The Effect of Lean Kaizen Application on Student's Satisfaction in Malaysian Higher Education Sector

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Abstract - Lean has been applied in the manufacturing sector for many years now. However, Lean implementation in the education sector has been somewhat slow in comparison, especially in the academic area. This motivates the conduct of this study, which is to identify waste in one of the academic work processes by applying value steam mapping and other lean tools. An experimental study was conducted to examine the effect of Lean kaizen application in the course planning and delivery process on students' satisfaction level at the end of a semester. The experimental study involved two groups of undergraduate students, one group with lean application and another group without lean application, from two universities in Malaysia. A questionnaire was used to collect the data totalling 205 respondents from University X and 201 respondents from University Y. The empirical results demonstrated that the use of Lean kaizen techniques did help to identify and reduce the waste by focusing on value adding activities. Furthermore, the finding of this study has showed that there is a significant difference in students' satisfaction between a group with lean application and a group without lean application. The mean of satisfaction for the group with lean application is higher than the group without lean application. Thus, this study has confirmed that Lean kaizen can be successfully applied in the Higher Education Sector to improve the academic work processes. This study has also provided the opportunity and guideline to other universities to change for the better.

AFFIRMATION

I hereby declare that this thesis submitted has been prepared by my own. Furthermore, no part of this thesis is waiting for any award.

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CHAPTER 1

INTRODUCTION

1.1 Background

Lean management has been reputable since decades ago as it has helped many organisations around the world to change for the better in terms of work performance (Balzer 2010). Lean is not a new approach because its benefits especially in the manufacturing sector have been proven in many studies. Lean helps the organisation by identifying any waste that occurred in the organisation's work process, then reducing the waste to provide value to the customer (Pedersen and Huniche 2011a). As such, lean has become widely accepted due to its benefits that can help an organisation to achieve success. According to Nordin, Deros, and Wahab (2010), the main objective of the Lean application is to evolve a quality organisation by providing a quality product through a waste free and smooth work process.

In western countries, several universities have started to implement the Lean principle in the Higher Education (HE) sector. The main purpose is to improve their service offerings by increasing the services quality in order to compete with other institutions. A positive impact of the Lean principles in that sector has been identified and presented in several studies. According to Radnor and Bucci (2011), several universities in the United Kingdom (UK) have started to implement the Lean programme, including Cardiff University, Nottingham Business School, Portsmouth Business School, University of St

Andrews and Warwick Business School. Likewise, the universities in the United States (US) have also applied Lean principles and practice in HE sector, such as the University of Central Oklahoma, University of Iowa, University of New Orleans, Rensselaer Polytechnic Institute and the University of Scranton. Most of these universities started implementing Lean principles and practice in the administrative work process, then the academic process.

All universities in the world are always changing to provide outstanding services (Green 2013). Malaysian universities, in particular, are striving to change to provide better services and to compete globally. According to Mat Lazim and Yusof (2012), Malaysian universities are continuously improving their services to produce quality graduates that can contribute to the development of the country. According to Malaysia's Prime Minister (Kementerian Pendidikan Malaysia 2012), the major contributor to the development of the country in terms of economic and social capital is through education. Therefore, by having educated people will help the country to improve and achieve the status of a high-income country.

Because of that, the universities in Malaysia today are working aggressively to improve their service quality and performance in many ways. As mentioned earlier, quality or satisfaction by certain parties can also be achieved by implementing the Lean approach (Nordin, Deros, and Wahab 2010). The Lean approach is also able to reduce or eliminate waste and improve efficiency in the work processes or services offered (Heikkila 2002; Jimmerson, Weber, and Sobek 2005; Kruskal et al. 2012). The reduction of waste and improvement in efficiency are the focus of this study. In other words, this study examines

the application of Lean in the higher education institutions, or universities. The major wastage in the higher education sector is as follows (Magaud 2007):

i. Inventory waste

This refers to surplus stocks that would increase the cost of storage and also probably lead to losses if the stocks have expiry dates.

ii. Defect waste

This refers to products or services provided by higher education institutions that do not achieve certain standards.

iii. Overproduction waste

This refers to products that were produced more than are needed or required.

iv. Motion waste

This refers to the unneeded movement of people within the work process.

v. Waiting waste

This refers to waste that is produced when the process has to wait because of delayed work.

vi. Transportation waste

This refers to waste that is produced when there is unneeded movement of things within the work process.

vii. Processing waste

This refers to waste that has been created when dealing with something more than are required.

There are many work processes in the universities. The academic work process is one of them and it becomes our interest in this study. This is because the provision of quality knowledge to students is the main function of universities (Kementerian Pendidikan Malaysia 2012). In our study, the course planning and delivery process has been chosen because as it is the main work process in academic area. The purpose of this study is to apply Lean approaches and investigate their effect in course planning and delivery work process, and how this affects students' satisfaction.

1.2 Motivation of the Study

The number of universities in Malaysia has increased since the 1960s. According to Mat Lazim and Yusof (2012), there are three growth phases of public universities in Malaysia: 1960s, 1970s to 1980s, and 1990s onwards. As of today, there are 20 public universities in Malaysia. The increasing number of public universities in Malaysia has resulted in competition among themselves, especially in the quality of degrees offered, the quality of researches contributed, efficiency in funds management and the number of students graduated. Hence, improvement in these areas needs to be done continuously by these universities, especially the newer ones in order for them to stay relevant in the higher education arena today, compared to the well-known and established public universities. The increasing number of public universities has also resulted in an increase in funds allocated by the government (costs), the number of staff (workers), the number of students (customers) and the number of graduates (products) (Mat Lazim and Yusof 2012). Furthermore, this increased number of costs, workers, customers, and products would

result in higher anticipation of quality or satisfaction, that is, meeting or exceeding the expectation of stakeholders.

According to Strong, Ringer, and Taylor (2001), if one wants to determine the satisfaction level, the stakeholders' expectations must be firstly identified and determined. Then assessment must be made to the performance with regards to meeting those expectations. The gap between the stakeholder's expectations and performance will cause dissatisfaction. Although this gap represents a model of satisfaction that was developed primarily within marketing to explain customer satisfaction, it is likely that the relationships apply to other stakeholder groups as well (Taylor 1993).

From the perspective of an organisation that receives public funding as its primary source of income, the government is considered as the main stakeholder in public universities (Benneworth and Jongbloed 2009). As the main stakeholder in public universities, the government satisfaction should be considered as highly important, or highest in the hierarchy, and carefully addressed. According to the Kementerian Pendidikan Malaysia (2015) and the Ministry of Higher Education (Kementerian Pendidikan Malaysia 2012), their aspirations are to improve the accessibility, quality, equity, unity and efficiency in the higher education sector, especially in public universities as public universities are highly funded by them. Two of the aspirations that are related in this study are quality and efficiency. The quality aspiration relates to the quality of students, the institution itself and the overall system. The quality of students is about the marketability of students in the job market, the quality of the institution is about the university ranking, and the overall system is about the contribution of the university in related fields, such as the

research output from the lecturers. The efficiency aspiration, on the other hand, is about the maximisation of the number of students graduated (output) by using the current amount of funds that have been allocated by the government. This study attempts to contribute to the public universities by providing methods that fulfill some of these objectives.

Contrary to Benneworth and Jongbloed (2009), Senthilkumar and Arulraj (2011), mentioned that students are the most significant stakeholder in a higher education institution compared to other stakeholders. They also refuted the idea that students are the main customers of a higher education institution as students can be perceived as products of a process, the internal customers for many campus facilities, the labourers of the learning process and the internal customers of the delivery of the course material. This statement is in contrast to Brochado (2009) and El-Hilali, Al-Jaber, and Hussein (2015) that supported the idea of students as customers of higher education institutions. Their main points are based on the belief that students are the direct recipients of services provided by the institution and it is them who make the decision as to whether or not to accept the service provided by the institution (purchase decision) according to their valuation. Nevertheless, Finney and Finney (2010) cautioned the idea that students as customers is not well suited in a learning process as they found that students who perceived themselves as customers are likely to react even in circumstances that are unconducive to success. However, it is a trend nowadays that universities are more student-centered as this is one of the approaches in the marketing strategy of highly competitive markets (Giner and Peralt Rillo 2015).

At the customers' (students') end, they expect, among others, that the public universities provide them with quality education and conducive surroundings at minimal cost. Their expectations have to be met or overachieved by the public universities, especially the younger public universities, to pave their names in the higher education arena, in line with other well-known and established public universities. These expectations can be achieved by measuring and improving their customers' satisfaction continuously (Paswan, Spears, and Ganesh 2007).

Customers' satisfaction is based on their evaluation of the utility of services or products in meeting their expectations or needs (Athanassopoulos, Gounaris, and Stathakopoulos 2001). According to Munteanu et al. (2010), a customer's satisfaction is a vital differentiator in planning for the marketing strategy of an organization whereby the organization is competing aggressively with other organisations. Additionally, Omar et al. (2009) view customer's satisfaction as a method of organisation communication, in which customer's satisfaction provides the most efficient and cheapest method to promote the organisation. This happens because satisfied customers will exchange their experience with other people. This can also be applied to the students of public universities. Public universities will be able to provide better services or improve their current facilities if they knew how to improve the perception of the students regarding satisfaction (El-Hilali, Al-Jaber, and Hussein 2015). The importance of service quality in universities has become very crucial these days, according to Athiyaman (1997), Cheung et al. (2011) and Oldfield and Baron (2000). The satisfaction of the students in relation to their needs and expectations will determine the education quality provided by the universities (Tan and Kek 2004). Universities need to provide exclusive learning experiences to attract a large

amount of student enrolment as the rivalry among higher education institutions becomes tougher nowadays (Curtis, Abratt, and Minor 2009; Hemsley-Brown and Oplatka 2006). As the situations mentioned above are with regards to the important views of students' satisfaction and their insights of service quality, most of the universities emphasised more plan and action on these issues and these are also well pronounced in researches (Astin 1993 and Wright and O'Neill 2002).

What are the endeavours to achieve the rank of student satisfaction? According to Ledden, Kalafatis, and Samouel (2007), universities must first be able to understand their needs and subsequently provide them with superior value or quality. Numerous factors can be identified from previous researches that contribute to students' satisfaction, regarding location and learning facilities (Kerwin 1981), respect from teacher to students, teacher's attitude towards training, instructional technology, course management, staffs, support services, and informal communication (Chien 2007). Additionally, other factors are also important such as teacher and teaching, course content, learning environment, and administrative services (Wei 2003), and teacher, course content, teacher's teaching, class materials and course setting (Urdan and Weggen 2000). The first determinant of student satisfaction, according to Deshields, Kara, and Kaynak (2005), is the curriculum. Moreover, students feel gratitude with their major curriculum when they consider it as preparing them for prospect career opportunities. An evaluation of business students' satisfaction found that the total design and delivery of the curriculum, especially in terms of perceived usefulness, has strongly influenced student satisfaction (Gibson 2010). In contrast to an old-style curriculum, a curriculum that transparently indicates to students how it is preparing them for career success is more probable to gain satisfaction (Caza,

Brower, and Wayne 2015). Furthermore, based on theories of employee satisfaction, we can suggest that curriculum modules that are engaging, useful, personally meaningful, and which provide students to give feedback will be more motivating and satisfying (Hackman & Oldham 1976). The statement is comparable to that of Storbacka, Strandvik, and Grönroos (1994) whom suggested subjective assessment done by the students themselves based on their experiences, life and outcome in universities; and these do illustrate their satisfaction.

With the above in mind, the public universities need to be more energetic in terms of the process of satisfying students' needs and expectations, and hence should exploit effective managerial techniques to improve the efficiency and quality of their groundwork. Essential for the service delivery process as this will influence the stakeholders' satisfaction are the employees of the university. According to Balzer (2010), the consciousness of employees regarding their tasks and responsibilities is essential in improving the work process and system of an organisation, especially in a university. Not only would the valuable inputs from the employees benefit the university, they would also affect their interpretation of their daily tasks. Hence, this would inspire them to move together with the university to achieve the objectives and outcomes that the university has underlined. Furthermore, Balzer (2010) also suggested that the benefits of Lean implementation would continuously improve employees' performance.

For these purposes, the Lean implementation in the university can be done in two ways: full application or partly implementation (Thirkell and Ashman 2014; Radnor et al. 2006). Full implementation is the implementation of Lean in all areas of organisation

management. It includes an overhaul or restructuring of all systems and process that can be found in an existing organisation to make sure that Lean is fully implemented. Hence, there is Lean compliance, not only in the organisation's standard operating procedures but also in the organisation's culture. On another perspective, this type of implementation is found to be hard and difficult to be implemented, especially in an organisation such as public universities. This is because the work culture and existing employees' behaviour there have been long established. The operation of public universities that never and cannot be stopped has also contributed to this difficulty during the full implementation of Lean. In addition, public universities also have interrelated work processes and systems with other agencies or organisations, industry or government link organisations. As a result, full Lean implementation is nearly impossible to be implemented in public universities as this would involve many organisations, legal requirements, political, bureaucracy organization and so on.

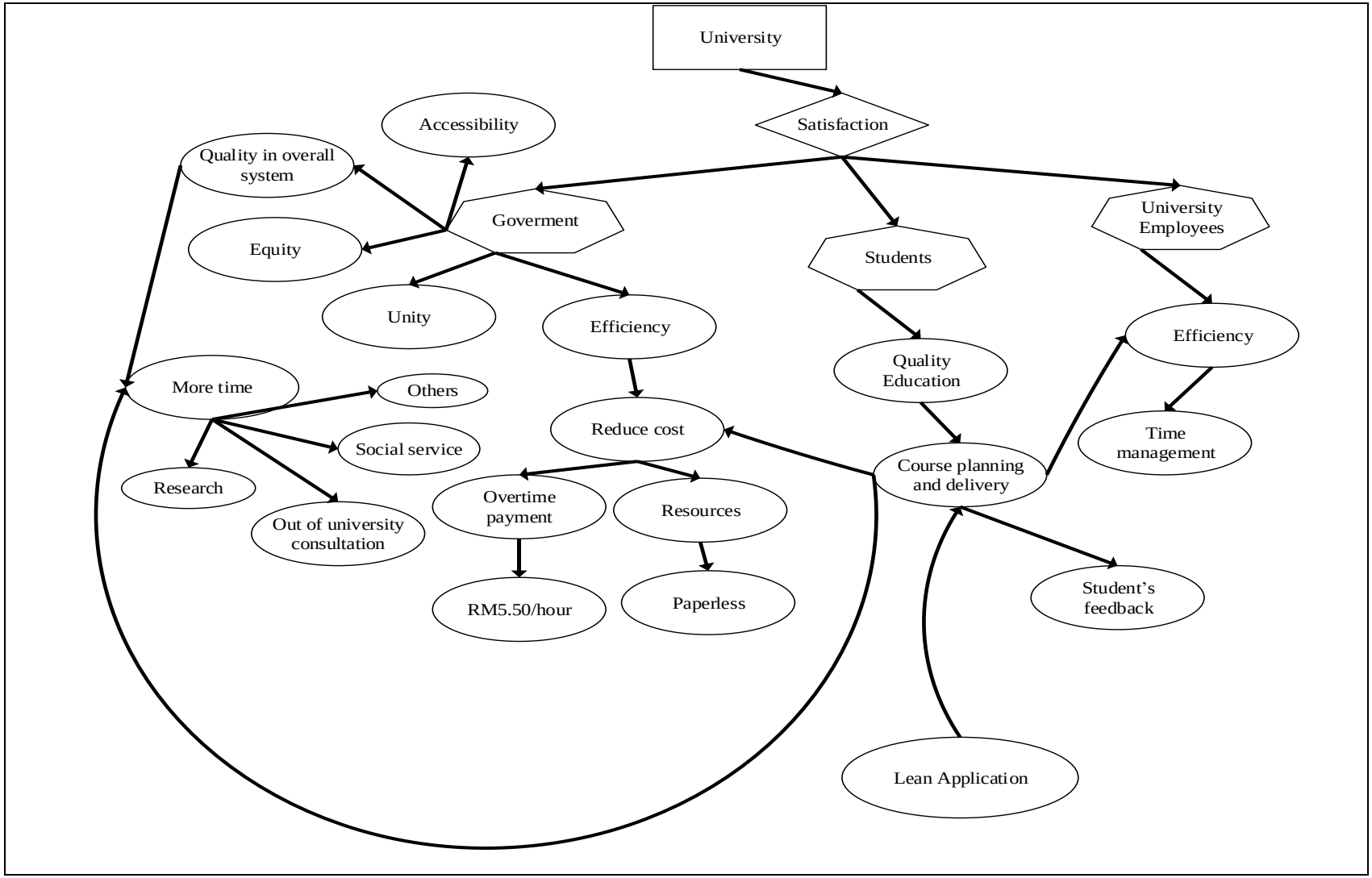
The partial Lean implementation is an approach where Lean is implemented in not all, but in certain work processes or systems that have been identified as feasible. The particular work process that has been identified is improved and this improvement would benefit the organisation. This type of Lean is also known as 'piecemeal' or 'kaizen-type' by Radnor et al. (2006). After identifying the work process, the improvement steps is then discussed with related staffs and customers during a few brainstorming sessions. As a result, an improved work process is proposed and approval from the superiors is needed to put that improved work process in practice. This type of approach is more probable to be implemented in public universities. Although this type of Lean implementation is targeted in tiny areas compared to the overall system in a public university, Radnor et al.

(2006) claimed that this type of Lean implementation is a strategic plan that comes from a full execution plan of Lean in an organisation. It can also be regarded as a tactical approach that is essential in an organisation that practices the Lean philosophy of reducing waste and ongoing quality improvement. Having said the above about nature of conduct of partly Lean implementation, it has been verified that the partly Lean implementation is a common practice in public organisations (Thirkell and Ashman 2014).

Figure 1.1 illustrates the connection between a university, satisfaction and Lean application that are considered in this study. Actually, it visualises the discussion of the motivation for this study. The Lean application in this study would indirectly benefit the stakeholders, namely the government; students; and the university's employees. By applying best practices in the process of course planning and delivery, this would not only increase the students' satisfaction, but also reduce certain costs, increase the staff's efficiency and provides more time for the staff to be involved in other useful activities. These elements that are affected and the way they are affected are our targets, as has been underlined in the discussion of the motivation for this study. They are also the main goal of the Lean tools implementation. The implementation of Lean methods focuses on the partial Lean application type as suggested by Radnor et al. (2006).

Therefore, based on these motivations, we would try to implement the Lean methods in the two new universities of our study.

Figure 1.1: The Relationship between University, Satisfaction and Lean Application



1.3 Aim and Objectives

As mentioned earlier, this study applies the Lean approach to the work process of course planning and delivery in two new universities, with an intention to improve the existing academic work process. In examining whether the Lean approach is able to improve the current work process of course planning and delivery, the impact (i.e., effects) of the Lean implementation on the work process (existing and future) will be described. Apart from that, the impact of Lean implementation will also be examined on staff's efficiency, students' satisfaction and cost reduction.

In relation to the above, this study will compare the results between a group with the Lean application and a group without the Lean application in two different new universities. This study is expected to contribute to the existing literature by identifying any activity that is not valuable in the course planning and delivery process in the higher education services. In addition, it is expected to help in improving the academic work process by reducing wastage of any sort, continuously.

Therefore, our research objectives for this study are as follows:

i. To identify waste that exists in course planning and delivery process by using Lean applications.
ii. To reduce or eliminate waste in course planning and delivery process by using Lean applications.

iii. To examine the effect of Lean applications on students' satisfaction on the taught course at the end of semester in University X and University Y.

iv. To provide recommendations for lean application in higher education sector.

The aim and objectives of this study are inspired by the connection between Lean principle and quality in service. Hence, the main hypothesis for this study is as follows:

The implementation of Lean methods in course planning and delivery work process will improve the academic work process.

Thus, several research questions are constructed to support the research hypothesis, as follows:

i. Can Lean be implemented in academic work process?

ii. How to apply Lean in academic work process?

iii. Can Lean applications improve the existing academic work process?

iv. Can Lean applications favourably affect students' satisfaction?

This study used data and respondents from two universities that are relatively new in Malaysia.

1.4 Contribution of the Study

This thesis contributes by extending the literature related to organisation management area by carrying out an empirical study that examines whether Lean methods can be successfully applied in the academic context.

To be more precise, the main contributions of this study are as follows:

i. This research has proven that there is a gap that needs to be filled in the empirical literature of Lean application in higher education institution. That is, there appears to be no study that has implemented Lean methods in a full-time undergraduate academic programme. Nevertheless, there are two studies by Emiliani (2004a and 2005) that analysed the application of Lean methods on the part-time master's academic programme and their impact on the students. However, the techniques used in those studies are different from this study as the perceived problems in his studies are based on previous literature and his experience. The Lean methods were also applied to the course elements, such as reading materials, syllabus development, etc. Initially, this study used an exploratory approach in identifying the perceived problems in the work process of course planning and delivery. Subsequently, the Lean techniques were applied directly to the work process of course planning and delivery and their impact was analysed not only on the students but also to on the staffs of the two universities. Other previous studies, however, only apply Lean to the administrative work process of higher education institutions.

ii. The most significant contribution of this study is that the Lean applications have improved the work process of course planning and delivery. Overall, the Lean

applications have impacted favourably on students' satisfaction, reduce certain costs, increase the staff's efficiency and also enable more time to be given to the staff to be involved in other useful activities (e.g., doing research, consultation and social work). This is in line with the stakeholders' expectations, as mentioned in the section of motivation for the study.

1.5 The Structures of the Thesis

This thesis is divided into seven chapters. Chapter 2 provides an overview of Lean implementation in manufacturing and service sectors. Lean in higher education is discussed including the success stories of implementation and the Lean methods.

Chapter 3 explains the data collection design that is used in this study. Besides that, it also discusses the research design, sampling design, ethical consideration and limitations of this study. The pilot study and reliability results are discussed in this chapter.

Chapter 4 explores the perceived problems faced by students and lecturers in relation to course planning and delivery process. The exploratory study is also applied to facilitate in determining the management dilemma, and as a guideline in doing the mapping of the value stream for the course planning and delivery process.

Chapter 5 reviews the relevant literature to develop the theoretical framework for the study, specifically the Lean framework.

Chapter 6 describes the Lean analysis and Lean implementation in this study. This chapter explains how the Lean tools are implemented in the work process of the course planning and delivery process after the issue of wastes is identified through value stream mapping.

Chapter 7 explains the data analysis and results of the study. The data is collected at the end of the semester of study term for the two groups. They are treatment group (a group with Lean application) and control group (a group without Lean application) involving students to determine their satisfaction level on the taught course at the end of semester.

Chapter 8 provides the conclusion of the study based on the findings. It also discusses how the results answer the objectives of this study. Besides that recommendations and limitations of the study are described in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Preliminary

We conducted literature search to obtain an overview of Lean applications and general information about problems that are affecting the smooth flow of course planning and delivery process.

2.2 Definition of Lean

Organisations are always trying to enhance and improve their qualities. They strive to deliver satisfactory performance for their stakeholders, especially their customers. Lean principles and techniques are among the powerful methods that have been applied by organisations to improve their performance, especially in the manufacturing sector. Lean is believed to have been introduced decades ago by a Japanese automotive company, Toyota. During that time, Lean was known as Toyota Production System. According to Kilpatrick (2003), Lean is defined as a method to improve the flow of production by reducing and removing waste continuously. This definition has been put forth by the National Institute of Standards and Technology Manufacturing Extension Partnership's Lean Network.

