

## The Challenges of Lean Implementation: A Multiple Case Study in Malaysian Aerospace Companies

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### ABSTRACT

The purpose of this study was to determine the challenges in implementing lean manufacturing among Malaysian aerospace companies. Literature indicated that various companies failed to achieve full lean benefits. This study adopted qualitative multiple case study as its research design. Three main steps in the case study protocol were followed. The data were collected through semi-structured interviews of sixteen respondents from four different companies in the aerospace industry. Thematic analysis was conducted for every case study together with the cross-case analysis. The results of this study revealed that the companies faced resistance from the employees. In addition, other constraints found that suppressed lean production included lack of commitment from the top management and the influence of negative local culture in the homegrown companies. The output of the study served as the foundation for the companies to strengthen their effort in enhancing the employees acceptance and commitment to lean manufacturing and production.

**Keywords:** Lean manufacturing, lean adoption, aerospace industry, case study, Malaysia

### INTRODUCTION

Lean manufacturing also known as lean production or simply lean is a philosophy of continuous improvement and waste minimization in a manufacturing environment. Lean manufacturing has been used by many organizations to compete globally, and it is considered an evolution in the continuous improvement process in manufacturing concept (Womack & Jones, 1994; Womack, Jones & Roos, 1990). The concept of lean began with the visit of the founder of Toyota to America in the 1950s to learn about the widely known Ford mass manufacturing method. Realizing that Ford version of mass production did not suit Toyota, Taichi Ohno adopted the elucidation of mass production and thus, Toyota Production System (TPS) began to evolve (Liker, 2004; Womack & Jones, 2003; Bowen & Spear, 1999). During the late 1980s, a team from Massachusetts Institute of Technology (MIT) International Motor Vehicle Program headed by Womack coined the term lean to describe Toyota's system. Lean literally means very little fat. Within an organizational context, lean produces improvements in efficiency and productivity, thus, reduces waste and creates more value to the customers. Womack and Jones (2003) connoted "value" as a capability provided to the customer at the right time and at the right price as defined in each case by the customer, whereas waste could refer to any human activity that absorbs resources but creates no value. On the other hand, Ohno (1988) introduced seven types of waste in manufacturing. The seven types of waste are over-production, transport, inventory, waiting time, defect, motion and over-processing. The philosophy of lean is to maximize customer value and to minimize waste (Womack & Jones, 1990). Value from the customer's perspective can be translated into specific products or services that meet the customer's needs efficiently at the right time and the right price. The translation of value to the product can only be

achieved by understanding what every step is doing to provide value to the next step of the manufacturing process. Another philosophy of lean that is currently being sidelined is the “respect for people” (Cardon & Bribiescas, 2005). This principle is deeply embedded in TPS (Liker, 2004). Respect for people promotes trust and communication among employees, humanizes the working environment, empowers the personnel (Hines, Holweg & Rich, 2004) and enhances self-directed learning (Puvanasvaran et al., 2008). Respect for people has been around for a long time but slowly overlooked as lean expanded. The most frequently cited lean principles in the literature are from Womack and Jones (2003). According to them, the five lean principles are as follow:

- Specifying value from the customer’s perspective
- Identifying and mapping the value stream
- Creating continuous flow
- Responding to customer pull
- Pursuing perfection

The awareness of the lean potential has heightened the number of organizations to adopt some forms of lean program. Over the past few decades, lean has been used by several companies as a method of process improvement. Among the large organizations that have adopted lean practices are Airbus (Drew, McCallum & Roggenhofer, 2004), Boeing (Dane & Kleiner, 2016; Leitner, 2005), General Motors (Moore, Mothersell & Motwani, 2014; Liker, 2004), Chrysler and Ford (Dane & Kleiner, 2016; Cable, 2009), and Porsche (Prakash & Kumar, 2011). Womack and Jones (2003) introduced common terms like value, flow and customer to assist people to understand the principles of lean. An evolution of lean manufacturing has expanded to service industries such as healthcare, education, legal and public sector (Nadeau, 2017; Bateman, Hines, & Davidson, 2014).

