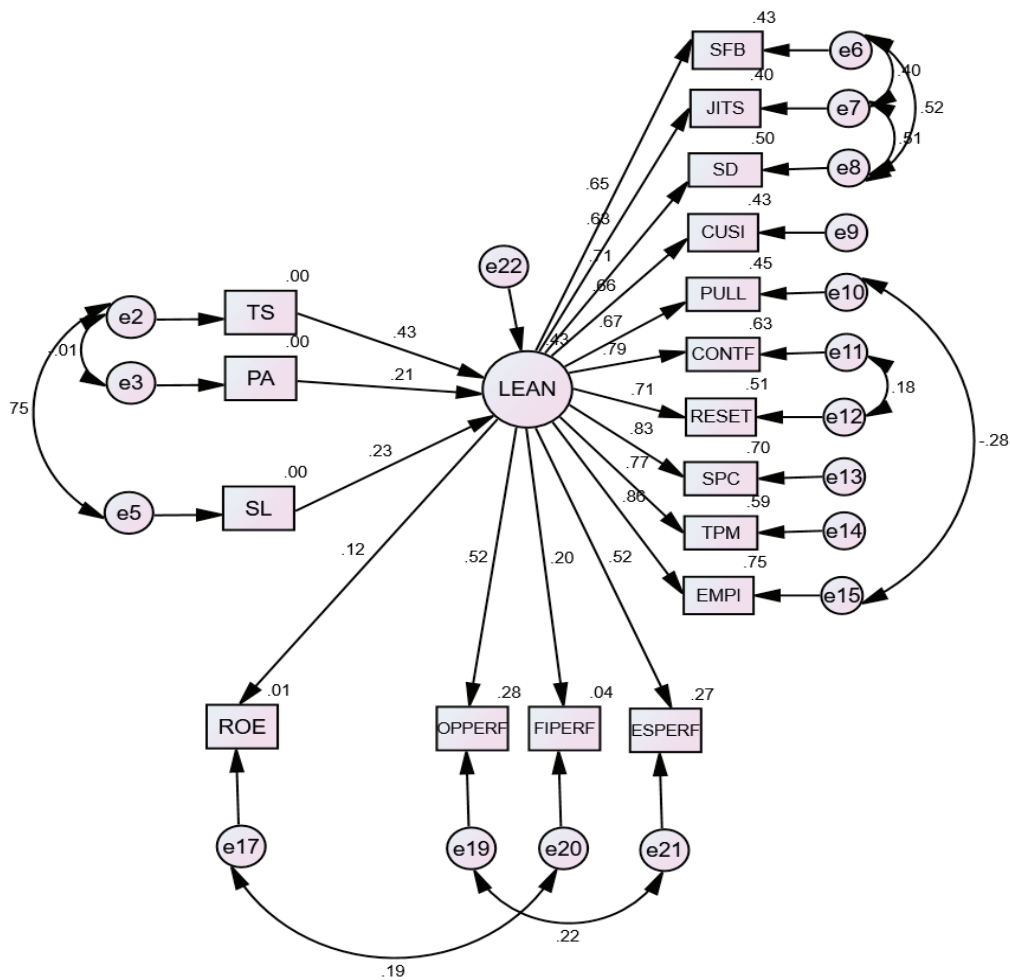


Figure 4 Structural model of revised framework

Table 3 Results of the Revised Theoretical Model Hypotheses Testing

			Estimate	S.E.	C.R.	p-value
H2: Transactional leadership	-->	Lean manufacturing practice	0.434	0.078	5.588	***
H3: Passive avoidant leadership	-->	Lean manufacturing practice	0.135	0.031	4.322	***
H4: Sustainable leadership	-->	Lean manufacturing practice	0.230	0.072	3.196	0.001
H7: Lean manufacturing practice	-->	Return on equity	14.447	7.203	2.006	0.045
H8: Lean manufacturing practice	-->	Operational performance	0.611	0.074	8.278	***
H9: Lean manufacturing practice	-->	Financial performance	0.378	0.117	3.227	0.001
H10: Lean manufacturing practice	-->	Environmental and social performance	0.689	0.084	8.194	***