Specifically, lean is a principle that functions as process improvement; works at reducing or eliminating waste that would result in losses to an organisation. This loss is mentioned as wastes by Kilpatrick (2003). Wastes are defined as actions, or results from actions that do not contribute in increasing an organisation's value, or that would result in losses to the organisation. Based on the work of Ohno (1988), he identified eight wastes that can be eliminated in an organization, namely overproduction; waiting; transportation; non-value-added-processing; surplus stock; defects; extra movement; and under-utilised people. Overproduction is about producing more than is needed by the consumer. Waiting is about not providing resources on time (JIT). Transportation is about not delivering materials to the assembly line. Non-value-added-processing is about not producing products accurately right up-front. Excess inventory is about non-optimisation of the inventory. Defects are about mistakes in production and services provided. Excess motion is about the avoidable passage in work approach, and underutilised people is about failure to utilise an individual's capability fully in an organisation. To overcome those wastes, Lean philosophy that are fundamentals to a method(s) has been proposed such as pull system, kanban, batch size reduction, 5s management, total productive maintenance, five whys, total quality management, reducing changeover time, visual controls, concurrent engineering and others. Evidence of benefits when implementing the Lean principle can be seen from participating organisations, regarding their operational; administrative; and strategic improvements. However, from the observation of Kilpatrick (2003), he also cautioned about certain hurdles that organisations would face when attempting to put the Lean principle into practice.

Womack, Jones, and Roos (1990) defined Lean principle that is used in production as a blend of the usefulness of customised production and mass production, which at the same time abstain from the expensive cost of the former and extreme plainness of the latter. This means that Lean is a progressive process of transformation as a result of an organised type of philosophy that were specified based on best practices, to improve an organisation sequentially. Lean is also holistic in nature in that its work is characterized by treatment of the whole organization. In other words, all elements of an organization are involved, and fusion in the mechanism requiring all elements of an organisation to work together to achieve the Lean status.

Lean can also be defined as few or minor, which means there would be lesser waste of the costs, time usage, layers of an organisation and suppliers per customer, according to Nightingale (2000). Additionally, she defined Lean as additional, in the sense of empowerment of the employee's capability, flexibility, productivity, quality, customer satisfaction and long-term success in competition among organisations.

According to Emiliani (2004b), Lean can additionally be interpreted as less doing of the unimportant or insignificant things; instead doing things that only bring benefits to the organisation continuously. He added that Lean is a management system that is backed by uncomplicated processes and apparatuses, conforming to the obligation of an organisation to continually scan the changing business environment.

Pedersen and Huniche (2011a) stated that Lean is basically about raising customer value and decreasing waste. To do that, the processes that are involved intra and inter

organisations need to be optimised. This is in line with the definition of Lean that were suggested by Cristina and Felicia (2013), Nordin, Deros, and Wahab (2010), Brandao de Souza (2009), Bhuiyan and Baghel (2005), Baines et al. (2006), Duque and Cadavid (2007) and Narasimhan, Swink, and Kim (2006). Next, Shah and Ward (2007) also suggested a similar definition of Lean in that they added the definition of waste as that which means differences between supplier, customer and the organization. Taj and Morosan (2011) defined Lean as production without waste. They also defined waste as an excess amount of materials, parts, working time and equipment that are not needed and should be avoided by the organisation. This is because waste is unnecessary which should be eliminated if it occurs in an organisation so that a product's quality can be improved, the cost of production can be reduced and customer's satisfaction can be increased.

Organisations like higher learning institutions (e.g. public universities) also can apply Lean principle as Lean is not only restricted to the manufacturing sector. This inclusion has been suggested by Womack and Jones (1996) and supported by Abdi, Shavarini, and Hoseini (2006), Atkinson (2004), Corbett (2007), May (2005) and Ehrlich (2006).

In summary, Arlbjorn and Freytag (2013) have categorised Lean into 3 levels: Lean philosophy, Lean principles, and Lean tools/techniques/methods. This can be seen in Figure 2.1. In order to achieve a Lean organisation, the steps that should be taken by the organisation can be from top to bottom or from bottom to top. This depends on the discretion of the organisation. An organisation is said to have achieved a Lean status when it applies all the three aspects.

Figure 2.1: Lean in Three Levels (Arlbjorn and Freytag 2013: 117)

2.2.1 Lean in the Manufacturing Sector

The first trace of Lean principle application was in the Japanese manufacturing sector, specifically at Toyota Motor Corporation (Ohno 1988). The rise of the Lean principle in Japan was observed as a result of limited resources and highly competitiveness of the automobile industry. Thereafter, the usefulness of Lean has sparked much intention from not only researchers, but also organisations around the world, to study the connection of the principle and its benefit to companies or organisations other than Toyota. Since then,

many studies have been undertaken to examine the Lean principle application, not only in the automobile industry, but also in other manufacturing sectors and other countries (Hines, Holweg, and Rich 2004). The application includes JIT, kanban, respecting people, mistake proofing and others. This is in line with the suggestion by Womack, Jones, and Roos (1990) that sectors other than automotive or in countries other than Japan are capable of adapting the Lean principle. This is because the manufacturing issues and technology applications are common problems faced by any organisation or company.

Sakakibara et al. (1997) examined the relationship between JIT and performance in the manufacturing sector. They found that there was an insignificant relationship between them. Nevertheless, there is a significant relationship between JIT and infrastructure; this is with regards to their practices. That is, JIT is practised in management including infrastructure practice. Usually this results in manufacturing performance. This is because infrastructure alone is sufficient for explaining the manufacturing performance. Hence, JIT in management has enhanced the effect of infrastructure practice on manufacturing performance. Sakakibara et al. (1997) also added that manufacturing performance in their study has a strong connection with the competitive advantage of an organization. Therefore, JIT is a tool for an organisation transformation as it produces targets of improvement and discipline for the whole organisation.

Cua, Mckone, and Schroeder (2001) revealed that the concurrent appliance of total quality management (TQM), total productive maintenance (TPM) and JIT arrangements could result in attaining manufacturing goal. The measurement of that goal is in terms of cost, quality, delivery, flexibility and weighted performance. Their studies show that TQM,

TPM and JIT can be combined practically to attain manufacturing performance. This is due to the integration of technical and social in the practices of TQM, TPM and JIT. They further added that based on their analyses, the concurrent appliance of the programmes (TQM, TPM and JIT) will result in higher achievement for an organisation, compared to when only one of the programmes being applied alone at one point in time.

Shah and Ward (2003) studied the impact of plant size, plant age and unionisation status on the probability of implementation of the Lean approach in the production systems of manufacturing practices. In their study, Lean is defined as an approach that involves many aspects and limits the scope of four main disciplines which are limitless in nature, in the sense of their applications. These four disciplines are JIT, TQM, TPM and human resource management (HRM), and when combined with a unified system will reduce or eliminate waste while still being able to satisfy customer demand by producing end products that tally with the customer order. Shah and Ward (2003) were able to do the above as they incorporated 22 Lean practices into the four Lean disciplines. A scale which consists of 6 items was employed to measure the performance of operations in a manufacturing plant. The six items include five years change in the cycle time of manufacture, scrap and amend costs, productivity, unit manufacturing costs, first pass yield and customer lead time. They found strong support for the impact of plant size on Lean appliance, while the impact of plant age and unionisation status is less prevalent. Their study also showed that the four disciplines in Lean approach do increase the performance of the plant's operation.

Jayram, Vickery, and Droge (2008) examined the effects of Lean strategy implementation in connection with the relationship between organisation and main supply chain partners, which comprise suppliers and customers. The final impact of the relationship between the implementation and the relationship was hypothesised to contribute to the performance of the organisation. Two disciplines in Lean principle, Lean manufacturing and Lean product design were chosen to test this hypothesis. Lean manufacturing consists of JIT production, reduction of setup time and cellular manufacturing. Lean product design consists of simultaneous engineering, manufacturability design, value analysis and standardisation. The performance of an organisation is usually referenced to return on investment, return on sales and return on assets. Furthermore, they suggested that the relationship between the organisation and main supply chain partners should be built earlier, i.e., before implementing the Lean strategy. The structural model analysis was deployed to test their hypothesis and the results showed that there is a positive relationship between the relationship above and Lean product design; positive relationship between the relationship above and Lean manufacturing' and positive relationship between Lean product design and organisational performance. It is recommended that the relationship between the organisation and main supply chain partners as more important to improve the aspect of a product in Lean strategy as opposed to the process aspect of Lean strategy.

Lawrence and Hottenstein (1995) studied the relationship between JIT and manufacturing performance by using the survey questionnaire conducted through the mail. JIT consists of 5 key components which are decreasing setup times, decreasing production lot sizes, materials flow and handling easing, decreasing inventories and defective product inhibition. The manufacturing performance was measured by quality, lead time,

productivity and customer service. The sample of the study was 124 plants in Mexico that has a connection with US firms. Although it may be hard for JIT in manufacturing to be applied in Mexico, they found that JIT has a positive and significant correlation with manufacturing performance. Their results also showed that the citizenship of the plant managers may also be a factor in the successfulness of JIT appliance.

Li (2000) studied the relationship between performance and competitiveness in manufacturing organisations. The measurement of performance is based on sales, profit after tax, and return on investment. The measurement of competitiveness is based on marketing, product design and its development, product manufacturing and human resources. Besides that, responses from executives in the manufacturing industry were taken. In her study, 300 manufacturing organisations were considered as a sample, to measure the significance of competitiveness to performance. From her analysis, the results showed that those executives highly rank marketing competitiveness. This shows that China, where the study was conducted, has changed from an economy of state planned to market economy. The competitiveness, which includes improving quality, sustaining on-time delivery, production cost reduction, and decreasing inventory levels are highly ranked as having a relationship with performance. Furthermore, human resource management also has an important relationship with performance in her study. All of these are principles in the Lean approach.

In her later study, Li (2005) investigated the intermediate infrastructural manufacturing decisions, which includes workforce management, production control and new technology applications' influence on an organisation's market performance. The market

performance, however, is different in this study as it was measured by market share that is controlled by an organisation. The market share is measured by product quality, new product and new market creation. The data sample for this study also consisted of Chinese organisations, totalled 800. The results showed that the intermediate infrastructural manufacturing decisions do contribute to an organisation's market performance improvement. Nevertheless, process type and new technology implementation are insignificant in terms of their contribution to market performance.

Robb, Xie, and Arthanari (2008) examined the relationship between operations practices and financial performance in organizations. They used data from a survey of 72 Chinese manufacturers of furniture. The results showed that operations practices have no significant impact on financial performance of organisations. However, the impact is intervening between importance and performance of operations dimensions. There are 13 dimensions of operations in this study and 68 variables of operations practice. They also performed factorial analysis by using structural equation modeling and found that human resources, customer relationships, and advanced manufacturing technology have a positive correlation with three of the dimensions of operations (speed, flexibility and innovation). From this study, they also found that market performance has a robust relationship with value and innovation performance, and have an indirect relationship with speed and flexibility performance.

In another study, Taj (2008) examined the refitting of the Lean principle in manufacturing and also its application in China. The assessment consisted of 40 questions and conducted at 65 manufacturing organisations of different industries. Those questions can be

categorised into nine categories, namely inventory, team approach, processes, maintenance, layout/handling, suppliers, setups, quality and scheduling/control. The outcomes of the study indicated that the adaptation of the Lean principle has been led by the petroleum industry, followed by computer, telecommunications and later by electronics. The Lean application in areas of layout design, volume flexibility, setup, visual factory and point of use delivery is still low compared to other areas such as materials flow, scheduling control, on-time delivery and overall defect. Taj (2008) concluded that there is still space to enhance the manufacturing sector with Lean applications.

Next, Taj and Morosan (2011) investigated the impact of Lean operations practice and production system design on manufacturing performance of organisations in China. Lean operations practice is represented by human resources and supply chains constructs that make 18 items of measurement. Production system design consists of 12 items, while manufacturing performance consists of 10 items. Items in manufacturing performance can be further divided into 3 categories, which are flow, flexibility and quality. This is based on a factorial analysis. Their results also showed that human resources and supply chains do have a valid positive impact on manufacturing performance, especially on flow factor and flexibility factor. However, human resources and supply chains are insignificant in describing the quality factor. Based on these, they suggested that the manufacturing organisations in China should transform themselves to not on rely on better supply and cheap labour factors. They should start focusing on quality improvement via manufacturing operations restructuring.

As a conclusion, Lean implementation in the manufacturing sector has become a widely acceptable technique in the manufacturing sector since decades ago. Past studies have demonstrated that the application of Lean in the manufacturing sector has managed to improve a product's quality, reduce production costs, thus increasing customers' satisfaction. According to Jasti and Kodali (2014), the number of research articles in Lean manufacturing before their study was conducted has risen to approximately 34% of total Lean manufacturing research articles. Lean manufacturing articles according to their study, has started from 1988. These studies have showed that the implementation of Lean in manufacturing organisations has benefitted the industry a great deal, as related in the research articles reviewed by Jasti and Kodali (2014).

2.2.2 Lean in the Service Sector

After years of applications in the manufacturing sector, the Lean principle has also spread evenly from the production of goods to the service and healthcare delivery and services, according to Brandao de Souza (2009). This is in line with the suggestion by Womack, Jones, and Roos (1990) that Lean principle is borderless in its implementation, as long as there is management in the organisation.

Hines, Holweg, and Rich (2004) mentioned that Lean application has evolved from the manufacturing or production process, or from only focusing on "shop floor" waste elimination and cost reduction to another application which tries to enhance a particular value in the services aspect. That is, that would satisfy the customer or put interest on the prospective customer. This can be done by adding certain service features and removing

certain activities while providing services to customers. The relation between value, cost and waste in the services can be seen from Figure 2.2. Services can be plotted in relation to their cost-value that is perceived by the customer. The farther above the cost-value equilibrium that a service can be plotted on the chart, the more appealing the service is to the customer. The cost-value equilibrium indicates the circumstance in which there is a win-win situation between the service provider and customer. In other words, the service provides precisely as much value as to the service cost, which the customer has agreed to pay. The movement from an ordinary internal benefits waste elimination focus in services to a customer value focus. This has exposed an organisation to a second opportunity in terms of value creation. That is, reducing internal waste via Lean principle is also able to increase overall service's perceived value and adding certain features to the service that would also increase the service's perceived value. Hence, when an organisation reduce or eliminate certain activities that are not needed or redundant in a service, the cost of service will be relocated through line 1 (refer Figure 2.2). If the service then is adding certain materials or services or anything that is perceived as valuable by the customer, the customer-perceived value of the service will be relocated again, but this time through line 2. This is what the second opportunity of value creation means according to Hines, Holweg, and Rich (2004).

Figure 2.2: Relation between Value, Cost and Waste in Services (Hines, Holweg, and Rich 2004: 997).

This explanation of Lean application in the service sector by Hines, Holweg, and Rich (2004) is considered as comprehensive and also one of the best. Their explanation is better understood when supported by the definition of waste by other researchers, such as Bhuiyan and Baghel (2005). They explained that waste is something that the customer is not willing to pay. This kind of waste or situation is more often seen in services as this sector involves many customers. Waste in service can also be described as mistakes or interruptions or delay in providing the services to customers by a particular organisation (Brandao de Souza 2009).

According to Piercy and Rich (2009), the implementation of Lean principle in the service sector has mainly been concentrated to those with tangible product, for example in retail

supply chain management and health services. This has motivated them to conduct a study that examined Lean applications in a real service sector, which was call centre service of financial services companies. They found that the Lean principle can be applied in that sector, and the application of it has outshined the classical management approach of service call centre. The lean application is in favour because it has added quality, low in cost, easier to apply, requires minimum staff training and generates significant improvement for the companies.

Krishnan and Parveen (2013) compared the Lean applications in the manufacturing sector and service sector. The service sector in their study consisted of only the health service. They found that the Lean approach, which is in TQM, JIT and HRM are the most practised in both the manufacturing and service sector. However, Lean application in HRM is found to be more significant in the service sector compared to the manufacturing sector.

Skinner (1969) claimed that the service sector is being led by the manufacturing sector in the sense of looking for ways and mechanisms to enhance the productivity of an organisation. This can be seen in the implementation of strategies to reduce costs, better quality and more flexibility that are initially introduced in the manufacturing sector. The shift in thinking, he added, to transform the implementation to the service sector from manufacturing, started in the 1970s. This claim is supported by two influential articles by Levitt in 1972 and 1976.

Levitt (1972) opined that the service sector is something that co-exists with tangible products. Hence, its competency, respectability and performance could also be witnessed with the physical products. At that time, Levitt was also responsible for possible implementation of Lean principle in the service sector, according to Bowen and Youngdahl (1998). However, this matter has been given little attention in the 1970s as the manufacturing sector was heavily dominating the economy at that time. Levitt (1972) emphasised that the service sector was in a state of recessive and incompetent compared to manufacturing sector then.

Levit (1972) also focused on this matter in his 1976 article. The service sector was in this kind of situation as one can easily see that the manufacturing sector provides mass production while service sector could not. Moreover, the service sector then was developed and run according to a bureaucratic model of operations that was outdated and did not consider customers' needs and satisfaction as important. This situation has prompted for an immediate transformation in the way service sector is being run then so that the service sector can progress parallel to the manufacturing sector. This can be done by carefully applying the same approaches that were done in the manufacturing sector then such as planning, controlling, quality assurance, continuous improvement and handling the customer responses well. This doing has resulted in much higher customer satisfaction then. Levit (1972) took McDonalds' company's operation as an example. McDonalds use appropriate technology and standardisation in providing good services to the customers, such as producing food in large quantities during a short time compared to conventional food preparation. Hence, as a conclusion, he suggested the application of

assembly line method and mass production thinking in the service sector that could create more efficient operations at lower costs and more satisfied customers.

But how do we know that an organisation has already applied the Lean principle in its services? According to Bowen and Youngdahl (1998), this can be known when certain principles could be easily recognised in that organisation. Among the principles are flexibility and responsiveness, customers focus, the empowerment of employees and teams, having knowledge management, integrate and disaggregate the value chain and networking organisation. However, Abdi, Shavarini and Hoseini (2006) mentioned that there are only four principles, or dynamic phases that need to be exercised by an organisation to verify that they implement the Lean approach in service. The four principles are as follows:

1) Learn, which is Lean thoughtful in your service

2) Expect, which is setting the anticipation

3) Analyse, which is doing a guideline or target of your operations

4) Navigate, which is considering expert opinion

Allway and Cobertt (2002) suggested ways for one who wants to explore the meaning of Lean in service sector organisation. The most important thing that should be done by the senior managers is to identify the functions of the combination of operations and

processes with the aim to generate output in the manner of services. During the transition to the application of the Lean in services, they added that the organisation should try to provide the highest possible value to the clients so that the clients will be satisfied in the sense of their needs and expectations. This is in line with a report from Emiliani (2004b) and Dahlgaard and Dahlgaard-Park (2006) that most of the happenings in the service sector and manufacturing sector organisations are not contributing to value-added activities.

As a proof, Dahlgaard and Dahlgaard-Park (2006) found that 74% of the total income in a leading Danish service organisation was used on various wastes. As the authors of the study, which are Allway and Cobertt (2002), both of them are working in the consultation service organizations then. Hence, the definition of Lean in the service sector in the study is considered as a clear orientation as it is the view of practitioners (Suárez-Barraza, Smith, and Dahlgaard-Park et al. 2012).

Different categories in the service sector industry have reported various case studies and researches in the literature that contains success stories of the application of the Lean principle in that sector. Those case studies and researches were conducted by academicians and practitioners from the field. Based on the above, there are five categories that can be found in the literature regarding Lean application in the service sector. They are Health Service, Education Service, Financial Service, Airline Service and Hospitality Service.

2.2.3 Lean in the Health Service Sector

Spear (2005) warned that there is a call for service improvements and innovations in health service as it is a global trend to disregard the traditional ways in providing the service. The factors that contribute to the pattern are pressures from the public, increased demands, increased costs, pressures from competitors to increase effectiveness and efficiency, need for more professionalism and specialisation in bureaucratic procedures and processes.

Martin (2007) reported that approximately 19% of health service organisations in the USA have adopted Lean principles such as Six Sigma, 13% adopted Lean thinking, 12% have outsourced health service for more efficiency, and 29% did not apply for any Lean principle at all. These justify the low adoption of Lean principle in the health service sector and more efforts should be made as there are still parts, areas and organisations in health service that could be improved.

Womack and Jones (1996) pointed out that the application of Lean principle can be done in the health service, especially in the hospital management. This can be initiated in the process of assigning patients during their reception, managing their medical attention waiting times, assuring their comfort during their stay and measuring the quality of the services that have been provided to them by the hospital. Collins and Muthusamy (2007) added that Lean principle can facilitate the health service to eradicate the errors and mistakes in the service, decrease the delays and waiting times and respond to the inadequate processes and procedures in the health service. Studies by Jones and Mitchell

(2006) and Lipley (2008) reported that few hospitals in the USA, Canada, Australia and the UK have adopted the Lean principle. It results in positive effect on productivity, cost reduction, reduction in patient's waiting time, better treatment of emergency case, improvement in management, inventory storage and better treatment for high profile cases such as cancer patients. They also reported the feasibility of the Lean adoption in hospitals of those countries.

Kollberg, Dahlgaard and Brehmer (2007) suggested a theoretical framework for estimating the performance of health service based on Lean principle application. The Lean principle in health service can be perceived as one of the many elements that partly contribute to an overall management plan to transform the mentality and daily work of the individuals in health service organisation. 21 critical success factors in the framework are based on five Lean principles suggested by Womack and Jones (2003). They are specifying the value, value stream, flow, pull and perfection. From the 21 critical success factors, they developed 31 key performance indicators that can be used to measure the performance. The overall framework is for the betterment of efficiency and effectiveness of the health service organisation. They also suggested that the model has to be used in parallel with estimation of other performance such as satisfaction and process mapping. This was supported by Aherne (2007) that the greatest challenge and achievement in adopting Lean principle in the health service organisation is to include all of the individuals involved in providing health service, which includes doctors, nurses, technicians, administrators and not to be forgotten, the auxiliaries. The inclusion of these people is to make them aware that there are potential benefits in the application of Lean principle in the health service organisation, which in turn will also benefit them.

Based on the findings from past studies, we can conclude that the Lean principle can and has been applied in the health service sector, although there are still many improvements that need to be made. It is worthy to note that the application of Lean principle in the health service sector should also include the top level management as they are directly involved in delivering the service, as mentioned by Suárez-Barraza, Smith, and Dahlgaard-Park (2012). This shows that the Lean principle has received significant attention in this sector and its application is continuing. Even though the health service sector does not produce cars as what Toyota does when they first apply the Lean principle, the health service sector has adopted the Lean principle very well and there is a possibility that their daily work will continue to be improved with Lean principle application (Fillingham 2007). The suggested self-assessment methodology by Dahlgaard, Petersen, and Dahlgaard-Park (2011) that is based on innovability, learnability and leanibility in the health service sector to increase performance based on identifying critical factors is one of the examples.

2.2.4 Lean in the Education Service Sector

The education service sector has evolved substantially over the last four decades (Gibbs 2013). There are so many changes that have been made to provide excellence in education service in the higher education service sector. The changes include distance learning, online programmes, programmes for executive, workshop-type training, twinning programmes and others. This shows that continuous improvement and innovation in the higher education service has become more important due to vast variation in terms of focus and mission in higher education worldwide (Green 2013). Following the domino

theory, every higher education organisation has started to build their uniqueness so that they can be more easily differentiated than others. This shows the fruitfulness of academic programme developer roles and usually also indicates the educational programmes provided by those organisations can be challenging, thrilling or frustrating. As a matter of fact, providing academic service in higher education can be a meticulous business (Green 2013). This is because the higher education service is a sector that needs to be continuously changed and improved to cope with the academia and the today's era of knowledge. As factors such as financial pressures and external criticism can make the university's instructors less reluctant to change, the implementation of TQM in the higher education service seems to be the right way to parallel the higher education institution to the changes and improvements needed (Spanbauer 1995).