### **Malaysian aerospace industry**

Aerospace industry has been selected by the Malaysian government as a strategic sector with high potential growth in the country's technological development and the industrialization program. Currently, Malaysia has an internationally recognized aerospace industry with a well-structured ecosystem and has gained a respected position in Southeast Asia. To date, the aerospace industry has attracted more than twenty thousand employees and has listed over two hundred companies in the field of aircraft, aviation, and composite research and manufacturing. Currently, Malaysia is among the leading suppliers for aircraft structure components mainly for the premier Original Equipment Manufacturers (OEM) – Airbus and Boeing.

Being the first and second tier aerospace component manufacturers and the suppliers to the two premier aerospace manufacturing companies, Malaysian aerospace industry is striving to achieve its missions in providing high quality and cost competitive products to its customers. Airbus and Boeing are implementing lean manufacturing and have become lean enterprises or moving toward that direction. Today’s supply chain is becoming highly interdependent rather than independent, as it has been the case in the past. Being part of lean enterprises value chain, the aerospace companies in Malaysia have adopted lean model for the past several decades (Abdullah & Ahmad, 2010; Nordin et al., 2010; Effendi & Mahmood, 2008; Puvanasvaran et al., 2008).

### **Criticisms on lean**

Lean offers tremendous benefits, and it is often considered to be one of the most important strategies that can be implemented by the manufacturing companies that wish to attain global prominence. Based on past research, lean has improved the productivity and efficiency of manufacturing companies in a variety of sectors such as automotive, electronic and aerospace industries (Jadhav, Matha & Rane, 2015; Tuli & Shankar, 2015; Martinez-Jurado & Moyano-Fuentes, 2014; Roslin et al., 2014; Hines et al., 2008; Lewis, 2008; Doolen & Hacker, 2005; Mathaisel, 2005; Liker, 2004; Crute et al., 2003; Shah & Ward, 2003; Mathaisel & Comm, 2000). Benefits of lean can be seen from cost reduction to securing competitive advantage and yet many companies failed to reach the full lean advantage.

The downfall of lean implementation can be seen across the globe. A research by Aberdeen Group (2006) stated that sixty-eight percent of the lean companies in the United Kingdom perceived lean in a narrow manner. Lean objectives should not only focus on cost reduction but more toward producing value to the business and customers. According to the Manufacturing Performance Institute (MPI) Census of Manufacturers (2007), only twenty-four percent of the US companies reported achieving a significant result in lean production but the rest of the surveyed companies were not achieving the expected result. Another finding by Pedersen and Huniche (2011) reported that up to seventy percent of the companies that implemented lean in Danish public sector have failed to become lean organization. The same situation occurred in China where more than twenty enterprises implementing lean have failed to achieve its benefits (Chen & Meng, 2010). Panwar, Jain and Rathore (2016) also reported a similar result in India. Literature has indicated that the most apparent reason for the derailment of lean is the people-related factor. Based on the findings from literature, the researcher classified the lean suppressive factors into two categories: organizational culture and people.

### **Organizational culture**

One of the prevailing criticisms of lean is the issue of organizational culture. The issue has been discussed widely in the literature (Zhou, 2016; Bortolotti et al., 2015; Bhasin, 2015; Jadhav et al., 2014; Dombrowski, Mielke, & Engel 2012; Atkinson, 2010; Nordin, Deros, & Wahab, 2010; Singh, Garg, & Shrama, 2010; Hines et al., 2008; Sim & Rodgers, 2008; Liker, 2004; Boyer & Sovilla, 2003; Womack & Jones, 2003). Culture is a system of shared values, beliefs, and assumptions that people across the organization share. Organizational culture impacts performance because it affects individual behaviors. The problem begins when an organization waits for the "lean implementation" to occur before turning to changing the culture. The issue of culture and management should be tackled before the real lean implementation begins. It is imperative to address the organizational culture during lean implementation (Bhasin, 2011; 2012a; 2012b; 2012c). In other words, the organizations failed to engage their employees in creating lean cultural improvement (Liker & Houseus, 2008; Liker, 2004). Lean requires more than changing the manufacturing process — it is a cultural change. It requires a transformation in corporate culture, practices, processes, and management (Womack & Jones, 2003).