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

**Table 4** Standardized direct, indirect, and total effect among variables of the revised theoretical framework

		Standardized Direct effect	Standardized Indirect effect	Standardized Total effect
H2: Transactional leadership	→ Lean manufacturing practice	0.430	0.000	0.430
H3: Passive avoidant leadership	→ Lean manufacturing practice	0.212	0.000	0.212
H4: Sustainable leadership	→ Lean manufacturing practice	0.233	0.000	0.233
H7: Lean manufacturing practice	→ Return on equity	0.122	0.000	0.122
H8: Lean manufacturing practice	→ Operational performance	0.525	0.000	0.525
H9: Lean manufacturing practice	→ Financial performance	0.197	0.000	0.197
H10: Lean manufacturing practice	→ Environmental and social performance	0.519	0.000	0.519

### Moderate Effect Testing

Regarding the moderate effect of automotive/part and non-automotive/part (H11), the Chi-square of the unconstrained is 430.475 and degree of freedom is 220, whereas the Chi-square of the fully constrained is 441.569 and degree of freedom is 236. The difference of the Chi-square is 11.094 and degree of freedom is 16. The p-value is 0.804, which can be summarized that the model is not different across types of industry. Meanwhile, regarding the moderate effect of sizes of company (H12), the Chi-square of the unconstrained is 442.140 and degree of freedom is 220, whereas the Chi-square of the fully constrained is 429.088 and degree of freedom is 236. The difference of the Chi-square is 6.948 and degree of freedom is 16. The p-value is 0.974, which can be summarized that the model is not different across sizes of company. Thus, it can be concluded that both H11 and H12 are rejected.

### Qualitative Results

Considering quality, the in-depth interview was conducted with middle and top managers working in 20 small and medium manufacturing companies and 20 large manufacturing companies. 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. In addition, managers proposed that they knew and applied some dimensions of lean manufacturing as they thought lean manufacturing was suitable for only automotive/part industry.

### Discussions and Conclusions

#### Hypothesis 1

The finding revealed that there is no relationship between transformational leadership and lean manufacturing practice, opposed to Cheerawit, Napompech, and Panjakhajornsak (2014). However, it confirms the results of Marynell (2013) and Langlois (2015). This is because most companies have operated longer than 15 years, and the operating system, situation and competition

are quite stable, requiring lower change. Transformational leadership will be useful when a company is trying to lead change.

#### **Hypothesis 2**

The finding revealed that there is a positive relationship between transactional leadership and lean manufacturing practice, which asserts the preceding researches, such as that of Marynell (2013). The key characteristics for success of lean manufacturing practice depend on the top management commitment, the empowering of workers, top-down and bottom-up relationships, assessing successful activities, having an obvious definition of process improvement plan, generating explicit concentration, direction, and objectives (Brown, Lamming, Bessant, & Jones, 2006; Forrester, 1995; Leitner, 2005; Liker & Meier, 2006; Longenecker, Moore, Petty, Palich, & McKinney, 2006; Smalley, 2005; Spector & West, 2006), which requires the characteristics of transactional leadership to be succeeded.

#### **Hypothesis 3**

The finding reported that there is a positive relationship between passive avoidant leadership and lean manufacturing practice. According to the author's knowledge, it is the first time that the relationship between passive avoidant leadership and lean manufacturing practice has been explained, which is the incremental contribution to academic research. Employees have experienced on their job more than others; thus managers should give chances to them to create and share their suggestions as well as feedback, which will enhance lean manufacturing and organizational success.

#### **Hypothesis 4**

The finding showed that there is a positive relationship between sustainable leadership and lean manufacturing practice. According to the author's knowledge, it is the first time that the relationship between sustainable leadership and lean manufacturing practice has been explained, which is the incremental contribution to academic research. Lean manufacturing involves with both insiders and outsiders, including all employees, suppliers, and customers. Lean manufacturing requires managers who possess the sustainable leadership. This kind of leader is able to create such efficient strategies that they can develop an organization and bring about better and faster learning, making the organization more flexible and adaptable than its rivals.