An article about total quality in the teaching by Dahlgaard, Kristensen and Kanji in 1995 is the first, to the best of our knowledge that contributed to the application of the Lean principle in education. The paper analysed and discussed the primary philosophy of total quality management (TQM) in providing education service. 5 TQM key principles and how to implement them in the education service were outlined in the paper, namely: leadership; customer and employee focus; kaizen (continuous improvement); the participation of everybody; and focusing on facts. The paper also introduced plan do check act (or PDCA) model in applying quality in leadership in the education service sector. This paper is said to have contributed to the application of the Lean principle in education as kaizen, customer and employee focus, and focusing on facts have strong links with the Lean principle.

Kells (1995) concluded and recommended that if the TQM was to be applied in the education service organisation, the most important thing being the role of the leader in the organisation, whether they are formal or informal leaders. He also emphasised the crucial role of quality in education service, especially which relates to the internal processes, as this will ensure a high level of service is provided by the organisation. However, the implementation of quality management that he emphasised, should not impact the management of the organisation in a negative way, he added.

Van Der Wiele (1995) conducted a case study involving a college located in the Netherlands. The study attempted to improve the college management by refining the communication between the college's internal departments. By using a quality roll out policy, all of the internal academic and administrative departments carried out the quality policy according to their turns after organising the policy themselves. The results showed that the process thinking of the people involved have been stimulated; therefore there is more awareness of the prospects to solve problems and improve communications between them.

Spanbauer (1995) suggested that if one wanted to implement the elements of TQM in the education service, the most important element that needs to be emphasised is customer service. This element, based on his opinion, cuts across other elements and service sectors and is the main objective of the TQM. In this paper, he tried to find ways to rejuvenate higher education service by implementing the seven concepts of TQM, namely leadership; education and training; customer service; organisational climate; meaningful data; scientific methods and tools; and team problem solving. He suggested that customer

service is the main priority for higher education service organisation and is crucial in ensuring waste reduction. Meeting the customer needs and expectation is a new concept for the higher education service sector because educators then were stereotyped as educators who only know what is best for their students.

Logothetis (1995) also recommended TQM in providing education service. The elements of the TQM that he considers as important indicators is that which clearly clarifies the customer's need (students, parents and society). According to him, it is important to help the education service provider in determining and monitoring the educational design and course quality. He also recommended education service providers to use various tools for quality control and continuous improvement.

Emiliani (2005) mentioned as a conclusion of his study that to improve the education service, whether in the learning or teaching process or the administrative process, there is a need to implement kaizen. For that matter, the education service institution needs to design carefully the process of the course offered and improve the thinking regarding teaching and learning methods by the instructors.

Dahlgaard and Ostergaard (2000) illustrated a relationship among the 5 principles of Lean production (specify the value, identify value, value flow, pull value and perfection pursue) and, among eight types of waste in the higher education context, for the first time in a model for the higher education organisation. Among the wastes are uncoordinated teaching, graduate students inability, failed courses, valueless courses, bad planning in teaching, bad planning in general, mismatched downstream and upstream activities and

bad courses design. They also suggested that there are many additional types of waste in the scope of higher education institution. This is because of the variation of the sophistication of the system and each higher education institutions have different types of customers. By referring to the interest of the higher education main clients, they analysed each principle in detail. The main clients of the higher education according to them are students, employers and society, but the most important client is the students. Higher education institutions exist because of students and for students. They mentioned that the main problem in higher education institution is there is too much waste. Hence, the Lean principle needs to be applied. However, the application of Lean principle is more complicated in the higher education institution than in organisations that produce goods. One of the reasons is there exists conflicting goals between the clients and the institution. They concluded that if the Lean principle was to be implemented in a higher education institution, the institution must first clearly state the value concept that they are trying to achieve.

Comm and Mathaisel (2005) investigated the development and application of Lean principle in 18 public and private universities in the US by using questionnaires. This is to determine the usage of Lean principle in the higher education service by conducting a quantitative study. They found that for any type of higher education institution, whether it is a university or college, is feasible to implement the practices of the Lean principle in providing for higher education service. Nevertheless, their study is more focused on the operations of the administration than academic process such as teaching, learning and research activities. They also found that the Lean principle implementation in the higher

education service has led to a significant amount of waste reduction and has improved the quality of services in administrative operations.

Isaksson, Kuttainen, and Garvare (2013) investigated opportunities available in the education service and research publication at Gotland University, Sweden to adopt the Lean principle by using Best Available Technology (BAT) and Best Available Practice (BAP). By using value flow analysis, they found that the distance learning process can be improved by shortening the delivery time by as much as 10%. Delivery time is defined as the time when the knowledge is needed to the time when the knowledge can be used. The in campus learning process, however, is difficult to be improved although there is a possibility that it can be improved. This is because of the structure of the programmes that represents obstacles to shorten the delivery time. Nevertheless, it still can be done if the whole structure of the programmes is changed to the apprenticeship system. By using BAT, they also found that the ability to produce a journal article in the university can be improved by shortening the publishing time by 10%.

Thirkell and Ashman (2014) conducted 34 interviews in two of UK universities, which they called as Old University and New University, to examine the role of the human resource task in smoothing the implementation of Lean principles. Those two universities have already implemented Lean principles in few of their activities. Based on that, they found that there are hitches in communicating, understanding and transferring Lean principles and applications in the higher education scope, in spite of the significance of the human resource role as the Lean thinking promoter. This is because the human resource staffs are not involved in the implementation of Lean principle for the overall

university system. As a result, the implementation of the Lean principle in the university has become very limited.

2.2.5 Lean in the Financial Service Sector

The most noteworthy article regarding the implementation of Lean principle in the financial service sector that came about while reviewing the relevant literature is by Swank (2003). The article is about the application of Lean principle in a financial service company called Jefferson Pilot Finance, where the author herself served as the Vice-President. The main problem that led to the implementation of the Lean principle is because of the internal processes in the company, such as application; collection; and request in the insurance business, being inefficient. This has led to a decreasing number of customers and in the flow funds. Upon overcoming this problem, the company decided to implement the Lean principle, inspired by the automobile manufacturing sector. They believe that their company is involved in the processing of tangible products like the automobile manufacturing company. Hence, they apply the Lean principle by improving the workflow process, specifically by improving seven dimensions of practices, namely placing linked processes near one another; standardising procedures; eliminating loopbacks; setting a common tempo; balancing loads; segregating complexity; and posting performance results. To measure the performance that will be achieved by the improvements, they set their targets. As a result, the average time of processing the issuance of insurance has been decreased by half; labour costs has reduced; reissue rate declined by 40%; and 60% increase in the new annualised premiums of individual insurance in two years' time.

Batiz-Lazo and Wood (1999) examined the degree to which modifications in the environment has led banks to evolve from traditional banking system to customer service delivery efficiency system. In other words, the study has attempted to identify the competitive and sustainable advantage creation in the banking system that responds to the market, especially the internal and external process of adjustment. By using a survey from a questionnaire-based interview, they found that most of the banks do counter changes in opportunities of growth by diversifying themselves, but the moves do not have a direct link to the core capabilities. This survey involves chief executives, planning heads and board member of banks. They found that information technology does have a significant role in helping the management to design the bank strategy as its role is secondary. However, information technology is accepted by the banks as a significant force to change the competition in the bank markets. This is because information technology is essential for prompt and fast service delivery to customers.

Cocheo (1995) wrote about changes in bank examination in the US. This is because the Office of the Comptroller of the Currency (OCC) has moved from procedure thinking to performance thinking. However, this type of examination is only accounted for noncomplex banks, which consists of 1700 banks that fall into that category. In general, non-complex banks mostly get involved in noncomplex transactions as compared to other banks. The examination emphasises on performance in documentation and policies in the bank, rather than formal policies. The changes have also decreased the weight of burden from many banks. These changes can be understood as reducing waste, especially in time management.

Streeter (1990) wrote about changes that have affected the American Banking Association (ABA). ABA has adopted Lean principle by forcing their staffs to perform better with fewer resources, to avoid more expenses. This was put in an application because of the needs of the ABA to cope with the demands from their members, which are bank companies, and to mirror the banking industry itself. According to Executive Vice President of ABA, the banking industry has faced many changes because of the intensified competition in the industry. The industry also has adopted technology application heavily because of their objective to satisfy the customers, the staffs daily work demand and the globalisation of the finance service sector. Because of that, the ABA has to be "Lean and mean", according to their Executive Vice President.

2.2.6 Lean in the Airline Service Sector

Reinhardt (2007) wrote about a case of Delta Airlines that applied the Lean principle of kaizen to revamp the system of baggage handling process at an airport in Atlanta, USA. The airport was chosen as it is a major transfer point for many flights in the USA. The problem they wanted to overcome by implementing the Lean principle is the increasing number of mishandled baggages. By applying the Lean principle, they hope to achieve the target of 75% decrease in baggage jams, 25% decrease in mishandled bags, 15% decrease in fuel costs, 7% reduction in transfer/terminating drivers, increase in customer satisfaction and others. According to evidences, after the new system was implemented, the baggage handling process at the airport has improved a great deal.

Hutchins (2006) wrote about a success story of United Airlines, on how they have escaped the bankruptcy status by not only restructuring the company, but also by implementing the Lean principle in their maintenance division. According to Jeff Green, a spokesperson of United Airlines, the Lean principle that stresses on efficiency, is adopted from Toyota. This principle has promoted work efficiency in all of their works. For example, all of the parts and tools that are needed for repair and maintenance work are located in a single location. With Lean principle, not only does United Services, the maintenance division of United Airlines, have achieved the United Airlines work targets, they also managed to accomplish other repairs and maintenance jobs from other airline companies, which are foreign and domestic airline companies.

Newton (2007) wrote about the implementation of Lean principle in Japan Airlines (JAL). The JAL subsidiary, JAL Ground Services (JGS) has improved their systems and processes such as ramp services, cargo and baggage handling, cabin cleaning, and other ground handling services at many airports in Japan, simply by implementing the Lean principle. To do so, they have brought in experts in Lean management from Toyota to review and advise them to increase their efficiency. By implementing Lean principle such as kaizen, they have simultaneously increased their productivity and reduced their costs. The reason they decided to implement Lean principle, according to their director of administration and planning, operations and customer services, is because they felt that the ground handling process in the airline industry has many similarities with the automobile manufacturing industry.

Greenwood, Bradford, and Green (2002) wrote about how Cessna, an aircraft company which focused on a single engine aircraft and business jets implement the Lean principle. The company needed to improve themselves then because of the growing pace of the industry. The company also needed to satisfy their customers whom demanded shorter lead times and more customised products. In a step by step approach, the company started themselves with hiring a consulting firm to create awareness of Lean among their staff. Then it continues with adopting standard work and implementing the pull systems. Consequently, they managed to reduce the lead times by 15% and produced three aircrafts in a year, instead of two aircrafts the year before.

2.2.7 Lean in the Hospitality Service Sector

Heskett (1987) wrote about the response of hotel industry in satisfying their customers. One of the ways is by giving the employee of the month award, which is evaluated based on customer satisfaction. As this could add value to the current services provided by the hotel, this is also parallel to implementing continuous improvement, or kaizen. Heskett (1987) also suggested that the hotel organisations should consider the quality of the services provided rather than the quantity of the hotels it has. The hotel organisations should focus on design, location and effective operation processes to achieve quality in service and perform better in the financial area. This is where the Lean principle comes in handy, which is, reducing waste and adding value to the current services. These need to be implemented, especially in operation processes.

Berger, Ferguson, and Woods (1989) investigated eight hospitality organisations, in search of features for their corporate values, that which could nurture adaptability and contribute to their growth. The most important thing that those firms share in common is that they desired all of their staffs to be Lean. One of the firms, for example, optimised the use of their resources, which defined by them as what they can obtain locally, such as architects, engineers, public relations and so on. That is done to avoid what they called as "out-of-towner" mistake. This is one of the definitions of reducing waste in Lean principle to them. Other firms also implement Lean principle by adding value to their services, such as owning their construction company to respond to customers' needs, hiring a person who can suitably interact with the customers as doorman and bellman, and apply focus group, reward system and brainstorming sessions in their firms.

Food service and preparation process also have their success story regarding the implementation of Lean principle. According to Engelund, Breum, and Friis (2009), in their research on food service at the Glostrup Hospital in Denmark, the implementation of 5s (sort, systematic arrangement, shine, standardise and sustain) and value stream mapping have resulted in a reduction of 5% in waste. The implementation of 5s has also resulted in the arrangement of ingredients of the food that will be served in the hospital to be in a pattern in which the most used ingredients are the most reachable compared to other ingredients. Apart from that, the value stream mapping has overcome the problem of meals that were not eaten and had decreased the demand for many staff in the kitchen.

March and Fugazi (2002) examined the usage of Lean principle in analysing the hotel airport shuttle service. Although the primary aim of the service is to pick the customers

from and to the airport and the hotel, this seems to be not adequate enough from the perspective of the customers. Instead, they demand that the service should also cover their trip to other places, such as shopping centres and business places. After the analysis was done, it was found that there are problems in the number of staff involved in the shuttle service and communications among them. The shuttle service was revamped based on priority, in which the airport and hotel trip were prioritised than other trips, and the other trips were streamlined by request process in a centralised area.

Beiser (2010) wrote about the effective implementation of Lean principle in housekeeping and operations in a hotel. The adoption of 5s and kaizen have eliminated waste and increase efficiency, thanks to the help of value stream mapping. The value stream mapping process helps to identify each step in the process of Leaning a hotel room, and this has made the kaizen and 5s methods feasible.

2.2.8 Major Problems and Challenges of Lean Application in the Service Sector

Based on the discussion of lean applications in various types of service sector, several problems and challenges of lean application in the services sector have been identified. The first problem or challenge is to define the value that will satisfy the customer. According to Allway and Cobertt (2002), the major problem of lean application is to identify the highest value that an organisation can provide to the customer in meeting their needs and expectations. Additionally, Aherne (2007) suggested that the organisation must first clearly state the value concept that they are try to achieve.

Besides that, the major challenge of lean application in the service sector is one that involves intangible products, that is, products that cannot be seen or touch (Piercy and Rich 2009). This has caused difficulties during the process of identifying waste because the process is also not visible.

Other than that, the greatest challenge in adopting the Lean principle is to influence and convince all people in an organisation to contribute and change. Thirkell and Ashman (2014) found that there are difficulties in communicating, understanding and transferring Lean principles and applications in the higher education context. This is because the human resource people are not involved in the implementation of Lean principle for the overall university system. As a result, the Lean principle is not able to be implemented successfully and covering all organisations.

Moreover, there are also very limited sources such as books and journals that can provide reference to implement lean in the service sector compared to the manufacturing sector (Balzer 2010). Nonetheless, the service sector still needs to use the success stories of lean implementation in the manufacturing sector as reference to implement lean.

2.3 Lean Methods

Before we employ the Lean methods to the course planning and delivery work process, an extensive literature review needs to be done to provide the general information and usage of several Lean methods examined in previous studies.

2.3.1 Value Stream Mapping

Value stream mapping (VSM) is the first and most critical a tool for implementing Lean philosophy in an organization. It is able to capture the flow of documents and data stream, concentrates on a group of items at once, and distinguishes the instruments, processes and systems that can enhance the stream while reducing the waste. VSM will illustrate the aggregate framework as opposed to the single procedure level, connects the material and data streams, delivers an understandable discussion to all members, and provides a diagram that entwines improvement ideas and systems. The reason for using value stream mapping is to help the administration group in envisioning and imparting not just how they are doing right now, but also on planning to improve the system for future by eliminating waste.

Forno et al. (2014) proposed procedures for building and applying VSM as can be seen in Figure 2.3. The reason why VSM is needed is because of the problems that arise in an organisation. The cause of the problems can be divided into three classifications, specifically products, processes, and peoples (employees). The product class consider the problems identified from the product's outline, which is quality from many aspects. That is a high number of segments and parts, numerous sorts of materials that go into making it, numerous connections and subassemblies that can cause problems. Besides that, there is also the problem of absence of soundness and institutionalisation. That is, issues with work process and system definition, and documentation. Usually, the way the work process is sorted out in an organisation leads to correspondence issues, or absence of

simultaneous responses, or uncoordinated staffing problems. This is when Lean approach such as VSM is needed, as its structure is comprehensive; hence solid.

If the VSM is not designed perfectly, this will bring problems or issues as it is connected with product development and work process. Unequal procedures are another reason for issues in the process class. This happens because every work process stage has diverse creation rates and process durations, with some mechanised or some are simply manual procedures. These distinctive variants of the work process will influence the rate in giving information between divisions. Even by using information and communication technology, work process can likely experience the ill effects of the absence of institutionalisation brought on by the adjustment in the work process, which is created by certain divisions not integrating with the other departments. Moreover, the absence of inter-departmental continuous work process will result in seven types of creation waste (overproduction, stock, holding up, transportation, treatment, deficient items, and pointless procedures) that will hinder procedure clarity, strength, and measurement. Another issue is because of lack of instruments in the work process. For example, the product design is good and the workforce know how to deliver it is good; yet the required devices are not accessible or are not suitable for every production stages.

The third class of possible reason VSM is needed is about employees. It is either they are not capable enough to manage the production process or they are caught in a non-attendance situation.

Figure 2.3: VSM Guidelines (Forno et al. 2014).

Arbulu et al. (2003) presented a three objective research paper. The first objective of the paper is to describe the old-fashioned methods that are still being applied till today of the type facility element. The second objective of the paper is to evaluate the purpose, with regards to stages of innovation system performance. The third objective is to present the method of value stream mapping (VSM) in demonstrating and examining supply chains. They introduced the existing supply chain arrangement that is usually used in the USA power plant developments and its analysis to accomplish their objectives. After the value stream mapping of the existing supply chain arrangement is presented, they then introduced the value stream analysis (VSA) to analyse the supply chain management in the work process of the power plan. They found that there were chances that the supply

chain management in the work process to be improved in future and their findings are not limited only to the organisations of interest as in their research paper.

Bevilacqua, Ciarapica and Giacchetta (2008) defined the utilisation of value stream mapping which is to dissect and upgrade the existing method in terms of dealing with the materials acquisition in phases of a task. A structure taken into account is the integrated definition (IDEF) strategy, which has these qualities: the stream examination approach, action based costing, and discrete occasion re-enactment exhibited. The value stream mapping examination is utilised to investigate, analyse and oversee process changes when utilising an IDEF model. A dynamic reproduction of the model is also utilised to assess the effect of the progressions considered, bolster the investigation of the procedure and demonstrate the execution of the proposed process. The general strategy is shown by applying the VSM to an organisation whose main business is the configuration and development of seaward oil rigs. The organisation has practical experience in building, acquisition, and its development forward looking in that it has a yearly arrangement of around six ventures. Some of these activities have regular elements as far as outline and parts, and most importantly, they are all additionally described by a short "time to the conveyance." This study attempted to survey the conceivable impacts, that is, the utilisation of new materials administration strategies have on decreasing both task fulfilment time and the assets required.

Brunt (2000) reported on the advancement of value stream mapping and supply chain.in organizations. The goal is to gauge the quality level of three organisations - steel maker, steel facility administer and first level part supplier. The methodology is expected to offer

experts some assistance regarding understanding the quality stream using a visual apparatus so that open doors for development can be distinguished. Also, present and future state maps have been highlighted in the research to delineate the advantages of an incline framework pictorially, and technique for building an activity arrangement is also mentioned. In summary, an examination of a portion of the value stream demonstrates that whilst numerous organisations purport to be "getting Lean", in reality most of the organisations have just touched the most superficial layer. This demonstrates the genuine force of the Toyota framework and points that in most organisations, although getting Lean is supposedly about getting more waste evacuated; instead this innovation has created new waste simply because the Lean approach was not applied correctly.

Dhandapani, Potter, and Naim (2004) explained that there is a prospective for the usage of value stream mapping inside India’s organisations to convey process change and money saving advantages. For example, in examining the steel organisations of India, it was found that by employing value stream mapping, yearly cost funds of 8% turnover may be accomplished, alongside the arrival of capital comparable to 3.5% of turnover through the evacuation of stock, and a decrease of lead time to half. However, the study did not consider a thorough rundown of expenses and be recorded in a manual to justify the advantages achievable from the Lean method. Specifically those which are supposed to be done were not done. For example, values have not been ascribed to the lower levels of wear and tear, decreased workforce costs and preparation costs are required to actualise the framework of Lean implementation. Despite these deficiencies, the proposals made in the study have been advanced to the contextual investigation of the organisation and it is up to them to consider the application. By embracing the progressions proposed in the

study, an in-plant Lean framework can obviously be effectively executed. It ought to be noticed that none of the upgrades suggested in the study require a real interest in either new apparatus or innovation. Instead, the organisation will benefit from lower expenses and enhanced income; hence permitting the organisation to take a solid, aggressive position inside of its business sector.

Domingo et al. (2007) investigated the flow of inside materials in fabricating the Lean approach. The approach was applied to the production system of Bosch manufacturing plant, Spain. The goal of their research is to build up a handling framework even in the little space, to design the problem resolution for amassed loads of parts. A change is proposed in receiving the milk run handling framework applying the advances in the method for Lean measurements. VSM was used to recognise the data for analysis, for example, the Lean rate and timing of the parts in each station in the assembly line. Taking into account the results from their study, VSM is shown to have upgraded the Lean metrics, reduces parts, work process and time. Hence, their results support the suggestion by Womack and Jones (1996) and Sullivan, Mcdonald, and Aken (2002) that VSM is most suitable in recognising and removing waste while at the same time enhance the workflow in a production system.

Lasa, Ochoa Laburu, and Castro Vila (2008) proposed that VSM is a method designed using the Lean philosophy development for overhauling the existing framework in a production system. From the time when it was hypothetically designed, the usage of VSM has been put into test by many types of research. Most of the results from those researches report successes in many areas of production. The study by Lasa, Ochoa Laburu, and

Castro Vila (2008) however have not only attempted to try to apply VSM but also to debate the qualities achieved, shortcomings and key perspectives to be considered while executing the usage of VSM, especially by the claimant. This is essential and realistic as the most astounding VSM execution is most preferably in all of the cases. Their exploration demonstrates that the VSM is a profitable method for upgrading the production frameworks as anticipated in Lean philosophy. However, there are key areas that need to be considered by the claimant before it can be put into practice. They are timing, preparation, suitable data framework, and administration, especially during the application stages.

Melvin (2008) commented a research on the application of VSM in the sustenance and drink industry, specifically yoghurt based drink. The purpose of the study was to differentiate the cause of waste and how to lessen or eradicate waste from the workflow (value stream). By keeping in mind the goal of the research and usage of VSM apparatus, it is important to characterise firstly the estimation of every procedure and how it is identified with other items. Besides, it is important to recognise the assets and exercises required to fabricate/create and convey the product. This likewise moves incorporates an ID of the key suppliers. Finally, the non-value adding exercises are identified and recommendations to diminish waste are provided. Recommendations to diminish and/or wipe out waste include new innovations in cooling quickly palletised items, upkeep practices to decrease machine blunders and re-advancement of the handling lines to stay away from superfluous development of merchandise. It was reasoned that with a specific end goal to achieve the objective of 20% decrease in CO2 emanations by 2010 there should be a mind shift to like vitality productivity and an interest in new innovations.