Lean has been adopted in various industries across different regions. Each of these regions is different and unique according to the organizational and national culture. Therefore, to accomplish a successful lean system, each region needs to have the appropriate combination of both organizational and lean culture. Misunderstandings could occur due to the cultural differences especially during the implementation of lean. Wong (2007) asserts that organizational and national cultures could not be kept separate in lean transformation. Within the lean philosophy, culture is reflected by two core values — respect for the people and continuous improvement. "Respect for the people" represents a belief that employees are a company's greatest asset. Liker and Hoseus (2008) describes the culture in Toyota as the way employees think and act every day. For those who have worked in Toyota for decades, this has become their second character.

### **People**

In this study, people are referred to both the top management and the employees in the organization. People are an essential part of the lean philosophy and culture (Liker, 2004; Mann, 2010). The prominent lean thinkers have highlighted the importance of people in lean. Krafcik (1988) and Ohno (1988) explain the philosophy of "respect for people" in lean. Womack et al. (1990) emphasize the pertinence of teamwork, communication, and continuous improvement in lean implementation. Shah and Ward (2003) highlight the importance of human resource management bundled in lean practices. Liker (2004) in his fourteen principles discusses the role of culture, respect for people, communication, leadership, continuous improvement and continuous learning. Both the top management and the employees need to understand and play their roles to sustain lean transformation. Empowerment of employees can lead to higher performance (Vidal, 2007) especially when the manager plays the role of a facilitator and the empowerment should be made as an imperative requirement (Lee, 2007) in this transformation.

Based on the relevant literature, employee attitude ranks as the primary obstacle to lean. This includes resistance to change, opposition and lack of understanding (Zhou, 2016; Jadhav et al., 2014; Rose et al., 2013; Panizzolo et al., 2012; Bhasin 2011; Saurin et al., 2011; Grove et al., 2010; Nordin et al., 2010; Yang & Yu, 2010; Wong et al., 2009; Lee, 2007). Wong et al. (2009) state that employees' resistance to lean system is a more significant barrier as compared to financial, resources and cultural issues. Lack of competency and inadequate training among employees (McLean et al., 2017; Zhou, 2016; Jadhav et al., 2014) and insufficient workforce knowledge and skills (Dombrowski et al., 2012; Bhasin, 2011; Olatunji, 2008; Achanga, Shehab, Roy & Nelder, 2006) also hinder the implementation of lean. Shah and Ward (2003) agree that lean can be implemented by changing the attitude and values of the employees. In addition, poor communication (Jadhav et al., 2014; Nordin et al., 2010; Shook, 2010; Sharrer-Rathje et al., 2009; Lee, 2007) between the employees and the top management also contributes to the poor performance of lean in an organization. Shah and Ward (2003) stress the importance of context in lean implementation. Some barriers are more specific to certain countries. Bollbach (2014) and Aminpour and Woetzel (2006) discover hierarchical structure in the organizations in China that hinders the lean practices. Bhasin (2011) also discusses about the importance of supervision in making sure the employees receive adequate knowledge and skill.

Kotter (2007) and Emiliani (2004) claim that the change in top management's behaviors is necessary to encourage lower level employees to be involved in the transformation. Management should lead the transformation and they should provide conducive environment for change. Company leaders also need to commit and provide proper support, not only intellectual support but physical engagement too. If not, top management's passive attitude toward lean implementation (Emiliani, 2004) may negatively impact the employees' perception of their leaders' commitment. Lack of management's involvement and commitment can also lead to other issues — including limited access to resources, lengthy decision-making processes and communication breakdowns (Scherrer-Rathje et al., 2009). In sum, leadership plays a major role in determining the successful lean practices (McLean et al., 2017; Jadhav et al., 2014; Grove et al., 2010; Nordin et al., 2010).

## **PROBLEM STATEMENT**

Past research revealed that lean has shown positive results in terms of enhancing a company's competitive advantage and profitability. However, several companies have faced difficulty in integrating lean practices successfully within their organizations (Bhasin, 2012b; 2012c). Literature has shown that the main barrier to lean practices is people-related factor. Numerous studies on lean implementation barriers in Malaysia have been reported in the literature (Khalili, Ismail, Rahman, & Radzi, 2017; Wahab, Mukhtar, & Sulaiman, 2017; Zakaria, Mohamed, Ab Rahid, & Rose, 2017; Khusaini, Ismail, & Rashid, 2016; Rohani & Zahraee, 2015; Rose, Deros, & Rahman, 2013; Nordin, Deros, & Wahab, 2010). Moreover, to the researcher's knowledge, none of the studies was conducted in the context of the Malaysian aerospace industries, specifically for the aerospace manufacturing sector.