#### **Hypothesis 5**

The finding presented that there is no relationship between lean manufacturing practice and overall efficiency, which is not corresponding to the preceding publications, such as those of Rahman, Laosirihongthong, & Sohal (2010) and Kiatcharoenpol, Laosirihongthong, and Chaiyawong (2015). This is because overall efficiency was measured by using their owner or manager's experiences, which may not reflect the actual numbers.

#### **Hypothesis 6**

The finding showed that there is a positive relationship between lean manufacturing practice and profit, which is opposed to the study of Moori, Pescarmona, and Kimura (2013). However, it confirms the studies of Fullerton and Wempe (2009), Hibadullah et al., (2013), and Jayaram, Vickery, and Droge (2008). This is due to the mediate effect or moderate effect of other factors between this relationship such as operational performance (Fullerton & Wempe 2009) and length of lean manufacturing adoption.

#### **Hypothesis 7**

The finding showed that there is a positive relationship between lean manufacturing practice and return on equity, which asserts the preceding publications, such as that of Oslen (2004). Organizations implementing lean manufacturing will reduce cost and increase supplier relationship, customer satisfaction, and high level of net profit, which results in high level of return on equity.

#### **Hypothesis 8**

The finding showed that there is a positive relationship between lean manufacturing practice and operational performance, which asserts the preceding publications, such as those of Hallgren and Olhanger (2009), Alsmadi, Almani, and Jerisat (2012), and Arawati and Mohd (2012). 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.

#### **Hypothesis 9**

The finding showed that there is a positive relationship between lean manufacturing practice and financial performance, which is not an n compliance with the study of Moori et al. (2013). However, it confirms the studies of Fullerton and Wempe (2009), Hibadullah et al., (2013), and Jayaram et al. (2008). This is due to the mediate effect or moderate effect of other factors between this relationship such as operational performance (Fullerton & Wempe, 2009) and length of lean manufacturing adoption.

#### **Hypothesis 10**

The result reported that there is a positive relationship between lean manufacturing practice and environmental and social performance. Based on the author's knowledge, it is the first time that the relationship between lean manufacturing and environmental and social performance has been explained, which is the incremental contribution to academic research. Not only is lean manufacturing practice associated with insiders, but it is also related to outsiders such as diversity of employees, occupational health and safety, stakeholder involvement in community, social and environmental issues, community relations, natural resource conservation, and emission levels.

#### **Hypothesis 11**

The result reported that the model is not different across automotive/part and non-automotive/part which asserts the preceding publications such as that of Womack et al. (1990) suggested that 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. Application of lean is not limited to the automotive sector only, but it has also found acceptance in a wide range of manufacturing industries operating under a unionized or a non-unionized environment in the US (Shah & Ward, 2003) or elsewhere (Anand & Kodali, 2008), and is being applied in big as well as small organizations (White et al., 1999).

## Hypothesis 12

The result reported that the model is not different across size of company which asserts the preceding research such as White et al. (1999) and Anand and Kodali (2008) suggested that lean manufacturing has found acceptance in a wide range of both manufacturing and elsewhere, and is being in big as well as small companies. Large companies represent facilities producing a particular product, which have a low rate of process and product innovation. To stay competitive, large manufacturers have to focus on cost reduction, improved productivity through higher capacity utilization, incremental improvement and the adoption of more efficient technologies. In contrast, small manufacturing entities lack market share and product demand; therefore, fewer employees are required (Jeserich et al., 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 et al., 2005).

## Recommendations

### Implications for Practice

The results offer some implications for the practitioners and entrepreneurs. The details are as follows:

1) The results presented that transactional, passive avoidant, and sustainable leadership can increase extent of lean manufacturing practice.

2) The results revealed that lean manufacturing leads to high level of return on equity, operational, financial, and environmental and social performance. Thus, managers should create good and two-way relationship, sharing, caring, bottom up communication, free-rein culture with their employees.