2.3.2 Root Cause Analysis or 5 Why's

According to Flott (2011), the root cause analysis is an investigation that looks for the genuine reason for an issue in order to resolve it. It does not play the passive role of only managing the indications of an issue. The root cause analysis and examination methodology explore the disappointment that stems from utilising the actual but deserted it after one third away or deserted it from the beginning of an occasion. By assessing the remaining exhibits or proofs after the issue has happened, and getting data from individuals that are connected with the issue's occurrence, experts can recognise both the contributing and non-contributing reasons that brought about the undesirable circumstance or issue. The procedure starts by gathering the information, breaking them down, then creating an appropriate remedial activity or producing useful alternatives to overcome the issue. Root cause analysis is a device to clarify what has occurred, how it occurred and why it occurred. By appreciating the actualities of the issue, the procedure permits the investigation of the wellbeing of the issue, and at the same time enable every individual that is connected to the issue a chance to utilise more trustworthy and financially savvy techniques to overcome the issue, with critical impact or long run haul change.

The outcome capacity of the analysis can be expanded to recuperate from the issue and also to ward off debacles that have the privilege of both budgetary and wellbeing results. Notwithstanding in checking the issue, it becomes vital to identify the components that clarify the how and why the issue happened. Recognising the underlying drivers of the

issue’s occurrence makes it conceivable to clarify the how and why the issue happened in the first place.

To uncover the underlying drivers (or root cause) of an issue, there is one question that is worth to be asked: "What could we gain from this circumstance?" Experts like Deming (1986) recommend that the issue or undesirable circumstance in manufacturing or production process is 95% that may be identified to be caused by procedure issues and just 5% may be related with workforce (employee) issues. In most associations, investing much more energy searching for "somebody" to accuse as opposed to "what" is at fault is very common. This is like much time spent discovering other issues, rather than solving the main issue.

When the root cause is recognised, then it must be fully resolved, after cost benefits analysis has been done. This analysis is done to determine whether it costs more to evacuate the root cause, or just essentially keep on treating the manifestations. This is usually not a simple investigation because it might be moderately simple to gauge the expense to evacuate the root cause. However, it is regularly hard to survey the expense of treating the issue’s side effect than to gauge the expense of treating the manifestation. This is due to the disappointment of certain segments, or procedures leading to the segment or procedure turn out to be entirely or halfway unusable. The root cause analysis is a designing way to deal with deciding how and why hardware or software, procedure, or a segment has fizzled. Hence, the root cause's objective is to comprehend the main driver of the inability, to avert comparable disappointments later on. When checking the disappointment occasion, it is imperative to decide on the components that will clarify

how and why the disappointment occasion happened. Distinguishing the underlying driver of the disappointment occasion permits us to clarify the how and why of an issue or disappointment.

Grace, Kearns, and Trapani (1997) suggested that root cause analysis should start with data collection. The main purpose of the data collection is to try to equate the outcomes or real achievements with the targets or objectives that have been set earlier by an organisation or company. If the outcomes do not equate with the targets, then the root cause analysis should be done to determine the problems that might have arisen in the work process. One of the root cause analysis methods they suggest is 5 why's. From the 5 why's method, the questions of why does the problem exist, when the problem exist and how frequent does it exist will be investigated. The definition of problem is not only limited to the unanticipated loss, but also includes other circumstances such as improving the existing work flow like eliminating waste, just as in Lean philosophy.

Root cause analysis (RCA) is a tool that has been widely utilised not only in manufacturing but also in the service sector such as healthcare (Dolansky et al. 2013). It is a tool to comprehend the components as without this mechanism, prescription mistakes may likely happen. Nursing schools has reacted to truly understudy these mistakes, though. Nonetheless, numerous actions taken still failed to understudy both individual and framework components that contribute to the mistakes. The motivation behind the research by Dolansky et al. (2013) is to introduce a contextual investigation that highlights the weaknesses of the undergraduate student of nursing course in prescription processing, while at the same time implementing the method of RCA to discuss the causes

and solutions of the weaknesses. The RCA in the study incorporated a basic assessment of the mistakes occurrence and a survey of the literature. The components of the mistakes recognised were ecological, individual, unit correspondence and culture, and instruction. The procedure of utilising the RCA gave a chance to recognise system revamp to avoid future blunders. The utilisation of the RCA advances a reasonable and simple culture in nursing instruction, while at the same time helps nursing understudies and workforce distinguish issues and arrangements, both in the execution and the frameworks in which they are working.

Nitecki and Abels (2013) used the 5 why's method to make more noticeable that library service value can be recognised by the stakeholders; hence making the library being perceived as valuable to the stakeholders. The "five whys" is associating quality of the library comparable to the worth the library gives to its stakeholders. It is regularly troublesome for stakeholders to express their thoughts as to why the library is or is not of quality and research undertaken does offer them some assistance in doing so. Notwithstanding evoking is the apparent estimation of the library to the personnel; the study likewise assembled the workforce view of reasons for library value that will impact on students and staffs. The research additionally presented the "library value wheel" which comprehensively characterises the reasons for valued consequences by the library's stakeholders. Since value and quality is a political apparatus, including the workforce and concentrating on their observations will be critical for upholding library support.

The test of deftness for embracing new business standards makes the requirement for measuring business execution comes under evolving conditions, according to Buyukozkan et al. (2015). In their research, they exhibit the monetary related and non-monetary outcomes as a result of executing diverse mixes of Lean procedures on the business decision. Bayesian Belief Network is utilised as a part for examining the impacts of variables under evolving conditions. Bayesian networks are coordinated non-cyclic diagrams, where nodes or hubs characterise arbitrary variables of concern and edges characterise descriptive or causal conditions among the variables. There are seven Lean components and four accomplishments concentrated on to examine the effect on three execution markers. Bayesian Belief Network is built on the Lean perspectives that could boost adaptability, dependability, quality and time of operations, which will positively affect the budgetary, non-monetary related and manageability performance of suppliers. The research considers automotive industry as their main interest in the experiment. The Lean techniques that were used in the experiment are setup time reduction, pull production or Kanban, small lot size, inventory level, continuous flow, value stream mapping, process flow improvement, preventive maintenance, 5 S, order in the plant, root cause analysis or 5 Why's, employee involvement, kaizen, error proof and waste elimination. They concluded that the Lean techniques, which includes 5 Why's, have significant effect on the enhancement of viability and achievement of the non-monetary components. However, the effects of the monetary components are comparatively lesser.

Duque and Cadavid (2007) defined root cause analysis (RCA) as the usage of uncomplicated Lean tools or techniques such as 5 Why's or diagrams that would identify the problem in the work process and discover the answers to the problem itself, not to

indicators or symptoms. The root cause analysis is also crucial when there are many independent parts, or station, or departments or teams involved in a work process or system as it would tackle the problem from its root, as the name of the analysis suggests. The benefits of the root cause analysis are to reduce scrap or waste and to reduce rework of employees or personnel involved in a work flow activity.

2.3.3 Standardised Work

Standardised work is about writing down all the standard work processes and teaching every worker about the thorough standard work (Rutledge, Xu, and Simpson 2010). Standard work is defined as laying down every phase of the work to be accomplished in one single using only one single approach.

According to Morrey, Pasquire, and Dainty (2013), standardised work archives the present and best process related to a specific work or action. The outcome from standardised work method is that work process can be completed reliably, guaranteeing that the coveted aftereffects of value, cost, conveyance, wellbeing and security that will be accomplished unfailingly. Also, by doing the standardised work, this will distinguish and dispose the wastes in the work system and process by the individuals who are completing the work. The procedure created to present the standardised work has two primary goals: i) Yield the correct apparatuses and ii) Instigate worker inclusion and authorisation. Regarding the first goal, the "correct" apparatus is characterised as a method of operation that would guarantee the right output to be accomplished every time. This would be explicit to every individual instrument. If the method is already Lean, then

the work process will obviously be completed competently. The primary objective of developing a standardised work is that the reliable and best system would prompt enhancements in work values. Also, in developing the standardised work, the process should emphasise the involvement of individuals with suitable knowledge, skill or experience to distinguish the benefits and functionality of the present systems and form it into a standardised work. The standardisation work process is therefore a method that is more focused on the work process rather than the end product.

The use of standardised work has enabled the work assessment standard to be carried out in a workplace. Jackson, Harkess, and Ellis (2004) reported that work assessment reports show that the utilisation of standardised work assessments has enhanced the general quality and generated a reasonable amount of data required for making precise and objective suggestions with respect to an employee's work capacity. The procedure of the Valpar Component Work Samples (VCWS) and the occupational analysis valuation process delivered an all-inclusive approach have demonstrated valuable in helping to determine an employee's work ability. The VCWS itself is developed from the standardised work. Hence, this suggests the superiority of standardised work in a workplace.

Jaffar, Halim, and Yusoff (2012) applied the standardised work (SW) to a car manufacturing plant in Malaysia. The purposes and benefits of the standardised work are to outline, create, record and envision an arrangement of assembling procedure with the subtle element and appropriate study about it. Standardised work is directed to increase the car manufacturing plant productivity and excellence. Excellence is defined as

excellence of the items to be delivered and excellence of the work that is to be carried out in the car manufacturing plant. With the fundamental target of the research which is to establish a methodical and sorted out rule on how information gathering and examination ought to be led, the point of interest and clarification on devices and techniques utilised for productive execution of standardising work was carried out. There are five noteworthy stages involved in the usage of exploration work in the research;

(i) observation, to comprehend the current study zone conditions,
(ii) information accumulation through observation, alluding to organisation's production framework and work study flow system,
(iii) information examination by utilising standardised work method,
(iv) improvement of organisation’s standard procedure, and
(v) outcomes assessment by utilising Lean philosophy measurements to break down the execution of the standardised gathering process.

The research outcomes demonstrate that, with methodical and legitimate execution, standardised work is able to provide loads of advantages, for example, expand proficiency and quality, and work process strengthening that would result in profitability, excellence and achievement. In addition, it additionally accomplishes 2 of the main elements in Lean philosophy, which are waste eradication and kaizen, or continuous improvement.

Lantz, Hansen, and Antoni (2015) suggested that during the organisation’s standardised work, joint effort in the outlining stage of the standardised work techniques and procedures, such as during the standardisation step, is a key essential for group learning

steps and proactivity, compared to self-ruling in performing work errands. This is based on Decuyper, Dochy, and Van Den Bossche (2010) suggestion that it is important that group learning is a borderless process. In line with that is a suggestion by Gersick and Hackman (1990) that borderless in group learning in an organisation may be particularly useful for groups with extremely busy schedules in institutionalised routine assignment circumstances, as data from outside can give a driving force to change and can build the differences of viewpoints that is valuable. In the context of Lean management, the setting of standardised work, that is, how work process is completed, is not a dubious process, and the standardised work should be functioning to handle the deviations and the unforeseen occurrences that would happen in many stages of the work flow. Along this work flow, sharing in choices about work methodology and objectives and in addition data from all of the employees in the work process is essential for group learning and proactivity in the work flow connection. Self-sufficiency, work unpredictability and cooperation are connected ideas, as all hint to choice scope. Therefore, it becomes necessary for an organisation to take enthusiasm for where in the regulation process the choice making is fruitful for groups that are proactive when work methods are standardised. The outcome bolsters our thought that group participation and choice making in arranging work plan and work systems, and also in setting objectives are critical for proactivity and group learning of an organisation. As a conclusion, Lanz et al. (2015) demonstrated that the confusion between standardised work and creative cooperation can be broken down by group support in the choice of work outline and entomb group coordinated effort. Group support would cultivate group correspondence to illuminate and add to a common comprehension of group objectives and techniques, hence strengthening the group support by means of these group learning forms.

Netland (2013) recognised that Volvo Production System depends on 10 fundamental standards of Lean philosophy, which are standardised work; Kaizen; quality projects; pull framework; stream introduction; concentrate on value stream; worker association; perception; client centred; soundness and power' work environment administration; and timing. Standardisation work is seen as the establishment of constant change that is aimed for improvement.

2.3.4 Respect for People

Respect for people in Lean philosophy is neither about being decent, nor is it about having extraordinary "relationship building abilities." It is actually about testing individuals to perform to their utmost capacity, and not being externally pleasant, as suggested by Graban (2014). Emiliani (2004a) suggested that respect for people also can be applied in the higher education institutions. That is, respect for people can be applied to not only the university's employees, but also to the students as well. Respect to the students, as he defines, is by giving them clear outcomes regarding the lecturer's expectations and also by lecturers fulfilling the student's expectation during their studies in the university. Emiliani (2004a) also suggests that in that sense, students can also be regarded as employees as they also follow and take instructions and orders from the lecturers.

Wilpert (1998) stressed that all employees should be considered during decision making process, as part of respect for them. This participative condition would motivate the employees to do their given job more successful and would open the opportunity in revolutionising the daily work of the employees. That is, it would help the employees to

achieve beyond desires, and concentrate on transformation and innovation through intellectual provocation.

Graban (2014) mentioned about the importance of respect for people in the healthcare service. The respect for people is one of the elements that not only non-existed in the healthcare service sector, but also in the car manufacturing sector. When he was in the car manufacturing sector, he used to hear the workers there complaining that they are not using their brains in the work process, but only their backs and arms. Hence, this situation has led to performance setback. For example in Toyota, the administration of the car manufacturing sector did not respect the workers as they were not connected to any kind of innovation activities.

After progressing to healthcare service, similar grumbling could also be heard, especially from the highly taught experts. They equate themselves with robots as their everyday duty in the healthcare services only involves using the machine that was already highly automated to the point that they no longer felt like researchers. Also, their superiors were not attaching them to any transformation procedure work that might be innovative and exploratory. In one case, a medical attendant was disappointed after being known as a mischief-maker on the grounds that she attempted to call attention to issues that aim to reduce the stream of patients. Just as in the automobile business, as Graban (2014) concluded, one of the most concerning issues keeping down the medicinal services frameworks is an absence of respect for workers, as can be seen from the limited staff participation in continuous improvement, or kaizen. In Kaizen system, one of the elements in Lean philosophy, as Graban (2014) suggested, begins with a problem

statement and opinion of how to settle the problem. Therefore, participative and collaborative effort among all employees from different ranks and departments are needed. This process should be encouraged daily, but the process should be short in terms of time to completion. This process is not only limited to roundtable talk, but can also be expanded to any discussion or forum that is in the electronic mode. Hence, the problem and solution can be stored and can be referred again and again. In this way, the workplace can be improved continuously.

According to Graban and Padgett (2008), Lean production philosophy originated from Toyota Production System. The system has two building blocks, which are based on the work process and respect for people. The first is about systematic and persistent eradication of waste from procedures, so that beyond any doubt individuals, hardware, and materials work in congruity to address client issues. Waste can be characterised as any movement that does not contribute any value(s) to the clients. Waste can influence clients, by increasing turnaround times or mistaken results. Waste damages the services offered by the organisations by swelling the costs without making any equivalent increase in performance.

The second is the rule of respect for people, which is an administration philosophy that empowers employees, who are in inclusion of a domain, of trust and regard. These two building blocks are given similar weightage by Toyota, stressing that, for instance, productivity enhancements driven by the end of waste ought not to prompt cutbacks. Doing as such would damper the inspiration of the employees to move in the direction of enhancing their work environments. Effective Lean endeavours are accepting the

employees as they are, and making their work less demanding and less inclined to mistake. Respect for people implies that the organisation would move them to enhance and at the same time utilise systemic mistake aversion routines, as opposed to advising workers to take care of themselves.

Villa (2010) lists eight types of non-value happenings in an organisation that should be avoided to become Lean. They are imperfections, overproduction, holding up, not using workers' capacities, transportation, stock, movement and additional process. Particularly, not using workers' capacities is a situation where the organisation failed to respect the workers that should have contributed more to the improvement of the organisation. That is, the workers' full capacities, skills, knowledge and abilities are not appreciated as one of the resources that should benefit the organisation. In the end, the organisation would end up in producing waste rather than eliminating waste. This is because they have to rely on other resources that would cost the organisation more to achieve the organisation's particular targets.

Yao et al. (2010) underline the activities that an organisation should exercise with regards to respect for people method in the Lean philosophy. Among the activities are organising and allocating work according to staff ability level, workloads, and culmination time allotment. Besides that, evaluating faculty competency against models, and deciding restorative activity and preparing needs are equally important. A lead week after week staff gatherings to arrange exercises, survey lab operations, reward achievement, commend achievements, and decide issues. Equally important are meeting with staff

independently to impart desires and give criticism, guides for improvement, enhancement would guarantee competency and profitability to staff and organization respectively.

Rutledge, Xu, and Simpson (2010) simply defined respect for people as stimulating the colleague and help them to progress. In the case of superiors, they should witness themselves in the working environment, situation and condition as those who usually visit the employees during their daily routine. Those 2 actions are the activities taken undertaken by Toyota, according to them.

Naftanaila and Mocanu (2014b) suggested that Lean is an exceptionally multifarious philosophy that is built from 3 fundamental notions, which are waste eradication; kaizen (continuous improvement); and respect for people. Respect for people, as they believe, involve activities which collaborate every people in an organisation to improve the organisation continuously and to eradicate the wastes.

2.3.5 5S

Graban and Padgett (2008) mentioned that 5s is a method in Lean management to achieve Lean philosophy in the organisation. This method is aimed to decrease time and process spent for searching supplies or for making unarranged outings for stock checking. Those time and process would affect workers' time and motivation; hence resulting in delays in turnaround time of production.

Thomas et al. (2015) documented that both the higher education institutions and further education institutions in the United Kingdom implement 5s technique alongside value stream mapping and waste identification. In comparing between those two institutions, they found that higher education institutions appeared to be more energetic and eager to drive the application of Lean techniques forward and in a more deliberate and all-encompassing way despite the fact that the application stage is only in early phases compared to further education institutions.

Villa (2010) suggested that 5s is generally accepted as the basis for Lean improvement in a workplace as it emphasises on workplace organisation. That is, the 5s method tells the organisation to sort out and standardise the place of hardware, resources and data as these would improve workflow and make the workers acknowledged when something is missing or occurring not according to plan. This is essential in accomplishing a given assignment. This permits the administration and workers to immediately decide when something is strange or if an issue exists. In a summary, 5s consists of the elements of sort, set in order, shine, standardise and sustain. Sort is about tools and materials organisation. Set in order is about the organisation of extra materials, shine is about workplace cLeaning, standardise is about preserving and monitoring the sort, set in order and shine methods, while sustain is about following the 5s by intra-organisation and inter-organisation corresponding, preparation and self-will.

Rutledge, Xu, and Simpson (2010) however, listed down 5s as sort, simplify, sweep, standardise and sustain. They defined sort, sweep (shine in Villa 2010) and sustain as nearly similar to Villa (2010). However, simplify (set in order in Villa 2010) is about

tagging or labelling of all materials or tools in a workplace. Standardise, in Rutledge, Xu, and Simpson (2010) definition, is about the necessity of documentation of the work procedures as this is essential to guide the employees.

Duque and Cadavid (2007) defined 5s as an arrangement of standards and refinement that enhance the work environment's nature and quality, beginning from cLeaning and arranging, and advancing to self-control of individuals and independent groups in an organisation. Likewise, the intriguing of the presence of 5s, in the light of the fact that it is seen by a few individuals as a somewhat unremarkable cLeaning method. Despite, 5s is actually a general rule to the establishment for the advancement of the working environment, such as self-control, TPM and respect for people. This is in line with the suggestion by Naftanaila and Mocanu (2014a) that 5S is about making a spotless, protected, deliberate and exclusive workplace that uncovers (and eradicates) waste and makes variations from the norm quickly and easily noticeable. The approach is built from the 5 Japanese words that start with the letter "S" which are seiri, seiton, seiro, seiketsu and shitsuke, which when translated into English means to sort, stabilise, shine, standardise and sustain, respectively.

Naftanaila and Mocanu (2014a) even described each of the 5s in detail and even create a phrase for each of the 5s. Their descriptions of 5s can be seen in Table 2.1 below:

Table 2.1: 5s and Their Description (Naftanaila and Mocanu 2014a)

Hashim et al. (2014) redefined 5s as structuring, systematising, sanitising, standardising and self-discipline during one of the author's assignment as the Quality Expert to the Malaysian Government at the Standards and Industrial Research Institute of Malaysia (SIRIM) for the period 1993 to 1994. They found that the 5s were the main factors in enhancing safety measures, cLeanliness, quality, productivity and image of an organisation. In general, the description of the redefined 5s is almost similar to other definition of 5s by other authors, which is to install Lean principles and philosophy in an organisation.

Edwards (2015) believes that 5s is a frequently applied Lean tool at the workplace in organisations. This is because it is able to improve the organisation's competency and

output. Although it was developed in Japan but it can be applied elsewhere, including western countries. There are organisations that apply and authors who suggest applying 6s according to Carneiro et al. (2009) and Galsworth (1997). The difference is by adding safety to the existing 5s, but this is not severely needed as the existing 5s has already included safety features. From an employee's safety point of view, he sees the benefits of 5 s as expanding the safety features at the workplace; enhancing the environment; expanding proprietorship and feeling of pride; less demanding support; enhanced quality through more visualisation of errors; and standardised work; and enhancing work attainment through lessened set-up times, diminished breakdowns and growing output. However, he warns that if an organisation failed to conform and appreciate the 5s, the organisation would suffer an early failure in achieving a Lean status organisation. This happens when the employees or an organisation only see the 5s as only a tool for housekeeping plan and not as a standard daily work process for continuous improvement or kaizen.

Ho (1998) stressed the importance of commitment from all of the organisation members in applying 5s, which includes the administration and the employees of the organisation. In the name of commitment, the organisation should appoint a 5s expert to guide the organisation following the steps of implementing 5s. He underlines the steps that can be taken by an organisation as is illustrated in the following figure.

Figure 2.4: Steps in Implementing 5s (Ho 1998: 62).

Gapp, Fisher, and Kobayashi (2008) supported Ho (1998) suggestion that 5s requires total involvement or participation of all persons in an organisation. This can be traced back to the Japanese organisations where the 5s was developed. Over back there then total involvement is essential in enabling 5s as part of the organisational culture.

Di Pietro, Guglielmetti Mugion, and Francesca Renzi (2013) found that the 5s framework encourages the making of a restrained and Lean workplace, delivers a visual format for fast confirmation of the working environment status and put the administrator in a situation that permits him to administer the workplace, and instantly distinguish any slowdown in the process. By presenting a great work environment and arrangement in the workplace, an organisation is able to decrease process imperfections by half. According

to their research, the utilisation of 5s methods is helpful in the identification between valuable work process and the pointless work process. Apart from that, the 5s method when used with visual stream mapping, have been found to decrease food dissipate by 5% in a hospital's meal production (Engelund, Breum, and Friis 2009). The key factor for the decrease is identified,as when the organisation of the ingredients of the hospital's meal has strongly been influenced by the 5s method. This is in line with the suggestion by Souza (2009) that 5s would result in a structured, more visible and orderly workplace, or can simply be defined as "*a place for everything and everything is in its place, when you need it*".

2.3.6 Just in Time

Just in Time (JIT) is a concept of obtaining parts, information, materials or resources consequently after the previous process or flow just when it is needed at the right time and in the correct amount (or quantity) (Emiliani 2004a).

Im and Lee (1989) described Just in Time (JIT) as a method of Lean management in an organisation that aims to decrease the time in producing output. The examples of the practices are a reduction in set-up time, factory compression, circles of quality, maintaining the preventive measures, Just in Time buying, kanban and many more. Not only that, Im and Lee (1989) stressed that the application of JIT does need extensive changes that should be done continuously in an organisation, especially in a manufacturing organisation. In the beginning, the organisation might suffer in terms of the amount of production because of the adaptation to JIT practices. This is common in

any organisation as the whole production system would need time to readjust to the new practice. Nevertheless, a lot of time, effort and energy is need for the JIT implementation. However, as time goes by, the JIT practices would benefit the organisation in the long run. Not only that, if the organisation tries to adapt JIT practices for a short period of time, the organisation would likely to fail, both in JIT implementation and organisational management.