## **THE PURPOSE OF THE STUDY**

The purpose of this study was to identify the lean manufacturing implementation challenges in Malaysian aerospace companies using qualitative, multiple case study approach. Based on the aim of the study, two research questions were formulated. The research questions were as follows:

1. What are the current status of lean practices in selected aerospace companies?
2. What are the challenges of lean implementation faced by the selected companies?

## METHODOLOGY

To understand a phenomenon, it could be done by using interpretivist approach. Interpretivism is often used in qualitative research (Creswell, 2009; Thomas, 2003). This study utilized a qualitative, multiple case study approach. The reason to adopt a case study approach as suggested by Yin (2009) and Eisenhardt (1989) was to gain a deeper understanding and insight of the lean implementation in aerospace companies in Malaysia. This approach has enabled the researcher to address the question of why an event happens and how it unfolds over time (Denzin & Lincoln, 2005). Furthermore, the justification of selecting this method was that it explored a real-life, contemporary bounded system (a case) over time (Creswell, 2007). In addition, by adopting multiple case studies, the empirical data were analyzed within each situation and also across different situations (Yin, 2012). Four case studies were selected comprising two local-owned companies and two foreign-owned companies. Two local-owned firms were selected due to the limitation of the tier 1 and 2 of the local supply chain aerospace companies in Malaysia. Therefore, it was pertinent to include two foreign-owned companies in this study to make a comparison. In addition, this study utilized the case study protocol (CSP) proposed by Eisenhardt (1989). CSP was selected because it provided a simple procedure to conduct the study. In the selection of the participants, the researcher used a purposive sampling method. Sixteen respondents were selected from the four companies. The overview of the respondents was presented in Table 1.

Table 1: The overview of the respondents

<b>Company</b>	<b>Respondents</b>	<b>Position</b>	<b>Background</b>	<b>Working experience (Years)</b>
A	A (I)	Continuous Improvement Manager	Engineering	16
A	A (II)	Assistant Manager	Engineering	20
A	A (III)	Engineer	Engineering	20
A	A (IV)	Group Chief Marketing Officer	Management	10
B	B (I)	General Manager	Engineering	22
B	B (II)	Production Manager	Engineering	5
B	B (III)	Engineer	Engineering	2
B	B (IV)	Manager	Engineering	5
C	C (I)	Chief Executive Officer	Management	4
C	C (II)	Manager	Management	10
C	C (III)	Lean Manager	Engineering	13
C	C (IV)	Production Manager	Management	13
D	D (I)	Lean Manager	Management	One year in the company 15 years in other companies

D	D (II)	Engineer	Engineering	5
D	D (III)	Production Manager	Engineering	5
D	D (IV)	Engineer	Engineering	5

For this study, all participants were assumed to be knowledgeable to answer the interview questions where most of them having relevant working experience between two to sixteen years in the aerospace industry. This study utilized semi-structured interview as the main instrument for the data collection. In general, the interview questions were divided into three parts: introduction, key and concluding questions. The first part of the interview protocol was to obtain the participants' background and their involvement in lean process. The key questions were specifically designed to probe further into the specific lean implementation. The questions were mainly focused on the why and when lean was implemented, the current status of lean implementation and the resources committed to lean, the employees' acceptance of lean, the difficulties faced in implementing lean and other related questions. Finally, the closing questions were zoomed into the efforts and steps taken by the company to resolve the negative lean issues. The researcher employed multiple strategies to establish trustworthiness and to minimize unreliable claims in this study (Lietz et al., 2006; Patton, 2002; Strauss & Corbin, 1998). These strategies consisted of credibility (internal validity), transferability (external validity) and dependability (reliability)

## COMPANY PROFILES

This section provides an overview of the companies.

### **Company A**

Company A is located in the southern state of Malaysia and was established in 1990 to spearhead Malaysia entrée into composites and aerospace industries. With the vision to become the center of excellence in aerospace and composites, company A has become the global partners to premier OEM and other global aerospace companies. Today, Company A represents about twenty percent of the domestic aerospace market and contributes to about thirty-six percent of total employment in the Malaysian aerospace manufacturing industry. Company A has started lean in 2003, starting with the manufacturing department. A year later the CEO launched lean program to be part of the company's working culture.