### Implications for Future Research

The results offer several implications for academicians. The details are as follows:

1) The future study would be to examine other potential independent and dependent factors of lean manufacturing practice.

2) According to the fact, the relationship between a variety of independent factors and lean manufacturing practice incline to be more robust for style of followership, length of lean implementation, organizational culture, and rate of competitive. As a result, the future study would be to test the moderate and /or mediate influences of these factors on the relationship between independent factors and lean manufacturing practice.

3) The future study might examine the magnitude to which interventions could create a lean manufacturing practice for leading higher organizational performance.

### Limitations of the Study

There are some expected potential limitations in this study. Firstly, the effect of external factors which may involve leadership style, lean manufacturing practice, operational performance, financial performance, and sustainable performance such as macroeconomics and economic crisis. Secondly, due to the study applying 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 required to offer greater definitive summarization. Lastly, the results describe situations and activities of firms operate in Thailand, which may not be compatible with overseas companies.

### Summary

Although lean manufacturing practice is one of the most noticeable strategies in business companies and operators, only 2% of organizations that responded to the survey have fully accomplished their goals and 24% of the said firms presented that they had accomplished significant results (Pay, 2006). Referring to the scarcity of accomplishment thereof at recent time, it is possible to be a challenge for the future study to discover both antecedent and consequence factors, which will lead to superior comprehending of the notions and utilizations. In addition, the future study can further discover the realistic factors and put them into the framework, which could be mediators and/or moderators, resulting in more comprehension about the sophisticated organizational phenomena associated with issues and situations of leadership style, lean manufacturing practice, operational performance, financial performance, and sustainable performance. Lastly, the research and the other augmentative future studies may continue to seek how to create followership style that enhances lean manufacturing, resulting in organizational advantage competitiveness.

## References

- Adams C. A., Muir S., & Hoque Z., (2014). Measurement of sustainability performance in the public sector. *Sustainability Accounting, Management and Policy Journal*, 5, 46-67.
- Alsmadi, M., Almani, A., & Jerisat, R. (2012). A comparative analysis of lean practices and performance in the UK manufacturing and service sectors firms. *Total Quality Management*, 23, 381-396.
- Anand, G., & Kodali, R. (2008). Performance measurement system for lean manufacturing: A perspective from SMEs. *International Journal of Globalisation and Small Business*, 2(4), 371-410.
- Avery, G. C., & Bergsteiner, H. (2011). Sustainable leadership practices for enhancing business resilience and performance. *Strategy and Leadership*, 39(3), 5-15.
- Arawati, A., Mohd, S.H. (2012). Lean production supply chain management as driver towards enhancing product quality and business performance: Case study of manufacturing companies in Malaysia. *International Journal of Quality & Reliability Management*, 29(1), 92-121.
- Bagozzi, R. P., & Yi, T. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1), 74-94.
- Barney, J. B. & Hesterly, W.S. (2010). *Strategic management and competitive advantage concepts*. Upper Saddle River, NJ: Pearson Prentice Hall.
- Bass, B. M. (1988). Evolving perspectives on charismatic leadership, In Conger, J. A., Kanungo, R. N., & Associates (Eds.), *Charismatic leadership: The elusive factor in organizational effectiveness*, (pp.40-77). San Francisco: Jossey-Bass.
- Basu, R. (2009). *Implementing six sigma and lean: A practical guide to tools and techniques*. Oxford: Butterworth-Heinemann.
- Bentler, P. M. (1989). *EQS Structural Equations Program Manual*. Los Angeles: BMDP Statistical Software.
- Bentler, P. M., & Bonett, D.G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88(3), 588-606.
- Bentler, P. M., & Chou, C. (1987). Practical issues in structural modeling. *Sociological Methods Research*, 16, 78-117.
- Brown, M. E., Treviño, L.K., & Harrison, D.A. (2005). Ethical leadership: A social learning perspective for construct development and testing. *Organizational Behavior and Human Decision Processes*, 97, 117-134.
- Brown, S., Lamming, R., Bessant, J., & Jones, P. (2006). *Administração da Produção e Operações*. Rio de Janeiro: Editora Campus/Elsevier.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage
- Burawat, P., Knutonbutr, C., Mechinda, P. (2014). The mediate effect of employee engagement on the relationship between perceived employer branding and discretionary effort. *DLSU Business & Economics Review*, 24(1): 59-72.