The main benefit of JIT practices in an organisation has been identified by Im and Lee (1989) as decreasing cost and production time. There are also other concurrent benefits such as problem handling, production improvement, suppleness of manufacturing, faster response to customers and marketing, better communication between departments and lots more. In order to make JIT implementation successful, there are ten critical factors that need to be well managed by an organisation. They are uppermost administration commitment, staff involvement, education, side by side scheduling, restructuring, supplier's contiguity, involvement of suppliers, set up time lessening, new accounting performs and quality.

Waters-Fuller (1995) put forward the claim that JIT can eradicate waste and enhance the production flow. By doing that, JIT can be understood as practices that add value to an organisation, not only after a long run, but also during the transformation process from traditional workflow to the implementation of JIT. JIT would benefit organisations by decreasing the costs associated, enhancing the quality of the products and enabling flexibility to the production process. As a conclusion, it provides a competitive advantage to an organisation. This claim is supported by many researches

Yasin, Wafa, and Small (2001) studied the practices of JIT in the public sector. The country of their interest is the US. The effectiveness of those practices were analysed using empirical methods. Their study indicates that JIT enhances the operational process, quality of services provided and organisational structure. However, before that, the public organisations must be eager and prepared to transform their processes and set-ups. In their study, there are nine variables measured in the successful implementation of JIT. Before JIT can be measured as successful or not, there are eight factors that need to be revised in an organisation in order to implement the JIT. The factors modified and the successful variables, based on their factor loadings to the JIT success order, are shown in Figure 2.5.

Figure 2.5: Implementation of JIT (Yasin, Wafa, and Small 2001: 1199-1200)

According to Salaheldin (2005), JIT has also improved organisations in Egypt in the areas quite similar to the areas mentioned by Yasin, Wafa, and Small (2001). In the case of Salaheldin (2005), his study consisted of organisations that are involved in manufacturing.

Bortolotti, Danese., and Romano (2013) stressed that the JIT can also be applied in the management of activities that are aimed not to produce, for example, the movement of resources; their supply; and storage. JIT is efficient in controlling the movement of production from the organisation to the consumers by synchronising the production of daily routines in the organisation with the demand from the market or consumers. Not only that, the JIT is able to re-structure the activities in the organisations such as the reducing setting up time, decreasing lot sizes, decreasing the waste in the production, optimising the machinery usage and also decreasing the time of the cycle. One of the JIT techniques is the U-shaped production workplace that encourages the continuous production movement. This can decrease the staff and resources movements. People have to remember that JIT is the set of methods or applications or techniques that consist of, for example, JIT supply, pull production, setting up time lessening, lot size reduction, layout for continuous flow, minimising the staff movement and many others. The most important thing to remember is that the JIT purpose is to reduce or eradicate waste in an organisation, in line with the purpose of Lean. This statement is also supported by other researchers such as Salimi, Hadjali, and Sorooshian (2012).

JIT not only can be applied to the manufacturing sector, it has also been applied in teaching and learning. Kopp and Burkle (2010) defined JIT in teaching and learning as the method that employs e-learning or virtual learning, such as a website or computer software to assist the process of teaching and learning. The usage of the e-learning according to Novak (2011) is better to be done before the real lecture or class begins. This is essential so that "warming up" the students is done prior to the real teaching and learning process begins. For example, the students can be supplied with several questions

few days before the lecture from the website. This is to stimulate their interest and hopefully, their passion for getting the answers during the lecture. The lecturers then would discuss the answers with the students during the lecture. The questions are open ended in that they might be open to any interpretation, for the sake of the discussion participation. However, JIT teaching and learning should not be confused with distance learning or a type of computer assisted learning. This is because the usage of the e-learning is only to stimulate the students cognitively and enhance their learning experience during the lecture through discussion that should consist from many angles or views. The difference between JIT teaching and learning from the traditional university teaching and learning process is that students are better equipped during the lecture and the lecturers are also equipped with the level of knowledge of the students before starting any lecture. This can be obtained from the student responses to the prior questions given from the website. The usage of JIT in teaching has already been proved to be fruitful not only by Kopp and Burkle (2010) and Novak (2011) but also by other researchers such as McFadyen and Watson (2013), Liberatore (2013) and Sun, Brandon, and Helena (2014).

2.3.7 Continuous Improvement/Kaizen

Doman (2011) defined kaizen as simply a process of continuous improvement or adjustment or transformation for the better in an organisation. There are three guidelines in the analysis of the kaizen process, which is to improve the organisation continuously; how workers do their work; and, how workers connect to each other and how the work process or production line was built. Workers in an organisation should do their work according to the specifications that have been described extensively by the organisation.

This is to avoid the variability in the quality and delay of the work process. Workers should also connect to each other in terms of what they know and aware of their roles and positions in every work process. That is, their positions should be standardised so that they know their responsibilities in the production line well. This is to avoid overlapping and misidentification in completing work processes as these would result in waste in the organisation. The work process should also be developed according to the flow or process that is as simple as it could, and not too complex to be understood by each of the workers. This is to optimise the time and resources that are used in producing or manufacturing the products. Hence, if there are errors or problems in obeying any of these guidelines, the organisation should conduct a meeting with the staff and workers to resolve the problem. This meeting is called a Kaizen process. This process is adapted from the Toyota approach of A3 Report Format. The A3 Report Format is used by Toyota to organise and control their workers in order to identify errors or mistakes in the work process and finding perfect solutions to problems.

According to Emiliani (2004a), Kaizen or continuous improvement is a daily process that is aimed to enhance the work process in business as reaction to the market situations that experience rapid changing. The kaizen process targets waste minimisation or eradication. In Emiliani (2005), the author stresses that the kaizen process differs from the quality improvement process. This is because kaizen takes into consideration any changes or improvements that would result in any factors or elements in a business, such as innovation; quality; customer's value; easiness; flexibility; time optimisation; cost reduction; decrease in the product prices; conformance; and others, so long as it improves the current business condition. The kaizen approach is free to use any tool or method in

accomplishing the main objective, which is a continuous improvement, as long as it would be recognisable to the customers. Although Kaizen begins in the manufacturing process, it can be and has been proved to be feasible in the business processes as well. Kaizen process is not only limited to a formal meeting between organisation's staffs, but can take the form of staff action during their normal daily tasks. For example, the process of staff's examining their common tasks and judgementally questioning the tasks undertaken, for the sake of improvement is also considered as a kaizen process. This approach is different compared to the normal kaizen process, as has been suggested by other researchers (for example Doman 2011; Pedersen and Huniche, 2011b; Sylvest 2008). The difference is that the kaizen process should take the form of formal meetings between certain amount of members of the meeting, which usually consists of facilitators, experienced workers and highly skilled staffs. The meeting usually consumes days in maximum or hours in minimum. Also, according to Emiliani (2005), the solution for the improvement should be achieved immediately throughout the kaizen process, without any delay. The members of the kaizen process should also be all of the people in the organisation. In the process of kaizen, Emiliani (2005) also suggested a guideline, or a form that can be followed, as in Figure 2.6.

Figure 2.6: A Guideline in Kaizen Process. (Emiliani 2005: 43).

Krishnan and Parveen (2013) reported that it is not only manufacturing companies which apply kaizen process in their workplace but also health service sector, or in particular, the hospitals. Kaizen is being implemented by more and more hospitals, as a method to decrease any useless activities and to more efficiently use their workforce.

In practice, Radnor and Osborne (2013) defined kaizen as a form of gathering or workshop that consists of inter-organisation staffs finding ways to make minor and swift changes. This process includes three stages; preparation, five day meetings and follow-

up activities during the implementation of the new changes, which consume three to four weeks.

Bhuiyan and Baghel (2005) explained that kaizen process consists of three types; management, group and individual. The Management of Kaizen should emphasise on organisation's strategy. Hence, it is the most essential kaizen process and therefore should include all of the people in the organisation. Group kaizen is about creating a team from a certain amount of workers to improve certain elements in the organisation. Individual kaizen is about staffs making recommendations to the management about changes that should be done in work process they are involved in, that is, the daily routine in certain areas of the organisation. Bhuiyan and Baghel (2005) have also showed evidence that there is a positive relationship between kaizen and quality in organisation's management. The explanation behind that is kaizen is regarded as a process which is highly concentrated on the end product through standardisation of the work process. Hence, kaizen can be implemented in any work process or environment. Moreover, according to Bhuiyan and Baghel (2005), Caffyn (1999) has set a clear definition of kaizen, which is "the ability of an organisation to gain strategic advantage by extending involvement in innovation to a significant proportion of its members". This kaizen definition contains ten general kaizen conducts that should complement the definition itself. These conducts should be exhibited in order for kaizen to be successful implemented in any organisation:

- Worker exhibits alertness and appreciation of the organisation's mission and objectives.

- Concentrate and have complete authority of the organisation's strategic aims and objectives in any improvement action.
- Develop and monitor mechanisms to inspire involvement in kaizen.
- Continuously reinforce and support kaizen assessment.
- Commitment to kaizen.
- Involve proactively in kaizen process.
- Efficient operation between internal and external frontiers at all levels.
- Experience learning.
- Execution of experiential learning.
- Kaizen is a shared cultural value in the organisation.

2.4 Waste in Higher Education Institution

As an organisation having daily work process, higher education institution, just like institutions in manufacturing and another service sector, does produce waste, whether consciously or not. This is because of the nature of waste itself, which cannot be easily identified and removed. As Balzer (2010) has pointed out, waste can be categorised into two forms: visible and hidden. The latter type is normally unconsciously exist in any work process; therefore it is usually considered as common by an organisation. Maguad (2007) mentioned that there are seven types of waste that are commonly found in the higher education institution:

i. Inventory waste.
ii. Defect waste.

iii. Overproduction waste.

iv. Motion waste.

v. Waiting waste.

vi. Transportation waste.

vii. Processing waste.

Inventory waste can be found when there are surplus stocks that would increase the cost of storage and also probably lead to a lost if the stocks. Examples are papers, photocopy machines and food. Defect waste can be found when the product or service provided by the higher education institution does not achieve certain standards. For example if certain tasks were not done correctly, inaccurately or incomplete, so they need to be thrown away or done again; hence will increase time and labour costs. Overproduction waste can be found when the product was produced more than needed or required. For example, the overproduction of examination question papers will result in paper wastage and increase in the overall needed examination cost. Motion waste refers to the unneeded movement of people within the work process. Next is waste in motion which occurs when there exists unnecessary activities in the work process that do not provide value to the organization, but which are unnecessary. It often leads to the futile usage of resources. For example, the distance of printer or photocopier that is quite far from a secretary, who uses them repeatedly. Waiting can be a waste when process needs to wait because of delayed work. As an example, when students need to wait to get confirmation letter for internship. This usually happens when there is process involved in the practicum procedures. This causes waiting waste as the students have to wait for their application decision while at the same time the application of practicum places can be accepted or

rejected. If the application were decided to be rejected, then the students have to apply again.

Transportation waste occurs nearly similar to motion waste, which is the unneeded movement of things within the work process. However, transportation waste focused directly on materials or information that needs to be officially transported from one point to another. An example is the transportation of certain machines or staffs or official information from one department to another, by mistake. This process will result in unnecessary time and cost consumption and at the same time may possibly result in certain damages. The last category is processing waste, which is a waste that happened when dealing with something more than is required such as reprinting meeting minutes that was misplaced or the same work performed by two workers due to misunderstanding.

Balzer (2010) however, classify waste into four categories:

i. People waste.
ii. Process waste.
iii. Information waste.
iv. Asset waste.

People waste can happen when the staff or workers are not fully utilised in an organisation. This includes misalignment of organisation's goal or objectives, an inappropriate assignment given to the staff, delay in giving the tasks that should be immediately performed by the staff, unneeded movement of the staffs and non-optimal work processing that would affect the staff's performance. Process waste is a waste that

can be found due to the work process itself that is problematic. Balzer (2010) identified 12 categories of process wastes that include ineffective process control, non-standardisation, unreliable process, poor scheduling, error correcting and others. Information waste can be divided into five types which are information mistranslation, missing information, information loss, irrelevant information and inaccurate information. The last category of waste is asset waste, which occurs when the owned assets are under-utilised. Examples are overproduction and inventory, unnecessary transportation, fixed assets and overburdening the people, equipment and facilities.

2.5 Success Stories of Lean Implementation in Higher Education

Several studies have discussed about the Lean project and its successes at several universities, particularly in the United Kingdom (UK) and United States (US). Although Lean is still new in the higher education sector, its application has shown a positive impact, especially in reducing wastes. All of the implementation projects were done to the non-academic function, especially the administrative area of the universities, except in a study conducted by Emiliani (2004a and 2005).

According to Behm et al. (2010), the University of Michigan in the US has applied Lean techniques in several departments such as the Department of Plant Operation, Department of Health System, Department of Accounts Payable, Department of Human Resources, Department of Finance and Research Administration and Department of Business School. Most of these departments have shown positive improvements after the application of Lean, for example, the reduction of process time, waiting time, and cycle time. The

highest changes were made by Health System, which includes 80% of the reduction in waiting time at the Clinical Research Billing Unit. Besides that, the author also discusses the application of Lean in other universities in the US, including University of Wisconsin, University of Iowa, University of Central Oklahoma, Bowling Green State University, University of Washington, University of Notre Dame, University of Southern California, University of Minnesota, Cornell University, University of Scranton, University of Virginia and Rensselaer Polytechnic Institute. Among the accomplishments achieved in these universities is the reduction of waste in terms of time and cost.

Rensselaer Polytechnic Institute has applied Lean to the one of the academic functions which is the course design and delivery (Emiliani 2004a and 2005). The author has succeeded in proving that the application of Lean has increased the students' satisfaction. This is based on the students' evaluation at the end of the course for five semesters. The respondents of this study are the part-time students of MSc in Management and MBA degrees. Emiliani (2004a) also said that the result achieved is only temporary, but improvements must be continuous because the course content changes every semester, for example, the reading material. This study has provided an opportunity for the higher education sector to apply a variety of other Lean techniques in the future, especially in the academic functions.

Slightly different from Behm et al. (2010), Cristina and Felicia (2013) discussed about the step model of Lean implementation at the University of Central Oklahoma and the University of Minnesota. There was a four-step model involved in the implementation in the University of Central Oklahoma. The first step is identifying the opportunities, the

second step is solution design, the third step is implementation and the last step is continuous improvement. The adoption of Lean has successfully reduced waste, increased students' satisfaction, improved services and also employees' performance.

According to an analysis by Radnor and Bucci (2011) that was undertaken on behalf of The Association of Business Schools (ABS), several universities in the UK have begun introducing Lean in their work processes. Among the universities are Cardiff University, Nottingham Business School, Portsmouth Business School, St. Andrew University and Warwick Business School. They have applied several Lean tools and techniques to their work processes such as value stream mapping, 5 Why's, A3s report, fishbone diagram and flow chart.

Apart from the analysis by Radnor and Bucci (2011), University of St. Andrews has also published the discussion of the Lean application in their university. They have listed the main areas that have applied Lean, with related achievements, as follows:

1. Student status letter

   Students can have the letter when needed without having to wait between five and ten days.

2. Job vacancy advertisement

   There is an annual saving of job vacancy advertisement which is about £150 000.

3. Library re-shelving

   The returns items are available at its location within four hours.

4. Student self-certification of absent

Students can certify their absence through online and this can help to monitor the students' attendance.

2.6 Research Gap

Based on the previous literature in the previous sections, it appears that there is none that has been devoted to the implementation of Lean in the academic process, specifically the course planning and delivery. Hence, this research will try to bridge this gap by offering a new dimension in the application of Lean in the higher education service sector.

Comm and Mathaisel (2005) said that most of the Lean application studies in higher education institutions only applied Lean to the administration area rather than to the academic area. However, there are two studies done by Emiliani have related the Lean implementation to the academic area. Emiliani (2004a) applied Lean principles and practices in course design and delivery that only focused on part-time masters' students. The other study conducted by Emiliani (2005), focused on the application of kaizen to improve graduate business school part-time degree programmes.

However, the techniques used in those two studies are different as compared to this study. This is because the perceived problems in those studies are based on previous literature and the author's experience. The Lean implementations were also done to the course elements, such as reading materials, syllabus development, and etc. This study, however, used an exploratory study to identify the perceived problems in the work process of course planning and delivery. Further, the Lean techniques in this study were applied directly to

the work process of course planning and delivery and their impact analysed not only to the students, but also to the staff of the two universities.

As discussed, there are two types of waste, which are the visible and hidden waste. Value stream mapping (VSM) is one of the Lean tools that can be used to identify the waste in a work process (Lasa, Ochoa Laburu, and Castro Vila 2008). Thus far, the VSM has only been applied to the non-academic work process, but not yet in the academic area, particularly in course planning and delivery. Emiliani (2004a) has suggested the application of VSM in academic work process be able to identify waste, but he did not even apply it in any of his studies. Therefore, this study attempts to employ the VSM technique effectively in the academic work process.

Previous studies only focused on the application of Lean in the higher education sector in the US and the UK. Thus far, there is still no example of the application of Lean in the higher education sector in other countries as Malaysia. Although the Lean application has been found to improve certain work processes in the higher education institutions in the US and the UK, there is no evidence that it will succeed in the other higher education institutions in other countries. Therefore, this study attempts to offer at least a guide in the application of Lean in the higher education institution.

2.7 Summary of Preliminary Literature Review

The Lean principle has been proven enhance or lift up the performance of an organisation, in the sense of financial performance and customer value added. Because of that, this

study will try to implement the Lean principle in a chosen higher education institution and examine the extent of implementation relative to the performance target of the institution, as mentioned in the motivation of this study.

The Lean principle has been implemented in many areas, especially in the service sector, although it has been initially developed in the manufacturing sector. The implementation will continue to spread to other sectors, as can be observed in the trend of the researches done nowadays. Awwal (2014) supported this idea and he concluded that this is because of the intense competition to achieve operational excellence. As manufacturing sector has given birth to the Lean principle, it takes no brainer to mention that this sector has heavily implemented this principle than any other sector(s). However, according to the literature review that has been done, the trend of the Lean research in the service sector has been well extended. The health service sector has devoted heavily on the implementation of Lean principle than any other service sector, while the education service sector is still chasing up at great pace. This is because the quality of education service and the tougher competition in that sector have been the two of the important topics that arise globally during these two decades (Thirkell and Ashman 2014). Nevertheless, we can see that there is a lack of empirical research with robust quantitative findings conducted in Lean researches in relation to the education service sector, especially in the academic work process. It is essential and necessary to clarify the logic behind the theoretical framework that recommends implementing the Lean principle. Hence, this study attempts to bridge the gap.

Most of the past studies have applied the case study method in conducting their researches. It is nothing unusual when it comes to Lean principle implementation, as the implementation is often unique and dissimilar between each organisation, irrespective of the services provided. Hence, the case study method is of relevance now. This study will use the case study method as the organisations involved in this study are higher education institutions and they usually differ from the other higher education institutions in previous studies (Green 2013).

Most of the past studies also include the strategy of focusing on the customers as the main interest of the organisations. Therefore, the significant force in transforming an organisation to become a Lean organisation is the customers. It has also been the reason Lean implementation has been done in other sectors than manufacturing, especially the service sector.

It can also be said that majority of the researches focused on the implementation of Lean principle in a specific service industry rather than focusing on the whole service sector. In implementing the Lean principle, most of the studies agree that the first step in implementing Lean principle is by creating awareness among the staff, followed by identifying all of the related processes where Lean principle can be applied. After that, the question of how Lean principle can be implemented can be raised, before the Lean principle is put into action.

AS prompted by the above, an exploratory study was done to identify the elements in the academic work process, which is the course planning and delivery work process. This

exploratory study is described in Chapter 4. From the exploratory study, by considering the Lean methods available and the feasibility of the universities involved in this research, several Lean methods can be applied in this study, such as stream mapping (VSM); root cause analysis or 5 Whys; standardised work; and continuous improvement or kaizen.

CHAPTER 3

DATA AND RESEARCH METHODOLOGY

3.0 Introduction

The purpose of this chapter is to discuss about the research process and how is the methodology of the analysis until the results are generated. This chapter explains the data collection design, research design, sampling design, and ethical considerations.

3.1 Research Process

According to Sekaran (2003: 422), research is an investigation to find the solution to a problem that fulfills a particular objective. The research process is a clear step by step process in conducting a research study (Cooper and Schindler 2008; Gravetter and Forzano 2003; Gelling 2015), including the methodology and design of the research that will be conducted.

Lacey (2013), has identified eleven steps in the research process that can be used as the researcher's guideline. The first step in conducting research is by assessing the problem of the study and based on that develop the research questions. Analysing the past studies will help in determining the problem gap of the study, the research questions, the

appropriate methodology and research design for the study. Creswell (1994) summarised the purposes of literature review as three main points, which are as follows:

- To provide the results of past studies that are related to this study
- To expand the study, continue the discussion of the topic's literature, and to enhance the previous studies by discovering the area that is still unexplored.
- To provide a theoretical framework for the study, as a benchmark to compare the final results.

After the literature review was done, a proposal of the research should be prepared to get the fund if approved and to get consent to conduct it from the management. The research proposal is a research plan, including the research time frame and methodology that will be used as the research guideline in conducting the research. The next step in the research process is to make preparation to collect the data by getting the approval from related parties to collect the data. Once approved, the sampling procedure will take place to select the sample of the study. A pilot study needs to be conducted to test the research instrument and also to provide an opportunity to amend any problem that has been found through the pilot study. Then, the data will be collected and analysed by using appropriate analysis to answer the research questions. Finally, Lacey (2013) said that the last step of the research process is by disseminating and implementing the results of the study.

Besides Lacey (2013), according to Gravetter and Forzano (2003), there are ten steps to be considered in conducting research in which they are almost similar to the steps underlined by Lacey (2013). It starts with identifying the research idea produced by

exploring and evaluating the literature. Then, the researcher will develop the research hypothesis and choose appropriate variables to measure the specific dimension. The next step is choosing the appropriate research strategy and design before the data can be collected and analysed. The findings of the research will be reported to the top management and also can be used for further study.

Likewise, Cooper and Schindler (2008) have derived a useful guideline to carry out a research project. The purpose of this model is to keep the research process work as planned. Figure 3.1 shows the research process model that has been proposed by Cooper and Schindler (2008). There are seven steps in this process, which are clarifying the research question; preparing the research proposal; determining the research design strategy; data collection and preparation; data analysis and interpretation; writing the research report; and the last is presenting the report to the management for decision making.

According to Lacey (2013), although there are a lot of research process models with a different number of steps, they still provide similar meaning and procedures. He also said that all of the research processes are acceptable and valid to conduct research. Hence, the research process by Cooper and Schindler (2008) has been selected to be used as a guideline to conduct this study. Figure 3.1 shows a summary of the research process flow of this study.

Figure 3.1: The Research Process Model (Cooper and Schindler 2008:55)

For this study, the research questions will be constructed after the management issue or dilemma is identified from problem areas. This is to ensure the right research questions are constructed to avoid worthless steps in the research process. Then, the literature review for this study is done. It has been discussed in depth in Chapter 2. As there appears to be no studies conducted on the academic process in higher education institutions, an exploratory study is applied to identify the management problem and research questions. They will be discussed in the next section of this chapter. Then, the research design is developed. The research design involves data collection design and sampling design. The data collection design includes the data collection method and the preparation process that is carried out. This process is also discussed in the next chapter. When the required data has been obtained, they are analysed and interpreted in a meaningful report, described in the subsequent chapter.