### **Company B**

Company B, another Malaysian-owned company, commenced its operations in 1992 and located somewhere nearby Kuala Lumpur as a premier manufacturer of metal-based aerospace parts, components, and assemblies. Since its inception, company B has been awarded various contracts from global aerospace companies. A new milestone was achieved in 1995 when the locally manufactured aircraft by company B took to the air on its inaugural flight on the 25th May 1995 at the Subang International Airport in Kuala Lumpur. Company B has started implementing lean since 2009 and the majority of the workers in the company are Malay. Company B is a wholly owned subsidiary of the National Aerospace and Defense Industries (NADI) Berhad.

### **Company C**

Company C is situated in the northern state of Malaysia with a total employment of more than 900 personnel. Initially, when it was established, company C is a joint-venture between two global aerospace companies and two Government-Linked Companies (GLC) in Malaysia. In 2009, company C became the property of two global companies. Company C is located in Malaysia where the country has become an attraction for investors in Asia due to its reliable infrastructure, a stable government and availability of skilled workers. Company C is headed by one of the representatives of the parent

companies where more than eighty percent of its employees are Malaysian. Lean is implemented by the two companies that owned company C, thus, it is common for a subsidiary company to implement lean as well. Company C that is located in Kedah is also expected to expand its workforce beyond its current capacity.

**Company D**

The parent firm of company D is based in the United States and it is one of the largest non-OEM manufacturers in the world. The vision to become integrated, global company has initiated the parent company to open its manufacturing facility in Malaysia. The 242,000-square-foot facility was announced in 2007 in Malaysia and began operating early in 2009. The former Prime Minister of Malaysia officiated the opening ceremony on 28<sup>th</sup> October, 2009 (AviationPros.com, 2018). It was another milestone for Malaysia on its journey to become one of the global players in the aerospace industry. The parent company has implemented lean. Therefore, lean is not foreign to company D even though it is relatively young as compared to the other three companies.

**FINDINGS AND DISCUSSION**

This section analyzed the empirical data obtained through the qualitative in-depth interviews and the multiple case studies. The researcher adopted Braun and Clarke (2003) thematic analysis approach in order to develop codes and themes. Braun and Clarke's thematic analysis was relatively easy to use for those who were unfamiliar with more complex types of qualitative analysis. The thematic analysis was flexible based on the study's conceptual framework. For multiple case study approach, two types of data analyses were required: with-in case analysis and cross-case analysis.

**With-in case analysis**

This section began with the findings from the first research question (RQ1). The first research question was intended to investigate the status of lean implementation in all companies. The findings from research question one were tabulated in Table 2.

Table 2: The findings for research question one

Company	Status of lean implementation			
	How did lean start?	Duration of lean	Resources committed to lean	Current status
A	Customer-driven	More than ten years	Internal change agent	Re-launching lean
B	Customer-driven	More than five years	Internal change agent	Re-launching lean
C	Since beginning	More than ten years	Internal and external change agent	Re-launching lean
D	Since beginning	More than five years	Module from the parent company	Full implementation

Company A started the lean implementation based on the persuasion from the customers. One of the respondents explained the adoption of lean through the persuasion of the major client — Airbus. Company A has a lean department that has a specific task of training the employees and monitoring the lean activities. Lean has been implemented more than ten years in company A. After a while, however, the culture has dissipated. Currently, company A in the process of restarting to implement lean as explained by one of the respondents. Lean in company B started from the customer. Being the

customer for the premier lean enterprise has influenced company B to implement lean as well. Regarding resources for lean; company B has a department that is explicitly overseeing any lean activities. However, the respondents were not certain regarding the company’s present status regarding lean implementation. From their knowledge, lean has been around for a while, but the goals were not entirely achieved. The implementation was still slow, as agreed by one of the respondents.

Company C started to implement lean from the moment the company was set up. Company C was a product of a strategic alliance between the premier OEM and another American company. The reason for its establishment was to take opportunity of the regional economic growth forecast in Asia. Company C also has a specific lean department to monitor and support any lean activities. The other three respondents also agreed that lean has already been implemented, but it was slowly deteriorating. C (III) as the managing director, took the initiative to re-launch lean with the support from the lean department. When the researcher asked how to re-launch lean, C (III) explained by re-educating the employees on the purpose and vision of the company and by deliberating on lean philosophy.