- Burns, J. M. (1978). *Leadership*. New York: Harper and Row.
- Casserley, T., & Critchley, B. (2010). *Sustainable leadership: Perennial*. Retrieved May, 21, 2016, from philosophy <http://vanel.org.uk/leaders/wp-content/uploads/2010/09/Sustainable-Leadership-article-sep10.pdf>
- Chabowski, B. R. Mena, J. A., & Gonzalez-Padron, T.L. (2011). The structure of sustainability research in marketing 1958-2008: A basis for future research opportunities. *Journal of Academic of Marketing Science*, 39, 55-70.
- Chau, P. Y. K., & Hu, P. J. E. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision Sciences* 32(4), 699-719.
- Cheerawit, S., Napompech, K., & Panjakhajornsak, V. (2014). Model of Leadership and the effect of lean manufacturing practices on firm performance in Thailand's auto parts industry. *Research Journal of Business Management*, 8(2), 104-117.
- Cruz, B. L., Pedrozo, E., & Estivaleta, V. F. B. (2006). Towards sustainable development strategies: A complex view following the contribution of Edgar Morin. *Management Decisio*, 44(7), 871-891
- Cua, K., McKone, K., Schroeder, R. G. (2001). Relationships between implementation of TQM, JIT, and TPM and manufacturing performance. *Journal of Operations Management*, 19(6), 675-694.
- Decarlo, T. L. (1997). On the measuring and the use of Kurtosis. *Psychological Methods*, 2(3), 292-307.
- Economist Intelligence Unit. (2010). *Managing for sustainability*. Retrieved May, 21, 2016, from: [http://graphics.eiu.com/upload/eb/Enel\\_Managing\\_for\\_sustainability\\_WEB.pdf](http://graphics.eiu.com/upload/eb/Enel_Managing_for_sustainability_WEB.pdf)
- Fiksel, J., Mcdaniel, J., & Mendenhall, C. (1999). *Measuring progress towards sustainability principles, process and best practices*. Ohio: Battelle Memorial Institute.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Forrester, R. (1995). Implications of lean manufacturing for human resource strategy. *Work Study*, 44(3), 20-24.
- Found, P. A., & Harvey, R. (2007). Leading the lean enterprise. *IET Engineering Management*, 17(1), 40-43.
- Fullerton, R. R., & Wempe, W.F. (2009). Lean manufacturing, non-financial performance measures, and financial performance. *International Journal of Operation & Production Management*, 29(3), 214-240.
- Global Reporting Initiative (2014). *Global Reporting Initiative (GRI) Index*. Retrieved May, 21, 2016, from [http://www.ab-inbev.com/content/dam/universaltemplate/abinbev/pdf/sr/download-center/AB\\_InBev\\_2014\\_GRI\\_Index.pdf](http://www.ab-inbev.com/content/dam/universaltemplate/abinbev/pdf/sr/download-center/AB_InBev_2014_GRI_Index.pdf)
- Hair, J. R., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). New Jersey: Prentice Hall International.
- Hallgren M., Olhager J. (2009). Lean and agile manufacturing external and internal drivers and performance outcomes. *International Journal of Operation Production Management*, 29(10), 976-999.
- Hayes, R., Pisano, G., Upton, D., & Wheelwright, S. (2005). *Operations, strategy and technology: Pursuing the competitive edge*. Hoboken, NJ: Wiley.