3.2 Exploratory Study

An exploratory study is an exercise in doing research to understand the management problem and to seek more information about the problem areas and eventually the research topic to develop the research questions of the study (Cooper and Schindler 2008). The purpose of the exploratory research that was conducted at the early stage of this study is to understand the situation surrounding the problem or issue and to help in developing the research questions (Cooper and Schindler 2008 and Sekaran 2003). The exploratory study was an initial survey among the students and lecturers. Furthermore, the exploratory study was also conducted to gather some information related to the problem(s) experienced by the students and lecturers in the course planning and delivery work

process. Structured interviews were asked to the students while semi-structured interviews were asked to the lecturers to obtain the information. Other than that, exploration was also done on several lean consultants, quality assurance management and university management in the higher education sector in order to develop the framework of study. The outcomes of the exploratory study are explained in detail in the next chapter.

3.3 Data Collection Design

Data is information such as observation, words, numbers, attitudes and many more. Data can be obtained from two types of sources, namely primary, and secondary. Primary data is first-hand data that can be collected through survey, experiments, observation and others (Sekaran 2003). Secondary data is an available data that has been collected and possibly also analysed by somebody else such as articles from the internet, annual reports and journal articles (Sekaran 2003).

To fulfill the research objectives, primary data were used in this study. The data of this study are:

i. Response from the structured interview with the students using a set of questions on the important activities and problems that they faced in the course planning and delivery.
ii. Response from the semi-structured interview with the lecturers on important activities and problems that they faced in the course planning and delivery.

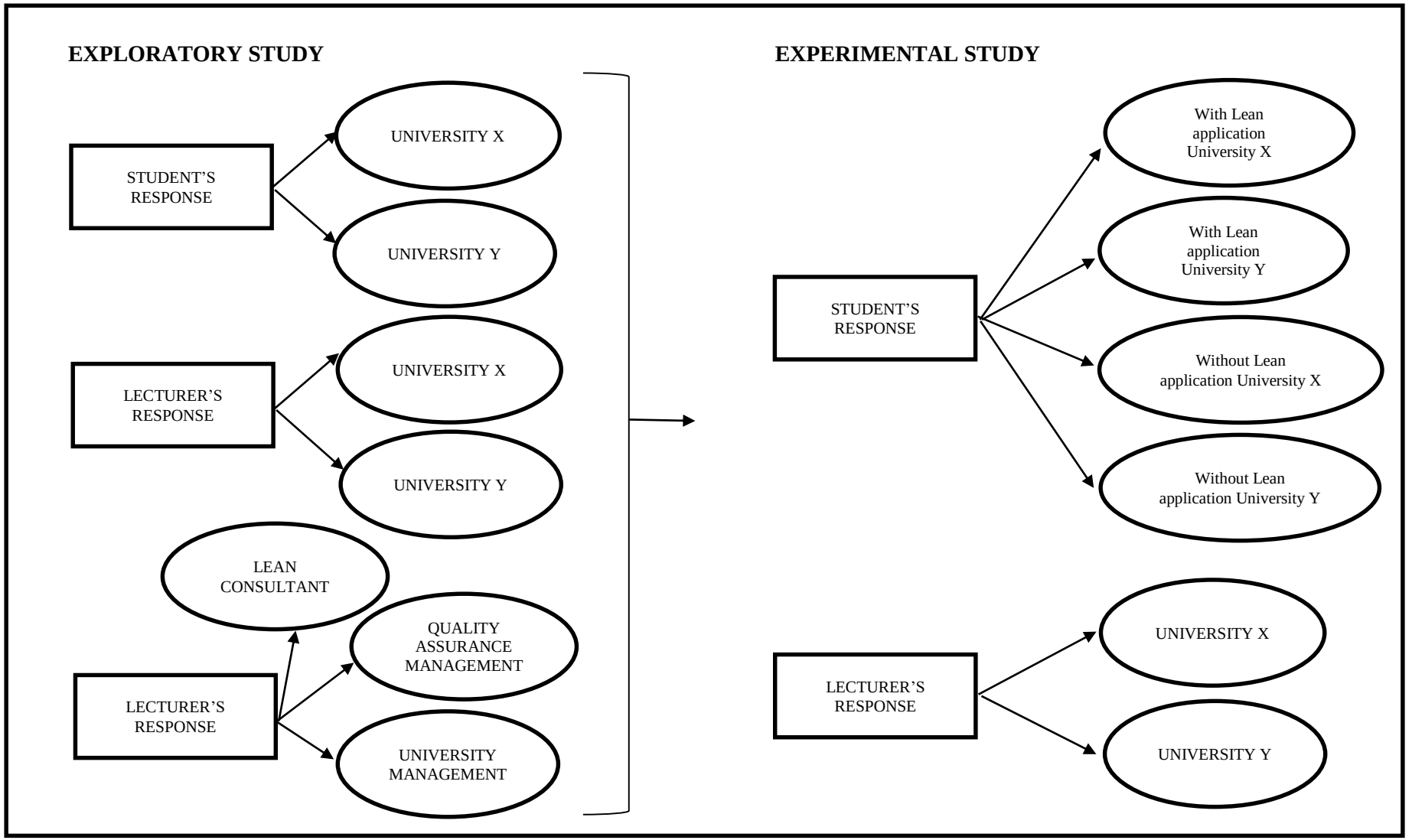
iii. Response from the semi-structured interview with the lean consultants, quality assurance management and university management on important activities and problems that they faced in the course planning and delivery.
iv. Response from the self-administered questionnaire about students' feedback on the taught course at the end of the semester.
v. Lecturers' opinion and comment (response) after the implementation of the Lean methods on the course planning and delivery at the end of the semester.

Figure 3.2 shows the respondents of this study, the type of the data that were obtained from them, the venue the data were gathered and the type of study that used the data. As mentioned earlier, this study involves two universities, University X and University Y. From each university, three undergraduate programmes were chosen. Each of the programmes has a similar pair programme across the universities. That is, the similar pair programme is offered in both of the universities. For illustration, Programme 1, Programme 2 and Programme 3 were chosen in this study. Programme 1 is offered in University X and University Y, Programme 2 is offered in University X and University Y and Programme 3 is offered in University X and University Y. The respondents of this study are the students and the lecturers from the three programmes. The data were gathered from them for the exploratory and experimental purposes of this research study.

As mentioned earlier, the exploratory study was done to collect some information related to important or valued activities to the respondents and the problems that are faced by them in the course planning and delivery work process. The respondents include the students, lecturer, Quality Assurance management and university management.

Moreover, the exploratory study was also conducted to gather some information about Lean application in higher education institutions from the Lean consultants and the appropriate lean tools to implement in the work process. The experimental study was done to apply the Lean methods in the course planning and delivery work process and to examine the effects of Lean application. Hence, for the experimental study, each of the programmes was divided into two groups; with the Lean application and without Lean application. At the end of the course, their feedback was collected to measure their satisfaction level on the taught course. The feedback data have been chosen because the students use this medium to express their satisfaction on the taught course (Lockwood, Ng, and Pinto 2007).

Figure 3.2: The Respondents of this Study and the Data Obtained from Them.



3.3.1 Hypotheses Development

In this study, there are two hypotheses that we would like to test. These hypotheses are developed based on relevant previous researches that have been discussed in the literature review section. As has been discussed in that section, the implementation of Lean methods such as kaizen, have been proven to increase productivity and at the same time reduce the overall costs (Greenwood, Bradford, and Green 2002). These findings are supported by other evidences, such as by Newton (2007). Not only kaizen, the usage of VSM, as a part of Lean methods, is useful in recognising relevant data for analysis in order to upgrade the Lean metrics; reduce useless parts; work process; and work time (Domingo et al. 2007). These findings are about the benefits of VSM that have been suggested and proven previously by Womack and Jones (1996) and Sullivan, Mcdonald, and Aken (2002). They clearly mentioned in their studies that VSM is most suitable in recognising and removing waste while at the same time enhancing the workflow of a system of production. Additionally, Melvin (2008) successfully differentiated the cause of waste and how to lessen or eradicate the waste from the workflow by using the VSM. Hence, our first hypothesis in this study is:

H1: The work processing time in course plan and delivery process will be less after applying VSM and other Lean tools compared to before the application of VSM and other Lean tools.

Not only do Lean tools or methods can improve work process and reduce the costs of an organisation, the relationship between customer's satisfaction and Lean implementation

has also been pointed out, for example by Pejsa and Eng (2011), among others. By taking General Electric Healthcare as an example, they stressed that the implementation of Lean tools have improved the customer's satisfaction rating of the company concerned. There are also other research findings related to the impact of Lean application towards customer satisfaction in the higher education sector. To the best of our knowledge, there is none that claim Lean application can reduce customer's satisfaction level or does not have any impact on customer's satisfaction. Overall, Lean implementation has been found to result in a fairly positive impact on customers' satisfaction (Emiliani 2004a and Cristina and Felicia 2013). Hence, our second hypothesis is:

H2: The satisfaction mean for a group with Lean application is higher than a group without Lean application in their course plan and delivery process.

3.3.2 Measurement Scale

The measurement scale can be categorized into four types in a research, which are nominal, ordinal, interval and ratio. According to Sekaran (2003: 185), nominal scale is a categorical data, while ordinal scale is a categorical data with order but the distances between need not necessarily be equal. The interval scale is a data with the same distance between two values, while the ratio scale is a data that has all the other data characteristics and absolute zero points. Table 3.1 below shows the characteristics of each measurement scale.

Table 3.1: Type of Measurement Scale (Cooper and Schindler: 2008)

There are three types of scale involved in an experimental study's instrument which are nominal, ordinal and interval as follows:

i. Nominal data:

   Lean application (Yes/No), Programme (1, 2 and 3), University (X and Y).

ii. Ordinal data:

   Satisfaction level of each item that measures course planning, course delivery, course assessment, lecturer characteristic and course material (7-likert scales).

iii. Interval data:

   Students' satisfaction (sum of multiple likert scale items).

3.3.3 Data Collection Methods

Choosing the right data collection method is very important to answer the research questions. There are several methods available to collect the data, and each of the methods has its own advantages and disadvantages. Sekaran (2003) discussed the data collection method according to three separate sections which are interviews, questionnaire and others. Table 3.2 below shows some of the advantages and disadvantages of data collection using those methods.

Table 3.2: Types of Data Collection Method (Sekaran 2003).

After making reasonable consideration based on the suitability of the methods, the personally administered questionnaire has been chosen to collect the data for this study. A 7-likert scale of the questionnaire was used to collect the data of students' satisfaction on the taught course at the end of the semester for both groups, which are the treatment group (with Lean application) and the control group (without Lean application). Besides that, face to face interview has also been used to obtain the data from the lecturers. They have been asked about their opinions regarding the application of Lean on course planning and delivery process.

3.3.4 Specifying the Treatment Levels

Cooper and Schindler (2011: 730) defined the treatment levels as "*the arbitrary or natural groupings within the independent variable of an experiment*". They also said that, the treatment level should be based on simplicity and common sense. In this study, two levels

of treatment have been applied, which are with the Lean application and without Lean application. The subjects in the treatment group were applied with the Lean application in course planning and delivery process, while the control group only follow the standard course planning and delivery process, or without any Lean implementation. The experimental environment can be controlled by controlling the possible extraneous variables, such as gender and age. The possible extraneous variables can also be controlled by assigning the subjects to respective groups by using matching group or randomisation (Sekaran 2003 and De Vaus 2001). Therefore, to control the experimental environment of this study, randomisation has been applied in assigning the subjects to treatment and control groups. The subjects have been randomly assigned to the group with Lean application and group without Lean application.

3.3.5 Choosing the Experimental Design

De Vaus (2001) defined research design as a well research plan that provides step by step work plan. He also said that developing a proper research design is very important to help the research progress as planned and to accomplish the research objectives. Moreover, Flick (2011) states that the purpose of choosing a suitable research design is to avoid answering the research question incorrectly and to make sure the research works as planned. Hence, we choose the best suitable research design for this study. The details of the steps are described in the following sections.

3.3.5.1 Type of Research Design

There are several types of research design including experiment, case study, longitudinal, comparative and cross-sectional. De Vaus (2001) divided research design into four major categories. The four categories are experimental design, longitudinal design, cross-sectional design and case study. Sekaran (2003) defined experimental design as a study that the researcher can create the situation, control and manipulate the independent variable(s) in order to create a causal relationship.

The second research design, longitudinal is defined as a study where a researcher collects the data at several points in time. Meanwhile, the cross-sectional design is a study that the researcher gathers the information at one point in time to answer the research question (Neuman 2012). The last research design which is case study is defined as a study that combines individual or group interviews through record analysis or observation to understand events, their implication and processes (Cooper and Schindler 2008).

For this study, the experimental design has been chosen to answer the research questions, as our interest is to examine the effect of Lean application of several groups. The treatment of this study is the Lean application to the groups alongside their pairs of control groups. The treatment has been applied to the experimental groups at the beginning of the semester. Then, at the end of the semester, data were obtained to examine the effect of the treatment on the treatment group by comparing them with the control group based on the students' satisfaction.

3.3.5.2 Reason for Choosing Experimental Design

According to Cooper and Schindler (2011), an experiment is a study where the researcher intends to test the effect of treatment by manipulating the independent variable. Through the manipulation, this will provide the opportunity to measure the changes in the dependent variable. Besides that, the extraneous variables in the study can also be controlled to measure the impact of treatment effectively compared to the other designs. Besides that, experimental study also allows for repetition which will increase the generalization. This study adopted the experimental design to measure the effect on Lean kaizen application in terms of students' satisfaction. The treatment is Lean kaizen application and the control is without Lean kaizen application, on the course planning and delivery process. Kearns, Shoaf, and Summey (2004) have applied experimental design in measuring the effect of web-based and traditional course delivery on students' satisfaction and performance. The study included two groups, where one group has been taught using web-based delivery and the other one group has been taught using traditional course delivery. Besides that, Talib et al. (2012), have also applied experimental design in their study. There are two groups involved which are a group who received lectures using Simple Explicit Animation (SEA) approach and the other group received a normal approach which is talk-and-chalk approach. Hence, this study has adopted experimental design to measure the effect of Lean kaizen application on students' satisfaction. The treatment is Lean kaizen application and the control is without Lean kaizen application on the course planning and delivery process.

3.4 Sampling Strategy

The population is defined as all of the elements that the researcher desires to investigate, while the sample is a subset of the population (Sekaran 2003). The elements can be human, item or anything that the researcher intends to investigate (Cooper and Schindler 2008). Sampling involves making a selection from a population of interest or to be studied (Flick 2011). Sampling provides several advantages in certain situation such as lower cost, greater accuracy of results, greater speed of data collection and when the population is infinite (Cooper and Schindler 2008).

Sampling procedures can be categorised into two categories, which are probability and non-probability sampling. Probability sampling procedure provides more confidence that the sample adequately represents the population (Graziano and Raulin 2000). Every element in the population has an equal possibility to be chosen for the sample. Non-probability sampling is used when the researchers are having a lack of sampling frame information about the population (Sekaran 2003). Therefore, the sample does represent the population. Table 3.5 below shows several types of probability and non-probability sampling, with advantages and disadvantages of each type.

Table 3.3: Types of Probability and Non-Probability Sampling

Category	Types of Sampling	Description
Probability	Simple random	The simple random sampling is a type of sampling that allow all the elements in the population to be selected as the respondent of a study (Miller and Salkind 2002).

Category	Types of Sampling	Description
	Systematic	The sample has been selected sequentially which is at every k^{th} element of sampling frame, k = (N/n) (N=population size, n=sample size) (Engel and Schutt 2014)
	Stratified	Stratified sampling is a procedure to choose the sample by dividing the population into several different groups where the characteristics intra group is similar. Then, the sample will be chosen from each of group/strata by using simple random sampling or systematic sampling (Cooper and Schindler 2008).
	Cluster	Sampling in which the population has been divided into many groups with similar characteristics; however the characteristics within group are heterogeneous (Engel and Schutt 2014).
Non-probability	Convenience	The respondents have been selected based on the most convenience respondent to be recruited (Mitchell and Jolley 2001).
	Purposive	The sample has been selected based on the purpose of the study and are not randomly chosen (Sekaran 2003).

3.4.1 Sample Selection for This Study

Three academic programmes were chosen for this study from two universities, X and Y. University X and Y are two of the newest public universities in Malaysia. Six experiments have been conducted to increase generalisation. Therefore, replication is the best strategy to increase generalisation and to be more confident that the same results will be obtained although using different samples and settings (De Vaus 2001). Three different courses,

which we call Programme 1, Programme 2 and Programme 3 from University X and Y represent the replication. This is the best way that can be done based on the limitation of time, cost and subjects of this study.

Besides that, choosing the correct sample size is very important to achieve generalisation. There are several methods available to determine the best sample size for a study. Moreover, the sample size determination process also depends on the types of study. Sample size can be calculated using a specific formula such as, $S\overline{X} = \frac{s}{\sqrt{n}}$, (where $S\overline{X}$ = standard error, s = standard deviation and n = sample size) (Sekaran 2003). Another alternative to select the appropriate size is by using sample size table based on the total population, provided by Krecjie and Morgan (1970) or by determining the sample size based on confidence level and sampling error (Cohen 2005).

In order to analyse the data by using parametric statistics, a minimum of 30 cases as a rule of thumb for determining sample size can be used (Hogg and Tanis 1996; Roscoe 1975). According to Cohen (2005), if the research involves a class of students, then all the students in the class should be included in the research as a sample. Hence, based on this reason, the sample size of this study is all of the students that have registered for the courses. The students are from six academic programmes which are from two different universities. The respondents from each programme were assigned randomly to both groups to give an equal opportunity for each and every member to be selected. The detail of random assignment will be discussed in Section 3.4.2.

There are 205 respondents involved in this study for University X, which consists of 78 respondents from Programme 1, 67 respondents from Programme 2 and 60 respondents from Programme 3. There are two groups for each programme which are a group with the Lean application and a group without Lean application. Programme 1 consists of 37 respondents from the group without Lean application, and 41 respondents from the group with Lean application. Programme 2 consists of 33 respondents from the group without Lean application and 34 respondents from the group with the Lean application. Lastly, Programme 3 consists of 30 respondents for each group.

For University Y, the total respondents who are involved in this study are 201. They consist of 31 respondents from the group without Lean and 35 respondents from the group with Lean application for Programme 1. For Programme 2, 36 respondents are from the group without Lean and 39 respondents are from the group with Lean application. The Programme 3 consists of 30 respondents from each group.

Furthermore, an interview was also conducted with the staff to validate and generalise the results. According to Cresswell (1998), five is the minimum sample size when conducting a qualitative study. Therefore, six staff from each university of X and Y has been chosen randomly to obtain their feedback regarding to lean kaizen application in the course planning and delivery process at the end of semester.

3.4.2 Random Assignment

It is very important to randomly assign the subjects to the groups when conducting an experimental study. Experimental design does not require the sample to be derived randomly from the population units. It is only sufficient to randomly assign the subjects to the group or treatment (Rosenbaum 2002; Guo and Fraser 2014; Fisher 1990). Cooper and Schindler (2008) said that the random sampling for experimental study is done by assigning the subjects to the treatment and control groups using randomisation technique. For this study, the subjects have been assigned randomly to the treatment and control group before the course begins. It is important to assign the subjects randomly to the groups to make the variability between groups also in random. This act will ensure that the groups are suitable for any purpose and to increase generalization (De Vaus 2001).

3.5 Instrument Development and Pilot Testing

Besides that, questionnaires from past studies have also been used as guidelines in developing the questionnaires for this study. For example, Apodaca and Grad (2005) has used the rating forms by two universities in Spain to measure the students' rating for the teaching. The first form has been measured based on five factors which are planning and preparation, communication skills and abilities, interaction with students, didactic and methodological resources and assessment. The second form consists of four factors which are planning and preparation, communication skills and abilities, interaction with students, didactic and methodological resources. Moreover, Burden (2008) has discussed the common question that has been asked in the teaching form for student evaluation.

Among the questions are student attendance, overall satisfaction with the course, the syllabus, text and course material, and etc. The instrument that was used for this study is the 7 Likert scale questionnaire. This questionnaire was developed by adapting the available questionnaires based on students' feedback. These have been regularly used by the universities at the end of every semester. Furthermore, the questionnaire's development has also considered the opinions and feedbacks from both the lecturers and students. The statisticians and experts were also involved in developing the instrument in order to validate the questionnaire.

Table 3.4: The Description for Each of the Questions in the Questionnaire

Question Number in Questionnaire	**Variable**	**Measurement Scale**	**Description**
Q1 (a)	Faculty	Nominal	Respondents will write their faculty's name on the space provided
Q1 (b)	Programme Name	Nominal	Respondents will write their programme's name on the space provided
Q1 (c)	Semester	Ordinal	1- semester 1 5- semester 6 2- semester 2 6- semester 6 3- semester 3 Others 4- semester 4
Q1 (d)	Sex	Nominal	Male Female
Q1 (e)	Age	Ordinal	1- 18-20 4- 27-29 2- 21-23 5- 30 and above 3- 24-26
Q2 (A)	Satisfaction (Course Planning)	Interval	7-point Numerical Scale (1 Definitely not agree until 7 Definitely agree)

Question Number in Questionnaire	Variable	Measurement Scale	Description
Q2 (B)	Satisfaction (Course Delivery)	Interval	7-point Numerical Scale (1 Definitely not agree until 7 Definitely agree)
Q2 (C)	Satisfaction (Course Assessment)	Interval	7-point Numerical Scale (1 Definitely not agree until 7 Definitely agree)
Q2 (D)	Satisfaction (Lecturer Characteristic)	Interval	7-point Numerical Scale (1 Definitely not agree until 7 Definitely agree)
Q2 (E)	Satisfaction (Course Material)	Interval	7-point Numerical Scale (1 Definitely not agree until 7 Definitely agree)
Q3	Comment/ suggestion	Nominal	Respondents will write their comment or suggestion (if any) in the space provided.

The questionnaires consist of three main questions which are the respondent's background, their satisfaction on the taught course and the respondent's comment or suggestion, as can be seen in Table 3.4. The respondent's background consists of, among others, programme; semester; and gender. There are five variables included to measure the respondents' satisfaction on the taught course. Based on these five variables, there are 6 items (questions) used to measure course planning, 7 items to measure course delivery, 5 items to measure course assessment, 6 items to measure lecturer characteristics and 6 items to measure course material, as stated in Table 3.5.

Table 3.5: Variables and Items of Course Planning and Delivery Process

No.	Variables	Items
1.	**Course Planning**	The course planning has been discussed at the beginning of semester
		The syllabus is understandable
		E-learning in course planning is effectively used
		The teaching sessions have been well prepared
		Presentations have a well-defined scheme
		The course's consultation has been well prepared
2.	**Course Delivery**	The course plan has been distributed uniformly throughout the academic period
		The learning outcomes have been informed before the class starts
		Course delivery is effective
		Students' participation has been encouraged during the course
		Summarisation of the lectures main points is satisfactory
		Course consultation has been implemented effectively
		Student feedback conducted at the mid-term of semester provides opportunity for the students to give comments on improving the course delivery process
3.	**Course Assessment**	The assessment is consistent with the course contents
		The information about the assessment requirement was clear
		The feedback of assessment help the students to understand the course content The assessment results were given on time
		Marks given are fair
4.	**Lecturer**	Positive attitude towards students
		Easy to contact
		Expert in course taught
		Responds with accuracy to the questions asked
		Ability to makes the course interesting
		A good public speaker
5.	**Material**	The material is consistent with the course contents
		Online materials were well provided

No.	Variables	Items
		Reference source is compatible with the requirements of the course
		The reading materials help to understand the course
		Course remembrance is satisfactory
		Teaching aids used in the classes are satisfactory

3.5.1 Pilot study

After the questionnaire has been constructed, a pilot study has been conducted to test the instrument and to predetermine any problems that will occur in the real study (Knapp 1998). In order to examine whether all of the items are reliable to measure satisfaction on the taught course, a pilot study (reliability test) has been conducted. The pilot study allows for any modification of the study if any problem occurred before the research was conducted. The sample size for this pilot study is 15 students. The items are reliable if the value of Cronbach's alpha is 0.7 and above (Litwin 1995 and Santos 1999). The results of Cronbach's alpha for this study are as follows:

Table 3.6: Coefficients of Cronbach's Alpha

Factors	Cronbach's Alpha Coefficient	Number of items
Course Planning	0.891	6
Course Delivery	0.936	7
Course Assessment	0.879	5
Lecturer Characteristic	0.905	6
Course Material	0.859	6
All items	0.969	30

Table 3.6 shows the coefficients of Cronbach's Alpha for each factor and items in the questionnaire or instrument of study. Since all of the values are greater than 0.7, it can be concluded that the instrument is reliable and has a relatively high internal consistency.