The parent company of company D was one of the biggest key players in the aerospace industry. It was an independent global supplier of multiple customers and platforms. In addition to having its lean department, the parent company of D aided the lean implementation by providing the syllabus, modules, and programs. The parent company has practiced lean for the past seventeen years and was the largest non-OEM manufacturer in the aerospace industry. Company D was doing well despite the early stage of the lean adoption. The findings from research question two were tabulated in Table 3.

Table 3: Findings from research question two

Case study	Challenges faced in implementing lean
Case study A	Employee attitude Employee competency Top management Organizational culture
Case study B	Employee attitude Organizational culture Existing infrastructure
Case study C	Employee attitude
Case study D	Employee attitude

**Case study A**

Empirical data showed that most the respondents agreed that the attitude of the employees created the biggest obstacle to lean. Lean was seen as a procedure or tool or technique rather than a philosophy by itself. The respondents also felt that lean was a “top-down” agenda that the employees have no sense of “ownership” toward it. One of the respondents explained that the lack of motivation and knowledge contributed to the “failure” of lean implementation. He claimed, in general, that employees did not practice the concept of continuous improvement as their *self-improvement*. Nevertheless, company A provided lean training with the expectation that later their employees would be able to disseminate the knowledge that they acquired to another group of employees. Unfortunately, most often this did not happen.

During the initial lean implementation, company A has a smooth journey until the top management started some major restructuring two years back. The researcher was made aware that the decision to restructure was not in full agreement with the employees. People and production were clustered based on customers’ requirements or value streams. This restructuring forced the employees to focus on the assigned customer needs, which resulted in less interaction with other employees from



different value stream. It has caused the working culture to change, and lean culture began to disappear. This restructuring created silos and islands. Empirical data also revealed that there was a lack of understanding of lean by the top management. If the top management did not fully understand lean philosophy, the information that transpired to employees would also be vague and incongruent. The implementation of lean in company A was supposed to be a bottom-up approach. Lean began from the production floor. However, the top management did not fully understand how lean works. Lack of understanding caused the top management's refusal to implement a simple tool like 5S. Another critical issue was within ten years, company A has changed leadership for five times. Each new CEO has his way of leading and managing the company. Therefore, the frequent change of top management has created lukewarm attitude and lack of commitment from the employees toward lean implementation.

### **Case study B**

Initially, when lean was implemented, people were very sceptical about its benefits. To the extent, there were some employees who were thinking of resigning from the company. However, the HR manager succeeded to persuade them to stay and brief them on the extra allowances and incentives that they would be getting. When the managers kept their promises, employees were more motivated to do lean. Previously, company B was in the business of making rifles. When it embarked on aerospace business, some of the former company employees were still around. Hence there was a conflict between the senior employees and the newcomers. The senior employees were the most difficult to handle. Most of the respondents agreed that the senior workers have had more experience, yet they were incognizant and have negative attitude toward change.

Two of the respondents expressed their concern about the influence of the local culture in the company. The respondents revealed that there existed "competing groups" in the company. They could sense the feeling of jealousy among the employees. Due to this issue — the new employees who mostly young graduates were intimidated by this "groupings" and contributed to a relatively high turnover. Another emerging theme that posed a significant challenge to the lean implementation was the location of the company. The location and layouts of the plant were designed for the previous rifle production. When this issue was raised to the board of directors, there was a suggestion for a relocation.

### **Case study C**

Based on the feedback from the respondents, it was clear that the employees did not fully understand how lean works. Their common perception of lean was additional work. The employees were complaining that their works were already overloaded. The employees also inclined to see quickly the benefits of lean for them. Since the lean benefits were intangibles so most employees have negative attitude toward lean. This would add to the slow implementation of lean.

### **Case study D**

Similar to other companies, the primary challenge of lean in company D was coming from the employees. They have become complacent in their "comfort zone" and it was difficult for them to change their routine work to adopt a new way of doing things. The employees did not fully understand the philosophy of lean and what the long-term benefits it would bring to the company. However, education and training could play a crucial role in breaking this resistance. It also required close monitoring and engagement. Respondents from company D agreed that the challenges were manageable, and they were confident that the lean implementation would be successful in due course with the support from the top management and the parent company.