- Heizer, J., & Render, B. (2014). *Operation Management* (11th ed.). Harlow, England: Pearson Education Limited.
- Herkness, D. F. (2005). A study of transformational and transactional leadership and its relationship to successful lean manufacturing deployments. *Dissertation Abstracts International*, 67(04).
- Heymans, B. (2002). Leading the lean enterprise. *Industrial Management*, 44(5), 28-33.
- Hibadullah, S. N., Fuzi, N. M., Chiek Desa, A. F. N., & Zamri, F. I. M. (2013). Lean manufacturing practices and environmental performance in Malaysian automotive industry. *Asian Journal of Financial & Accounting*, 5(1), 462-471.
- Hines, P., Rich, N., & Esain, A. (1999). Value stream mapping – a distribution industry application. *Benchmarking International Journal*, 6(1), 60-77.
- Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1–55.
- Jayaram, J., Vickery, S., & Droge, C. (2008). Relationship building, lean strategy and firm performance: An exploratory study in the automotive supplier industry. *International Journal of Production Research*, 46(20), 5633-5649.
- Jeserich, N., Mason, T., & Toft, G. (2005). *What Indiana makes, makes Indiana: Analysis of the Indiana manufacturing sector*. Central Indiana Corporate Partnership and Indiana Manufacturers Association and Indiana Department of Commerce. Retrieved May, 21, 2016, from <http://research.policyarchive.org/11766.pdf>
- Jöreskog, K. & Sörbom, D. (1996). *LISREL 8: User's Reference Guide*. Chicago: IL; Scientific Software International.
- Kaplan, R. S., & Norton, D. P. (1992). *The balanced scorecard-measured that drive performance*. Boston: Harvard Business School Press.
- Kiatcharoenpol, T., Laosirihongthong, T., & Chaiyawong, P. (2014). A study of critical success factors and prioritization by using analysis hierarchy process in lean manufacturing implementation for Thai SMEs *5th International Asia Conference on Industrial Engineering and Management Innovation (IEMI 2014)*. Xi'an, China, July 21-22, 227-230. Beijing: Atlantis Press.
- KPMG. (2007). *Sustainability reporting in Australia*. Retrieved May, 21, 2016, from [http://kpmg.com.au/portals/0/ras\\_sustainability\\_reporting\\_aust200710.pdf](http://kpmg.com.au/portals/0/ras_sustainability_reporting_aust200710.pdf)
- Langlois, T. D. (2015). *Examining the association between leadership styles and an organization's lean manufacturing maturity level* (Doctoral dissertation). San Diego, CA: Northcentral University.
- Lathin, D., & Mitchell, R. (2001). Learning from mistakes. *Quality progress*, 34(6), 39-45.
- Leitner, P. A. (2005). The lean Journey at the Boeing company. *ASQ World Conference on Quality and Improvement Proceedings*, 59, 263-271.
- Liker, J. (1998). *Becoming Lean*. Portland, OR: Productivity Press.
- Liker, J. K., & Meier, D. (2006). *The Toyota way fieldbook: A practical guide for implementing Toyota's 4P's*. New York: McGraw-Hill.
- Longenecker, J. G., Moore, C. W., Petty, J. W., Palich, L. E., & McKinney, J. (2006). Ethical attitudes in small business and large corporations: Theory and empirical findings from a tracking study spanning three decades. *Journal of Small Business Management*, 2, 167-183.
- Mann, R., Gibbard, G., & Hartman, J. (1967). *Interpersonal styles and group development: An analysis of the member-leader relationship*. New York: Wiley.