3.6 Ethical Considerations

Ethical approval must be obtained to ensure that the rights of the respondents and other parties involved in the study are protected and kept confidential (Sekaran 2003; De Vaus 2001). After receiving the approval, the study can be carried out according to the plan which has been approved. This study has been approved ethically by Coventry University before the research was conducted. Besides that, this study has also received approval to be carried out on Malaysian higher education institutions by the Economic Planning Unit of Malaysia and Deputy Vice Chancellor of Academic from both of the universities involved in this study. The completed ethical review form is attached in Appendix D.

3.7 Summary

This chapter describes the research methods that has been applied in this study. Appropriate methods were used to increase the reliability and validity of the research. Therefore, the results can be generalized to the broader population.

CHAPTER 4

EXPLORATORY STUDY

4.0 Introduction

According to Lewis (2010), since 1960s the higher education sector has always make changes to their main services offered, specifically in the academic process. Providing an effective teaching and learning process is very important to gain students' satisfaction in the higher education sector. According to Sidin (2000) and Suarman, Aziz, and Yasin (2013), the effectiveness of teaching and learning process is the major factor that will affect the students' satisfaction after the students have experienced the process. Meeting students' expectation is important to the sector for assurance of quality services since students are the main customer of higher education sector (Suarman, Aziz, and Yasin 2013). A successful graduate that is produced by the institution will help them to compete with other institutions; hence this will give a good image of the graduates to the society. Hence, improving the quality of services offered to the students is very important to ensure their expectations were met.

As stated earlier, the aim of this study is improve one of the work processes in higher education in Malaysia, which are course planning and delivery process. Due to limited information and to better understand the current situation, an exploratory study was conducted. Through this study, the elements of the process that are important to the

students are identified and discussed. Besides that, the problems that exist in this process were also determined from both the students and the lecturers. The result of this assessment will give a clear picture regarding the students' expectation and value. Suarman, Aziz, and Yasin (2013) stressed that an evaluation of teaching and learning can help the lecturers to measure their quality of teaching and learning process.

4.1 Exploratory Study

This study was conducted to explore the current situation of course planning and delivery process in order that any management dilemma can be uncovered. It was intended to help in understanding the situation to make sure that the dilemma or problem has been treated correctly. In addition, this study was also intended to determine the problems that are disturbing the flow of course planning and delivery process perceived by the students and the university staffs. According to Emiliani (2015), there are very limited studies that apply Lean principles in higher education sector, especially on the academic or teaching areas (Emiliani 2015; Barosso et al. 2010). Cooper and Schindler (2008) stated that, an exploratory study is very important before a research was carried out because it can help in defining the precise research questions especially when the literatures of the study are very limited to be reviewed. Therefore, the exploratory study has been conducted first before conducting the experimental study that can provide insights of the situation.

Furthermore, the results of this study were used in conjunction with value stream mapping process (VSM) to analyse the current work process, and to identify the value added activities, non-value added activities and non-value added but necessary activities. It is

very important to analyse what is/are most needed and valued by the customer before making an improvement (Balzer 2010). Thus, this exploratory study attempts to fulfill the following objectives:

i. To explore the important activities in the course planning and delivery process for the University X's students and lecturers.
ii. To explore the important activities in the course planning and delivery process for the University Y's students and lecturers.
iii. To identify the perceived problems that are faced by University X's students and lecturers involved in the course planning and delivery process.
iv. To identify the perceived problems that are faced by University X's students and lecturers involved in the course planning and delivery process.

The respondents for the exploration's purpose are students and lecturers that have been selected from the two universities, which are University X and University Y. The respondents for this study were randomly chosen. In collecting the information from the students, a questionnaire was used; whereas for the lecturers, a semi-structured interview was conducted. About 120 set of questionnaires were distributed to the four faculties in both University X and University Y to obtain the related information from the students. 5-likert scale questions have been used to measure the important activities in the course planning and delivery process and the problems that are faced by the students. The questions have been asked to gather the required information useful in conducting the experimental study. The results were used for the exploration purpose only.

In addition, twenty lecturers were randomly chosen from each university as the respondents of semi-structured interviews in order to obtain their opinion regarding the activities and problems in the course planning and delivery process. Qualitative data have been collected from the lecturers in order to gather the details and useful information related to the research (Blaxter, Hughes, and Tight 2006). Besides that, several open-ended questions related to the problem in the course planning and delivery process were asked to the students. The students are also asked if they had other problems in the work process. The response rates of the surveys for the students in University X is 92 out of 120 (76.7%), whereas in University Y, the response rate is 116 out of 120 (96.67%).

The data was analysed by using graph and chart, as well as frequency and percentage analysis for the quantitative study. In addition, in terms of opinions and open ended ``questions, the data was recorded and categorised manually based on the answers provided by the respondents regarding important activities and problems in the course planning and delivery process.

4.2 Important Elements in Course Planning and Delivery Process

Commonly, the course planning and delivery process starts with preparing the course plan, then delivering the course and ends with releasing the course's results at the end of semester. According to Lockwood, Ng, and Pinto (2007), there are several major components of teaching and learning process, which are learning resources, lecture sessions; consultations; team projects; quizzes; course design; class attendance; and examinations. The learning resources have been provided as hard and soft copies to

facilitate the students' learning. Feedback from the students is also one of the important elements as it gives an opportunity to the students to voice out their opinions.

Slightly different from Lockwood, Ng, and Pinto (2007), Suarman, Aziz, and Yasin (2013) stressed that besides learning material, assignment, syllabus, and examinations, the lecturers and students in the teaching and learning process are also major components of the teaching and learning process. For the lecturer, this includes the lecturers' motivation; competence; and techniques of building relationships with the students. While for the students, there are students' competence and relationship with other students. In addition to this two authors' findings, Patel (1995) also describes about the teaching and learning process. He stated that teaching and learning process in a lecture environment involve the lecturers, students, syllabus, lecture, reading material, assessment and examinations.

Based on the results of the exploratory study that was conducted to the students of both universities, the students rated all of the elements stated in the questionnaire as important in the course planning and delivery. This can be seen by the rates given by them for each of the element. All of the elements were rated higher than 3.0 (5-likert scale). Below are among the course planning and delivery elements rated as important by the respondents:

i. Course Materials

Reading materials are relevant sources that are related to the course that aids the teaching and learning process. Reading materials that are provided to the students usually are notes, handouts, textbooks and PowerPoint slides either in soft or hard

copy (Patel, 1995 and Lewis, 2010). Besides that, the syllabus is also one of the course materials. It is a document that contains important details about the course such as learning objectives and expected outcomes of the taught course. Commonly, it also contains topics of the course, list of reading materials and lecture plans. According to Burden (2008), a syllabus is a starting point for teaching and learning where the clear goals have been stated and these will be used as a guideline to teach the course. A copy of the syllabus should been given to the students before the class begins. It is very important for the students to know the learning outcomes of the course, so that they know what to achieve during the teaching and learning process.

ii. Lectures/Tutorials

Lectures/tutorials happen when lecturers deliver the knowledge to the students. According to Desai (2013), lecturing is planning and delivering a presentation. The lecturers should improve themselves to be an effective presenter by initially making a proper teaching plan to attract students' attention. Lectures/tutorial commonly take place through face to face meeting, but it also possible to perform them virtually.

iii. Consultation

If a student has any problem related to the course after lecture or tutorial classes, they can use the consultation hours to meet their lecturers for help. According to Lockwood, Ng, and Pinto (2007), consultation hours are held after classroom

session to discuss anything related to the course, on either face to face meeting or online mode (email, chatting etc.).

iv. Students' Attendance

Dotolo (1999) said that every university is concerned about their students' attendance. Their attendance is important because they are the people that will receive the knowledge. It will ensure that the class can function well (Lockwood, Ng, and Pinto 2007). Students' attendance can be monitored by using a list of students; names and ask them to sign in a designated column or by an online system that can be used only by the lecturers. This can help the lecturers to recognize which student is having an attendance problem so that they can take appropriate actions on the student(s).

v. Assessments/results

Assessments for the course are usually performed during the semester periodically. The assessments given to the students are in the form of quizzes, tests, individual project, group project, presentation and final examination (Suarman, Aziz, and Yasin 2013). According to Emiliani (2004a), the assessment should be paralleled to the course learning outcomes. Assessment is not only to evaluate students' performance, but it also intended to improve their learning, inform teaching, to help students achieve the highest standard, and provide meaningful report on their achievements (Desai 2013). The feedback and results of the assessment are also very important to the students. They would be informed

of their performance in the course from the assessment results in order to know their mistakes and improve them (Emiliani 2015).

vi. Students' Feedback

Students' feedback should be looked as a good and positive thing (Desai 2013). It can help the particular faculty to evaluate their performance and use that as a guide to improve their weaknesses. Lewis (2001b) said that evaluation on students' feedback must be done continuously, broadly based on all aspects of teaching, descriptively and diagnostically to know the specifics and details, and all that must reflect the lecturer's personal goals.

In terms of the lecturers' perspectives provided in the semi-structured interviews, they agreed that all of the above elements stated by the students are important. Besides that, they also said that there are other activities that are important in the course planning and delivery process which are as follows:

i. Printing/photocopying the quizzes/tests questions

This is a necessary activity in order to make sure the assessment process run as planned. This process will take place before a quiz or test session is being held.

ii. Marking and importing results

Marking is very important in order to check the assessment activities. The lecturer marks the quiz, test questions or project reports and then imports the results into

the system for recording purposes. The assessment marks are very important to determine the students' grades.

iii. Vetting process

Vetting process is an activity of checking and assessing the final examination questions. This process is very important to make sure that the questions are relevant and parallel to the learning objectives of the course.

4.3 Problems in course planning and delivery process

It is very important for higher education institutions to investigate and solve the problem that occur in their system, effectively. A good performance of course planning and delivery process can help the institution in many ways such as increase students' satisfaction level that will lead to students' loyalty. This is because satisfaction with the services offered is positively associated with brand loyalty (Paswan, Spears, and Ganesh 2007; Douglas, Douglas, and Barnes 2006). Below are the problems in course planning and delivery that have been identified by previous studies:

i) Course assessment problem

Course assessment includes quizzes, tests, projects, presentation and final exam. Emiliani (2004a) found that the assignments are usually ambiguous and too lengthy. Sometimes, the format of the assignment is not standardised. Besides that, he also said that the examinations are held at a relatively minimal number. The more attempts given will allow the students to improve their performance and give an

opportunity to the students to learn. This is also agreed by Lockwood, Ng, and Pinto (2007). Supposedly, the more trials given to the students to take the quizzes, the more they will learn.

ii) Lecturers' problem

Suarman, Aziz, and Yasin (2013) found that students' perception of lecturers is still at moderate level. There is a gap between students' expectation and their experience. Besides that, in a study conducted by Kim (2013), students were not satisfied with the lecturers' feedback on the assessments given. They didn't receive complete and clear reasons of their reports' mistakes from the lecturers. The lecturers also make them feel depressed by giving only negative comments on their works. Kim (2013) also said that, the students hoped to have a supportive lecturer and they are willing to be criticised by the lecturers, but with more explanations and reasons. The lecturers should also be easily accessible during consultation hours.

iii) Lecture

Besides that, professors often teach in a similar way they were taught before, which is the traditional method where students get fed up with a lot of information (Emiliani 2004a). The teaching approach also does invite students to perform critical thinking.

iv) Course material

Emiliani (2004a) found that there are several problems with the course materials, especially the syllabus and the required reading materials. According to Emiliani (2015), among the problems of syllabus that have been identified through past studies

is there are a lot of information in the syllabus that are confusing and difficult to understand. There is also no information on difficult to understand topics that will lead to lower marks and required more attention. The plan that is stated in the syllabus sometimes has been implemented differently.

The required reading materials such textbooks and notes sometimes are confusing especially when there are a lot of reading materials required. The case study that has been used in the class is usually based on other countries' situation and this is confusing since the laws and regulations practiced over there are different. In addition, Lockwood, Ng, and Pinto (2007) revealed that students will understand more and the level of their appreciation increased when learning with a real case study and data. This is because they can relate between what they have learned and the real problems that happened outside. Because of this they feel more excited to learn. In that case, they can see the clear picture of the relationship between course material and their potential career in the future.

v) Students' feedback

Students' feedback is important as a guide to improve lecturers' performance, but as commonly, students refused to give more comments on teaching and learning process especially for open-ended questions (Svinicki 2001). He also said that students might refuse because they do not see any improvement of their feedback on the process. The lecturers may ignore the important information of students' feedback on the teaching and learning process because they feel that students misunderstood their teaching and gave nonreliable rates to them (Lewis 2001a).

Another problem on students' feedback is it is only being conducted at the end of the semester and not being done continuously during the whole semester. It should be done more than once during the whole semester such as adding another evaluation in the middle of the semester (Lewis 2001b; Emiliani 2004a). This will allow the lecturers to understand their students' problem and improve their performance based on the feedback. The students will also have the opportunity to voice out their problems and express their opinions for better and effective understanding and learning.

4.3.1 Student's perceived problems in course planning and delivery process

Based on the results of the exploratory study, there are several perceived problems faced by students from both the universities. The problems have been rated by the students higher than 3 based on a 5-point Likert scale. This means that the solutions for the problems are essential to them. The elements in course planning and delivery process that triggered the problems to the students are reading materials, assessment and delivery methods. Both respondents of University X and University Y are having similar problems.

Table 4.1: Students' Perceived Problems in the Course Planning and Delivery Process

Elements	Problems
Reading materials	• The students agreed that the syllabus of the course is too long for both universities.

	• The students from both universities said that there is no guideline in the syllabus that states the mistake or error that previous students always done which lead to lower grades. • The lecture notes sometimes were late been uploaded in the e-learning portal and there are also some notes never been uploaded during the course. • Most of the problems or laws are based on US cases which are not been practiced in their country. • The course only provides lecture notes, reading materials, graded tests and assignments as the course material. There are no other alternatives available to help the students in remembering the course in the future.
Assessments	• The results of assessments usually are late returned to the students. • There is no discussion or feedback after the quizzes or test to allow the students know their mistakes and learn from the feedback. • Carry marks were not issued before final exam.
Delivery method	• The students also said that the learning approach of the course is routine and common. • There are some lecturers that only concerned to finish up the syllabus according to the plan rather than to help in increasing the students' understanding of the course.

Table 4.1 shows the perceived problems that are faced by the students from both universities based on the elements in the course planning and delivery process. This information will be used in identifying the waste in course planning and delivery process during mapping process, to reduce or eliminate the waste.

4.3.2 Lecturers' perceived problems in course planning and delivery process (University X)

This section states the problems in the course planning and delivery process experienced by the lecturers of University X. The problems have been analysed and compiled in accordance with a hierarchy as follows:

i.Lecture, tutorial and consultation (14 weeks)

Students' responsibilities	**35%**
Poor planning (course plan)	**25%**
Ineffective consultations	**10%**
Poor facilities	**5%**

There are about 35% of the lecturers who said some of the students are not responsible enough, for example they do not attend classes at the right time or do not bring the textbook to class as this can interrupt the lecture session. The course plan is not effective since sometimes the class is cancelled due to a stretch public holidays. Students also do not fully utilise the consultation sessions allowed for them.

ii.Students' attendance

Signing in	**30%**
Poor planning	**30%**
Importance of attending	**25%**

In terms of attendance, 30% of the lecturers said that there are signature problems as some students sign in for their friends or ask their friends to sign in for them. There are also some lecturers who complained that there is poor planning in the students' attendance system, as the students' attendance should be recorded twice, manually on the form and in the computer system. There are also some students who are not aware of the importance of attending the lectures, so they continually become absent from the class.

iii.Printing and photocopying the quizzes/test questions

Paper and time wastage	**15%**

15% of the lecturers stated that printing and photocopying the quiz or test question have led to paper and time wastage.

iv.Quizzes and tests

Poor assessment planning	**50%**
Students' responsibility	**30%**

Half of the lecturers stated that the assessment planning is poor. This situation happened because sometimes either the students or the examination hall is not available on the planned date of quiz or test session. There are also some students who are not responsible enough by being absent during the assessment session. This has led the lecturer to conduct the assessment again for them with different questions and this invites time wastage.

v.Marking and importing the results in the system

Time constraint	**45%**
Error in importing data	**10%**

There are 45% of the lecturers in this study who stated that time constraint is a problem to them, while 10% of them faced a problem during importing the results' data process, such as mistakenly imported the data into the system.

vi.Results/carry marks

Lateness	**35%**
Rework	**10%**

35% of the lecturers said that sometimes the results or carry marks of the assessment are returned late to the students. Moreover, there are also rework processes to be done such as checking the result again if the students are not satisfied.

vii.Project Presentation

Students' responsibility	**35%**
Time constraint	**35%**
Facilities	**5%**

About 35% of the lecturers said that the students are not responsible during the group presentation, such that some of them do not take part during the presentation and some others are not well prepared. There are also 35% of them who said that the time allocated

to them to conduct the presentation is the problem and another 5% said that the facilities was also one of the problems that hinder good conduct of the project presentation.

viii.Project submission

Students' non-conformance	**50%**
Wastage	**5%**

50% of the lecturers face problems with the students who do not comply with a project's submission date and the format for report submission. There are also wastage in terms of paper usage happened (5%).

ix.Students' feedback (semester end)

Lack cooperation	**45%**
Ineffective	**20%**

There are students who do not give cooperation to fill the feedback form at the end of the semester, said 45% of the lecturers. There are lecturers who said that the feedback form was ineffective (25% of the lecturers) since it is only being held at the end of the semester and the students do not experience the improvement that has been done based on the feedback.

x.Vetting process

Non-conformance	**40%**
Time constraint	**10%**

40% of the lecturers said that some of the examination questions (prepared by other lecturers) do not comply with the required format. Some (10%) of the lecturers also said they do not have enough time to prepare and complete the questions on time.

xi.Final exam

Poor planning	**40%**

During the final examination, the problem is poor planning, for example they have to sort the answer scripts when the examination was held in a large hall with other final examination of various other courses.

xii.Comments and or suggestions

Better planning and management	**65%**
Facilities	**15%**

About 65% of University X's lecturers suggested for better planning and management such as a better system for registration process and a better class schedule to avoid overlapping schedules. Besides that, a 15% of University X's lecturers suggested that the learning facilities should be improved such as providing better tables and chairs in the classroom.

4.3.3 Lecturers' perceived problems in course planning and delivery process (University Y)

This section discussed the problems in the course planning and delivery process experienced by the lecturers of University Y. The problems have been analysed and compiled in accordance with a hierarchy, as follows:

i.Lecture, tutorial and consultation (14 weeks)

Poor planning (course plan)	**30%**
Ineffective consultation	**25%**
Poor facilities	**5%**

30% of the lecturers stated that the planning of the course is poor, for example the lecture and the tutorial are not conducted as planned. The consultation sessions are also not effective because the students come for consultation when they do the course project. There is also a lecturer who says that the facilities for lecturing are not suitable.

ii.Students' attendance

Importance of attending	**35%**
Signing in	**30%**

In terms of attendance, 35% of the lecturers said that there are some students who are not aware of the importance of attending the class. Some of the students are late in attending

the class or are simply absent from class. There are also some students who sign in for their friends or ask their friends to sign in for them.

iii.Print and photocopy the quizzes/test questions

Accessibility	**15%**
Paper wastage	**5%**

15% of the lecturers stated that, they have to walk in particular distances to use the printer or photocopier. This has resulted in time wastages for them. Moreover, printing and photocopying the quiz or test questions also led to paper and time wastage.

iv.Quizzes and test

Poor assessment planning	**35%**

35% of the lecturers stated that the assessment planning is poor. This situation happens because the timing and place of the assessment are not appropriate.

v.Marking and key in marks in the system

Time constraint	**40%**
Error in importing data	**10%**

40% of 20 lecturers stated that the problem they face in marking and importing the results is the time constraint. They do not have enough time to mark the assessment in a short time. They also sometimes mistakenly import the results into the system.

vi.Results/carry marks

Lateness	**25%**

25% of the lecturer said that sometimes the results or carry marks of the assessment are being returned late to the students due to their time management.

vii.Project Presentation

Student's responsibility	**35%**
Facilities	**20%**
Poor planning	**15%**

About 35% of the lecturers said that the students are not responsible with the group presentation because some of them lack in the preparation and commitment. 20% of the lecturers said that poor facilities provided to them are also one of the problems in conducting the presentation. There are also some lecturers who said that the time allocated brings a problem when conducting the project presentation.

viii.Project submission

Students' non-conformance	**45%**
Unstandardized guideline	**5%**

There are 45% of the lecturers who have a problem during students' project report submission because the students do not comply with the submission date and the report format. There is also wastage in terms of paper usage (5%).

ix.Students' feedback (end semester)

Lack cooperation	**50%**
Ineffective	**20%**

Some students do not give full cooperation to fill the feedback form at the end of the semester, as said by 50% of the lecturers. The feedback is also ineffective, according to 25% of the lecturers since the feedback giving process is only being held at the end of the semester and the students do not have the opportunity to experience the improvement based on their feedback.

x.Vetting process

Non-conformance	**25%**
Time constraint	**5%**

25% of the lecturers said that some of the questions prepared by other lecturers do not comply with the required format. Some of the lecturers (5%) do not have enough time to prepare the questions on the given time.

xi.Preparing final results and validation

Time constraint	**40%**

During the final examination, the problem is commonly happening is time constraint especially when distributing and collecting the answer booklets.

xii.Comments and or suggestions

Better planning and management	**35%**
Students' responsibility	**30%**

There are 35% of University Y's lecturers who suggest for better planning and management such as a better system for registration process and a better class schedule to avoid overlapping schedules. 15% of University Y's lecturers also complain that students should take an extra care and extra responsibility in their own education.

4.4 Course Planning and Delivery Process

Course planning and delivery process in University X and Y is a process of preparing and delivering the course plan. This process focuses on the teaching activities in order to provide learning to the students. According to Parse, (2004), the traditional definition of teaching is telling, and learning is the destination. Smith (2001) said that teaching refers to designing and implementing activities to promote student learning. A good teaching is important because it will lead to continuous learning.

Based on the exploratory research that has been conducted, the course planning and delivery process starts with course preparation and then course delivery until the results of the course for each of the student are released. The preparation and delivery of the course are a repeating process in the 14 weeks, which is the duration of study in a semester. The following weeks after that include students' preparation week for final examination, final examination weeks and semester break.

4.5 Summary

Providing a high quality service is very important to the institutions of higher education to achieve students' satisfaction and to be more competitive than the other competitors. The main factors that contribute to students' satisfaction depend on efficiency of the faculty's staff, approach in classroom management and the passion to interact with students (Howell and Buck 2011). The purpose of the exploratory study that has been conducted is to explore the situation of the current course planning and delivery process to allow the improvement action to take place.