### **Cross-case analysis**

Cross-case analysis method was adopted to synthesize the overall results. The researcher categorized, analyzed and tabulated the individual cases in a table to compare and to provide insights for the cross-case analysis. In this analysis, the researcher compared the similarity and differences among companies with regard to lean implementation. Table 4 showed results from the cross-cases analysis.

Table 4: The findings from the cross-cases analysis

Findings	Case study			
	A	B	C	D
<b>Challenges faced during lean implementation</b>				
➤ Top management	✓			
➤ Culture	✓	✓		
➤ Employee attitude	✓	✓	✓	✓
➤ Employee competency	✓			
➤ Existing infrastructure		✓		

The most common challenge faced by these companies was the employee attitude. Company A also confronted with the issues of employee competency, top management and culture. Company B, on the other hand, encountered a unique issue — the existing infrastructure. The following were the detailed cross-case analysis of the findings.

**Employee attitude**

Attitude is a way of thinking that influence personal behavior. The right attitude toward lean resulted in employees’ commitment, participation and engagement. The evidence from the with-in case analysis exhibited that all the participating companies were facing employees’ resistance toward lean implementation. Resistance is defined as a refusal of an individual to comply with something. The opposition may be due to the fear of change. There are several possible reasons why employees fear changes, especially from those who firmly believe the current way of doing thing works. New ways represent moving away from the comfort zone, additional work, more time and added goals. Companies A and B both have senior employees that have been working in the companies for an extended period. Senior employees were found to be complacent and have entered a comfort zone wherein previously their work specifications were clearly defined. The key reason why employees resisted change could also be due to the lack of understanding of the lean philosophy. The findings from the analysis also revealed that the employees were sceptical of the lean benefits for them. The attitude of “what is it for me” explained the level of understanding of lean was still at the surface level. Thinking lean as a set of tools reflecting the superficial understanding of lean philosophy. Similar findings could be detected in companies C and D.

The finding regarding the employees negative attitude toward lean was in line with the literature (Zhou, 2016; Jadhav et al., 2014; Rose et al., 2013; Panizzolo et al., 2012; Bhasin 2011; Saurin et al., 2011; Grove et al., 2010; Nordin et al., 2010; Yang & Yu, 2010; Wong et al., 2009; Olatunji, 2008; Lee, 2007; Spear et al.,1999). Another intriguing finding that was not discussed throughout the literature was the challenge posed by the gap between the junior and senior employees. It was apparent in company B. The junior employees that came with higher qualifications and salaries threatened the older generations. The juniors were more tech-savvy, “friendlier” with the new tools and equipment and proactive. The feeling of jealousy and the emergence of “tribes” added to the already existing problem. Human Resource Department (HRD) should consider taking some initiatives to ensure that these two generations understand that they were not competing but complementing each other. The companies should develop diverse teamwork so that both generations could collaborate and achieve the “win-win” situation.

**Employee competency**

Main results from company A also revealed the employees lacked of knowledge and skills and have poor supervision. Supervision is when a leader or manager oversees the work done by his or her subordinates. Proper supervision is critical because it involves coaching, training and developing the subordinates’ knowledge and skills. Supervision in lean requires direct observation and immediate attention. Kotter (2007) in his book, *Leading Change* explained that there must be a sense of urgency for change to be implemented. There was a saying that reflected the role of supervision; “if the worker has not learned, the instructor has not taught”. The empirical finding showed that most employees in

this study lack of proper knowledge and skills in lean. This result was also in line with the findings from Dombrowski et al. (2012), Bhasin (2011), Achanga et al. (2008) and Olatunji (2008).

### **Top management**

Company A acknowledged top management as the contributing factor in determining the success of lean. The other three companies, B, C, and D agreed that their top management was fully supportive of any lean initiatives. This finding reinforced the premise that top management support played a critical role in implementing lean (Emiliani, 2008, 2004; Kotter, 2007). Even though a company's initiatives for lean implementation should come from both senior and middle management, visible and active leads by the senior management was critical (Scherrer-Rathje et al., 2009). Company A has been implementing lean for more than ten years. By looking at the duration, the implementation should be in full swing. However, the frequent changing of top management would affect the employer-employees relationship. Thus, making commitment to lean adoption was getting weak.