- Marynell, T. M. (2013). *Leadership for success with lean manufacturing: The relationship between style and successful implementation* (PhD Dissertation). Minneapolis: Capella University.
- Moori, G. R., Pescarmona, A., & Kimura, H. (2013). Lean manufacturing and business performance in Brazilian firms. *Journal of Operations and Supply Chain Management*, 6(1), 91-105.
- Northouse, P. G. (2004). *Leadership: Theory and practice* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Olivier, A. (2012). How ethical is leadership. *Leadership*, 8, 67-84.
- Ohno, T. (1988). *Toyota production system: Beyond large-scale production*. New York: Productivity Press.
- Oslen, E. O. (2004). *Lean manufacturing management: The relationship between practice and firm level financial performance* (Doctoral dissertation). Columbus, Ohio: Ohio State University.
- Pay, R. (2006). Everybody's jumping on the lean bandwagon, but many are being taken for a ride lean might not always produce the expected benefits and here's why. *Industry Week* (11 March 2006). Retrieved May, 21, 2016, from: [http://www.industryweek.com/articles/everybodys\\_jumping\\_on\\_the\\_lean\\_bandwagon\\_but\\_many\\_are\\_being\\_taken\\_for\\_a\\_ride\\_15881.aspx](http://www.industryweek.com/articles/everybodys_jumping_on_the_lean_bandwagon_but_many_are_being_taken_for_a_ride_15881.aspx)
- Pavnaskar, S. J., Gersheenson, J. K., & Jambekar, A.B. (2003). Classification scheme for lean manufacturing tools. *International Journal Production Research*, 41(13), 3075- 3090.
- Rahman, S., Laosirihongthong, T., & Sohal, A.S. (2010). Impact of lean strategy on operational performance: a study of Thai manufacturing companies. *Journal of Manufacturing Technology*, 21(7), 839-852.
- Sakakibara, S., Flynn, B. B., Schroeder, R. G., & Morris, W. T. (1997). The impact of just-in-time manufacturing and its infrastructure on manufacturing performance. *Management Science*, 3(9), 1246-1257.
- Schaltegger, S., & Wagner, M. (2006). Integrative management of sustainability performance, measurement and reporting. *International Journal of Accounting, Auditing and Performance Evaluation*, 3(1), 1-19
- Shah, R., & Ward, P. T. (2003). Lean manufacturing: context, practice bundles, and Performance. *Journal of Operations Management*, 21(2), 129-149.
- Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, 25(4), 785-805.
- Smalley, A. (2005). *TPS vs lean and the law of unintended consequences*. Retrieved May, 21, 2016, from [www.superfactory.com/articles/smalley\\_tps\\_vs\\_lean.htm](http://www.superfactory.com/articles/smalley_tps_vs_lean.htm)
- Smalley, A. (2005). The starting point for lean manufacturing: Achieving basic stability. *Management Services*, 49(4), 8-11.
- Soriano-Meier, H., & Forrester, P. L. (2002). A model for evaluating the degree of leanness of manufacturing firms. *Integrated Manufacturing Systems*, 13(2), 104 - 109
- Spear, S., & Bowen, H. K. (1999). Decoding the DNA of Toyota production system. *Harvard Business Review*, 77(5), 97-106
- Spector, R., & West, M. (2006). The art of lean program management. *Supply Chain Management Review*, 10(6).
- Stogdill, R. M. (1974). *Handbook of leadership: A survey of the literature*. New York: Free Press.

- Stuart, A., & Ord, J. K. (1994). *Kendall's Advanced Theory of Statistics, Vol. 1: Distribution Theory*. London: Edward Arnold.
- Takala, T., & Pallab, P. (2000). Individual, collective and social responsibility of the firm: Business ethics. *A European Review*, 9(2), 109–118,
- Tansakul, S., & Sutthiwatanaruputh, S. (2014). 7 causes of low level of productivity in Thai labor. Retrieved May, 21, 2016, from <https://www.scribd.com/document/240531364/7-Causes-Low-Productivity>
- White, R. E., Pearson, J. N., Wilson, J. R. (1999). JIT manufacturing: A survey of implementation in small and large US manufacturers. *Management Science*, 45(1), 1–15.
- Weston, R., & Gore, P. A. (2006). Brief guide to structural equation modeling. *The Counseling Psychologist*, 34(5), 719-751.
- Womack, J. P., & Jones, D. T. (1996). *Lean thinking: Banish waste and create wealth in your corporation*. New York: Simon & Schuster.
- Womack, J. P., Jones, D. T., Roos, D. (1990). *The machine that changed the world*. New York: Harper Perennial.