### **Organizational culture**

The respondents from companies A and B agreed that organizational culture was one of the obstacles in lean. Both companies admitted that the lean practices were also fading. For company A, the main contributor for this issue was the existence of the value streams. The key setbacks of this structure was that it created a self-serving island and silo-working environment where interaction and communication across all structures deteriorated. Lean culture was about working together and not in silos. Based on the with-in case analysis for company B, a large number of senior employees from the previous management was still around. Those employees were the most difficult to handle due to their resistance to change. Companies C and D, however, did not see organizational culture as a barrier to lean due to the strong commitment by the top management to proceed with the lean implementation. Thus, one of the enablers for good working culture was the influence of the committed lean leaders. These leaders led by setting the vision, providing the roadmap, and inspiring the employees. In sum, leadership plays a significant role in cultural change.

### **Existing infrastructure**

Finally, another key emerging theme from case study B was that the existing infrastructure was not compatible with lean manufacturing layout. As discussed in the findings, the management of this company was considering relocation as one of the possible options.

## **CONCLUSION**

In conclusion, the significant findings have identified the critical obstacles faced by the participating companies and the diverse paces of the lean implementation. Employee attitude was identified as a pertinent factor that could influence the lean operations in the participating firms. Literature indicated similar results. Another key theme that emerged from the study was that the organizational culture was deemed as one of the obstacles in the lean adoption. Moreover, companies admitted that the lean practices were fading. For company A, the main contributor obstacle was the existence of the value stream. The setback of this structure was that it created a self-serving island and silo-working environment where interaction and communication across all structures were weakened. Lean culture was about working together but not in silos. In addition, the companies were facing employees' indifferent attitude toward the lean initiatives. Resistance by the employees was found in all the companies surveyed. Resistance was defined as the workers' inert attitude toward change. The opposition may be due to the fear of change. There were several possible reasons why employees fear changes, especially from those who firmly believed the current way of doing things works. The study also found that employees felt to be complacent and have entered a comfort zone with the old way of doing their job without the need to adopt the new lean way. The reason why employees resisted change was due to the lack of understanding of lean philosophy. Empirical findings showed that the employees were sceptical of the lean benefits. The attitude of "what is it for me" explained the level of awareness of lean among employees which was still at the surface level. Perceiving lean as a trend that all companies must "jump in" has indicated the superficial understanding of the lean philosophy.

Furthermore, another challenge in lean implementation was posed by the gap between the junior and senior employees in terms of qualification and salary. As evident in company B, the junior employees that came in with higher qualifications and salaries threaten the older generation. The junior group was more tech-savvy and possessed proactive attitude. The feeling of jealousy and the emergence of “cronyism” added to the already existing malaise. Human Resource Department (HRD) should consider taking swift initiatives to ensure that these two generations understand that were not competing but complementing each other. The companies should develop diverse team work so that both generations can collaborate and work together harmoniously. Next, the issue of infrastructure also emerged from the data. Informants asserted that the existing infrastructure was not compatible with lean manufacturing layout. As discussed in the findings, the management was considering relocation as one of the possible options.

### **IMPLICATIONS OF THE STUDY**

The article discussed the challenges for lean manufacturing implementation in the specific context of aerospace industry in Malaysia. Although the study was not conducted using a new method, it did give a new insight and understanding for the researcher in using a qualitative multiple case studies. The results of this multiple case studies provided a meaningful insight in explaining the varied phenomena occurring among the participating companies. The findings elucidated the differences in lean practices in local and foreign companies. The aerospace industry was a multi-billion dollar investment and has tremendous pressure to become more efficient. Lean was adopted for addressing challenges and meeting expectations and implemented across the supply chain. The problems faced by the Malaysian aerospace companies in implementing lean were not significantly different from other manufacturing companies. Main implication of the study is that a new framework for lean management for aerospace companies is required to suppress the obstacles found in the present study. Several themes have emerged from the study such as (a) company culture that is not prone to lean philosophy, (b) employees negative attitude toward lean approach, (c) lack of communication and interaction among the departments on how to sync the lean implementation, (f) improper infrastructure to run lean manufacturing, and finally (g) generation gap between old and young employees who have different perceptions on lean adoption. Besides the need for a new framework, this study has a significant limitation that it was restricted to the aerospace industry. Thus, further studies should be conducted to include other industries so that a more generalized model could be develop to characterize lean approach more accurately.

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