Based on this study, the important elements in course planning and delivery process to the students and lecturer have been identified. They can be categorised into five elements, namely course planning; course delivery; course assessment; lecturer characteristic; and course material.

In terms of problems in the process, the students from both universities say that they are facing several problems in the course planning and delivery process, which are reading

material; assessments; and course delivery. The lecturers from both universities also face several problems in the process, such as the poor planning in delivering the course, the schedule of the assessment plan, the time constraint in marking the assessment and the redundant work in recording student attendance.

Besides that, they have problem in terms of students' responsibility on their course learning where some of the students are absent without reasonable excuses and did not submit the report on time.

As a conclusion, the exploratory study helps us to understand the process from the perspective of the students and the lecturers, and to identify the problems that they face in the process. This study has provided an insight that, there some problems that exist in the process that need further action and improvement.

CHAPTER 5

THEORETICAL FRAMEWORK

5.1 Introduction

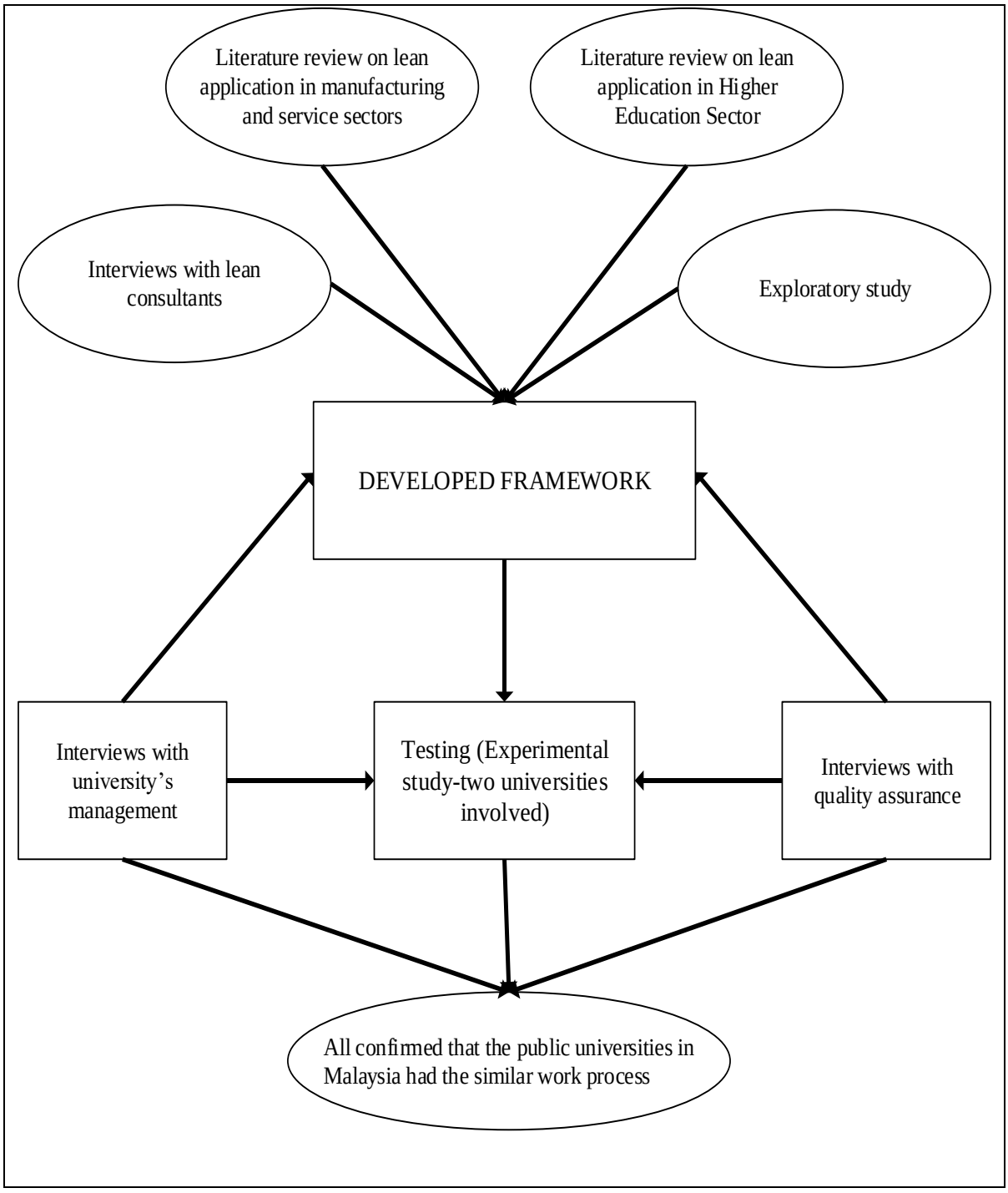
This chapter will discuss the development of the theoretical framework of the study. The development of this framework has been made after reviewing the literature of lean implementation in various sectors, namely manufacturing; service sectors such airlines; health care; and also the higher education sector. Furthermore, interviews and an exploratory study have also been conducted during the process.

5.2 Theoretical Framework

Firstly, the framework of this study has been developed by reviewing the literature on Lean kaizen techniques. The definition of lean has been discussed including its application in the manufacturing and service sectors (see chapter 1 and 2). Besides that, the application of lean in higher education has been explored to better understand lean application in this sector. The lean methods that can be applied are also discussed in detail in Chapter 2. It can be concluded that, lean is suitable for various sectors as long as it has management commitment in its organisation (Womack, Jones, and Roos 1990). Balzer (2010) has stated that lean thinking can help the Higher Education Sector to improve their

work process in terms of time and other resource wastes. Figure 5.1 shows how the theoretical framework of this study has been developed.

Figure 5.1: Development of the Theoretical Framework of the Study



Apart from reviewing past studies about lean, this study has also conducted exploratory study involving the students and university staff. The information gained from this study is very important in understanding the problems and issues that occur in the process perceived by both students and university staff. The information has also been used accordingly to help determine the important activities or elements in the course planning and delivery process. The results of this exploratory study are discussed in Chapter 4.

To strengthen the development of the framework, this study has also considered the opinions and suggestions of six lean consultants in Malaysia. They have agreed that lean kaizen is suitable to be applied in the academic process context and even suggested the best lean methods and tools to be applied in the course planning and delivery process based on the problems that commonly occur in the work process. The Lean tools used were also confirmed as the most suitable from the literature review in Chapter 2.

A triangulation methodology was used in constructing the framework. The use of triangulation methods consists of using various types of methods and data that have been adapted in the study. Triangulation has the benefit of ensuring that the weaknesses of one method are cancelled by the benefits of another method being used. This will provide validation especially for a study with limited literature (specifically the university sector) and to provide a well-developed model of the study (Creswell 1994).

The developed model has been tested via a detailed experimental study on two universities in Malaysia. To further validate and generalise the framework, interviews with other university management and quality assurance were made to explore the work

process in the other universities. The results of the interviews indicated that the work process of course planning and delivery is more or less similar as in the other Malaysian universities. It involved course preparation, delivery, consultation and etc.

5.3 Conducting the Interviews

The interview methodology has been made with six lean consultants, universities management and Quality Assurance. It was a semi-structured interview to gain the information. Six lean consultants have been asked regarding their opinion in terms of lean application in higher education work process, especially in the academic area. Besides that, they also have been asked regarding the appropriate lean tools to apply based on the problem that occurred in the work process.

To develop a valid framework, the opinions and recommendations from the universities' management have also been considered. They were asked regarding the values that are perceived by the customer and also in terms of the course planning and delivery process in their institutions. In order to support the statement by the universities management, a semi-structured interview also has been conducted with the Quality Assurance department in the Higher Education of Malaysia. It can be concluded that the activities in the course planning and delivery process for all the public universities in Malaysia are more or less similar since they come under the same ministry and have been accredited by the same accreditation body.

5.4 The Developed Lean Framework

Womack and Jones (1996) have come out with 5 principles as a guideline to adapt the lean philosophy that comes with value, value stream, flow, pull and perfection. Balzer (2010: 25) has adapted the principles in the Higher Education Sector as follows:

1. Defining the value based on stakeholders' interest
2. Identifying the work process flow
3. Eliminating or reducing waste in the work process
4. Adapting pull activity instead of push activity
5. Continuously improving the process to achieve perfection

Figure 5.2 shows the developed model in an attempt to apply lean in the course planning and delivery process in this study based on the five principles of Lean in Higher Education.

Figure 5.2: The Developed Framework of Study (Balzer 2010: 25)

Indicator:

Figure 5.2 shows the steps involved in implementing lean philosophy in the course planning and delivery process of this study. There are five steps to follow which are derived from the lean principles by Womack and Jones (1996). In the first step, the value that is defined by the customer was identified through a thorough literature review (refer Chapter 1 and 2) and also exploratory study (refer Chapter 4). Furthermore, there were also discussions conducted with the interviewees to explore the value component, as expected by the customer.

In the second step, the work process flow was identified by drawing the current state map using VSM. The data set information also has been determined via interviews and observation (refer Chapter 6). The work process has been drawn weekly, as suggested by the consultants. There are three main activities involved in this process. They are course planning, course delivery and consultation. The third step was completed by analyzing the current state map first to identify any problems or wastes that occurred in the work process. The "Five why's" tool was subsequently used in order to identify the root cause of the problem being investigated. Then, several appropriate lean tools based on the recognised wastes have been identified that were also re-confirmed in the interview sessions with the consultants. The 5S methodology has been applied as the basis for lean improvements in the workplace as it focuses on workplace organization (Villa 2010).

Additionally, some of the identified "wastes" were also eliminated by way of "respect for people" and reducing the process change over time (refer to Chapter 6).

The fourth step is improving the flow by applying standardized work principles and JIT in the work process (refer Chapter 6). Then, the future state map was drawn up based on the improvements that have been made. Subsequently, the improved work process was implemented and the achievements recorded. The final step was to achieve perfection by continuously making the improvements. This is because customers' perception always change overtime (Emiliani 2004a and Balzer 2010). The perfection part of the framework is a loop, which means that this will be used on a continuous improvement basis.

The improved work process has been implemented in two universities that were involved in this study. A detailed experimental study has been applied where there were two groups involved (refer to Chapter 3). One group was the treatment group and the other was the control group. The effect of lean kaizen application in the work process on students' satisfaction have been examined via students' feedback taken at the end of the semester. As discussed in the literature review (refer Chapter2), lean application is expected to give a positive effect on customer satisfaction (Nightingale 2000 and Taj and Morosan 2011).

The Framework was validated by implementing it in two universities and the validation was sourced from other universities and Quality Assurance management. The recommendations and suggestions from the university management, quality assurance and lean consultants have been considered. Amendments are subsequently made to improve the model.

5.5 Summary

This chapter has provided insights as to how the theoretical framework of this study has been developed using proven Lean methods and sources from past studies. It presented the steps in applying lean in the higher education work process. Besides that, it also shows how an appropriately identified lean tool set was applied to improve the work process according to identified problems or wastes that occurred in the process. As a conclusion, this chapter has provided a guideline in applying lean management in the academic context of the Higher Education Sector's work process.

CHAPTER 6

LEAN ANALYSIS AND IMPLEMENTATION

6.0 Introduction

This chapter describes the implementation of Lean tools that have been proposed in the literature to improve the course planning and delivery work process. Lean tools were used to evaluate the current state of the work process in Programme 1, 2 and 3 of University X and Y. Thereafter the findings were used to design the better future state of the work processes. This chapter explains how the Lean tools were implemented in the work process of course planning and delivery process.

Value stream mapping (VSM) is a map that shows the process of a product or service from resources or raw material related to the customer (Rother and Shook 2003). Rother and Shook (2003) introduced the VSM based on Toyota's practises and applied it to the Lean systems. They noticed the presence of mapping method and its advantages from Shook's experience while working for Toyota. VSM at Toyota is known as Material and Information Flow Mapping. It has been used by Toyota to illustrate the current and future work plan before applying the Lean systems (Rother and Shook 2003).

Mapping the work process is vital because it indicates successfulness in implementing the Lean techniques (Locher 2008). It allows us to see the workflow better, hence allowing us to better understand the current work process. It also provides an opportunity for the practitioner to evaluate the process in determining the value added, the non-value

added and the non-value added but necessary activities. The non-value added activities that have been recognised will be reduced or eliminated from the process, possibly by using Lean approach. Then, the future state map will be drawn according to the improved work process after the Lean approach has been implemented (Jimmerson 2010 and Tapping and Shuker 2003).

6.1 Value Stream Mapping in the Service Sector

The application of Lean in the manufacturing sector managed to improve a product's quality, reduce production costs and also helps to increase customers' satisfaction (Vlachos and Bogdanovic 2013). It has become a widely acceptable technique in the manufacturing sector since decades ago (Taj and Morosan 2011). Likewise the service sector (Ikatrinasari and Haryanto 2014), has also started to grab the opportunity to improve their services offered by adopting the Lean thinking. The subsectors in the service sector that have successfully applied Lean are banking, airline, education, healthcare and administration. Although these sectors produce intangible products, the flow of the work processes can still be developed for them as Lean is versatile that can be used in any sector, either it produces tangible products or services (Womack and Jones 1996).

VSM has been used in the service sector as a tool to identify waste or non-value added activities, and to make an improvement to the work process. Healthcare sector especially, has proven that VSM is worthy to apply in the service and manufacturing sectors (Vlachos and Bogdanovic 2013). In addition, Ikatrinasari and Haryanto (2014) applied VSM at

Directorate Airworthiness and Aircraft operation to identify the value added and non-value added activities. They used the current state map to evaluate the process and eventually came out with the future state map that is of higher efficiency.

In terms of the availability of sources for reference, there are several books that have guided the service sector to apply the VSM in their work processes, in order that waste or non-value added activities can be identified. Thus, the VSM can help to improve the processes in the service sector through waste reduction and Lean application, similar to how it has worked successfully in the manufacturing sector. Jimmerson (2010) produced a book of VSM application in healthcare processes, titled "Value Stream Mapping for Healthcare Made Easy", while Tapping and Shuker (2003) with "Value Stream Management for the Lean Office", which is especially relevant for office management area.

6.2 Value Stream Mapping in Higher Education Institution

Higher education institutions (HEI) have to persistently change in order to improve their services (Balzer 2010), to become competitive and in tandem with the other sectors. The higher education sector has also realised that Lean in management is useful for their work processes (Cristina and Felicia 2013; Hines and Lethbridge 2008). However, Lean in management has only been adopted by HEI about six to seven years before 2012, which can be considered as new compared to the manufacturing sector (Antony et al. 2012). Lean application in the work process of higher education sector has also been proven to provide more benefits to that sector and the other sectors. Among the benefits involved

are increasing the organisation's performance, reducing the work cost and also reducing the time cycle (Ziskovsky and Ziskovsky 2007).

In order to help universities to grab the advantages of Lean application, Balzer (2010) provides a clear guideline to improve the value and performance of the university's work processes. He discussed several cases of successful Lean application in certain universities. For instance, the University of Iowa has used VSM to evaluate the hiring work process and managed to reduce the number of steps in the work process and also the waiting time. Not only that, University of St Andrews (2012) has adopted VSM to evaluate and eliminate waste in the university's work process. However, the VSM application in the academic area is still scarce. Moreover, most of the HEI applied VSM or other Lean techniques in the administrative work processes (Balzer 2010). Emiliani (2015) claimed that he is the first researcher who applied Lean techniques in the academic work process, specifically in the teaching process. Lean application in the core processes of HEI, which are teaching and doing research, are far behind the administrative (Barrosso Santos, S.M.F., and Carravilla. 2010). Moreover, Barrosso et al. (2010) also said that, if the wastes in the academic work process were tackled first, this will ease the process of Lean application in the teaching area.

6.3 Why Mapping is Important

In the book written by Womack and Jones (1996) titled "Lean Thinking", the authors emphasised a phrase which is "just do it" to encourage people to start applying Lean in their work process. In fact, they have come out with 5 principles as a guideline for them

to adapt Lean philosophy, which has value, value stream, flow, pull and perfection. However, they realised that many people skipped the second step, which is to map the value stream. Before applying Lean in the work process, mapping the value stream is very important to understand the work flow. Lean techniques, such as kaizen, will be more effective if is applied purposely with VSM in eliminating the waste. Furthermore, Rother and Shook (2003) listed several reasons as to why the VSM is a needed tool for Lean implementation. The reasons are as follows:

- It helps to visualise the flow of the work process.
- It helps to recognise not only waste but also the cause of the waste.
- It visualises the connection between information and material flow of the work process.
- It helps in choosing the right Lean concepts and techniques based on the identified waste.

They also specified that mapping is not just a technique for deriving Lean; it also allows us to see the workflow visually and precisely. In support, Jimmerson (2010) also claimed that the VSM provides a vision of the process activities to identify any problem in the process. Hence, it gives an opportunity to solve the identified problem for improvement. Besides that, it also helps in providing values to the customer by way of eliminating waste in the process. In this way, this can help to increase customers' satisfaction.

6.4 Value Stream Mapping Steps

Toyota Production System is the founder of value stream mapping in the work process (Jimmerson 2010). Throughout its successful applications, the VSM has listed all the steps or activities that are involved in producing a product or delivering a service to the customer. According to Rother and Shook (2003), mapping every product that we have is not the best choice to begin the VSM process. This is because they explained the importance of drawing the value stream map for both current and future states.

Figure 6.1: Value stream mapping process (Rother and Shook 2003).

Figure 6.1 shows the steps of mapping the value stream. The first step of mapping is by selecting a family product. A family product is a group of products that have similar processing steps. Choosing a family product is important as it enables to select the right value stream. This is because for most of the time, an organisation produces more than one product. Hence, drawing everything on a map will make the mapping process difficult. This even makes it hard to identify the waste in the complicated work process. That is why the family product should be selected first to increase the successful percentage of Lean implementation. Table 6.1 shows the example of product family matrix in order to group the products in a family, which is by grouping the products that have the same processing steps.

Table 6.1: Product Family Matrix (Tapping, Luyster, and Shuker 2002: 31)

Based on Table 6.1, W and I can be classified as one family. Besides that, Y and J also can be classified as a family because both of them have the same processing steps. However, since W and I have more steps than Y and J, so W and J will be chosen.

After choosing a family product, the current state map is then sketched. The purpose of drawing the current state map is to see the flow of the work process clearly in order to identify the waste in order to implement the Lean. According to Rother and Shook (2003), one of the procedures to implement Lean in the work process is to produce the product based on the takt time and to develop a continuous flow. Takt time is the available work time per shift divided by customer demand per shift.

The next step is by drawing the future state map of the process. The future state map actually shows the improved work process. In other words, the future state map is drawn after Lean has been applied to treat the problem or waste that has been identified in the current state map. Then, the last step is to prepare the work plan and its implementation. This step contains a plan on how the improved work process (future state map) will be implemented and continuously improved over time (Locher 2008).

6.5 Mapping Procedure

Generally, all of the courses offered in University X and Y apply the same course planning and delivery process that has been outlined by their top management. To map the work process of course planning and delivery, the steps outlined by Rother and Shook (2003) was adopted. Besides that, other sources such as those by Tapping and Shuker (2003) and Jimmerson (2010) also have been referred in this study. They have discussed the implementation of VSM in the service sector, which is a more relevant sector for this study. This study follows the four steps of value stream mapping process (Rother and Shook 2003) to map the course planning and delivery process. The mapping process also

involved 12 lecturers from each of the university. Besides that, this study has also received support from the head of department and the dean of faculty from each of the academic programmes that are considered in this study.

6.5.1 First Step: Choosing Value Stream

Value stream is a flow of activities that deliver 'value' to the customer (Tapping and Shuker 2003). In the higher education sector, a student is classified as the main customer who receives the core service offered by the higher education institution. The student's perspective on value definition is that where he or she receives quality teaching and learning process from the university in the course of pursuing his or her degree (Swee Mei and Kong Teong 2002). Thus, this study has focused on teaching process, and thereafter the course planning and delivery process of the teaching process.

The first step in developing the value stream map for this study is by listing all of the services offered by University X and Y. Both universities offer more or less similar academic programmes, which are the Diploma, Bachelor's Degree, Masters Degree, and Doctor of Philosophy (PhD). The value stream map for the Bachelor's Degree and Diploma programme has similar work processes; however the study duration is different. The value stream map for the Bachelor's Degree programme has been chosen because of the number of students enrolled in that programme is higher compared to the Diploma programme (Tapping and Shuker 2003).

There are also several factors that are considered in choosing the right value stream. According to Tapping and Shuker (2003), the voice of the customers is very important to select the value stream as not all of the value stream can be solved simultaneously. In this study, the voice of the customers has also been considered in choosing the right value stream that is to be solved. As mentioned earlier, an exploratory study has been conducted to first understand the situation and problem that are faced by the customers. The data and information gathered from the exploratory study are very useful in improving the work process when used with value stream mapping.

6.5.2 Second Step: Drawing the Current State Map

There are two semesters in a year of an academic term. Semester I (starts in September) is the first session of the academic year and Semester II (starts in February) is the second session of the academic year. The study term consists of 14 weeks of study in each semester. The 14 weeks of study are further divided into two, separated in between by a week of mid-term break. This study is conducted in Semester I, which is in September. There are about 4-5 weeks of semester break after Semester I completed and before Semester II begins. Whereas, there are about 10-11 weeks of semester break after Semester II completed and before Semester I begins in the following year. Usually, the final year students will undergo industrial training during this long break.

Figure 6.2: Upstream and Downstream of Map (Tapping and Shuker 2003).

In this stage, the current state map for course planning and delivery process is drawn. The drawing process begins from the downstream and backwards to the upstream of the work process. According to Tapping and Shuker (2003), the current state map can be drawn by "walking" from the downstream to the upstream of the process. In this study, the downstream of this process is the students, while the upstream of the process is the university. Based on the information collected, the closest activity to the students in the course planning and delivery process was identified. Then, the process was mapped backwards by walking to the upstream of the process. The closest activity that has been identified in the downstream is the students who receive their results. This process is done by logging on to the university's website by using their designated username and password via the intranet system. Before the results were released to the students, the marks were imported into the system. The lecturers have to mark the examination papers and prepare all of the assessment marks. The prior activity before the marking process by the lecturers is the student's final examination process.

In the study week, which is a week before the final examination, it is necessary for the lecturers to release the carry marks for the student's information. The carry mark is very important to them because it shows to them their achievement throughout the 14 weeks of study term. Commonly, the total of carry mark weighs about 40 to 50 percent of the student's mark for the course. Carry mark is a total score of the course assessment during the study period, such as quizzes, tests and a group project. The rest of the score is contributed by the final examinations mark which weighs about 50 to 60 percent of the student's mark for the course, depending on the course structure. The study term can be divided into two terms which are the first term and second term. In between of the terms is a week of mid-term break. The duration of the study term is 15 weeks, including a week of mid-term break. The first study term is around 6 to 8 weeks before the mid-term break. The second study term is also around 6 to 8 weeks. Subsequently there is usually a study week, right before the final examination weeks. For this study, there were six weeks for the first term and another eight weeks for the second term.

During the study term, there are three primary activities involved which are course preparation, lecture and consultation. In both terms, a different assessment must be carried out. These are tests, quizzes, students' presentation and project submission. In between of these terms is the mid-term break. The students are eligible for a week of study leave. During this week, the lecturers perform the marking process for the Test 1 assessment. Figure 6.3 below shows the current state map for course planning and delivery process that have been drawn based on this information and based on VSM data set that will be discussed in the next section.

The symbol Δ indicates time waste or delay activity. While ** indicates redundant activity happening.

Figure 6.3: Current-state map

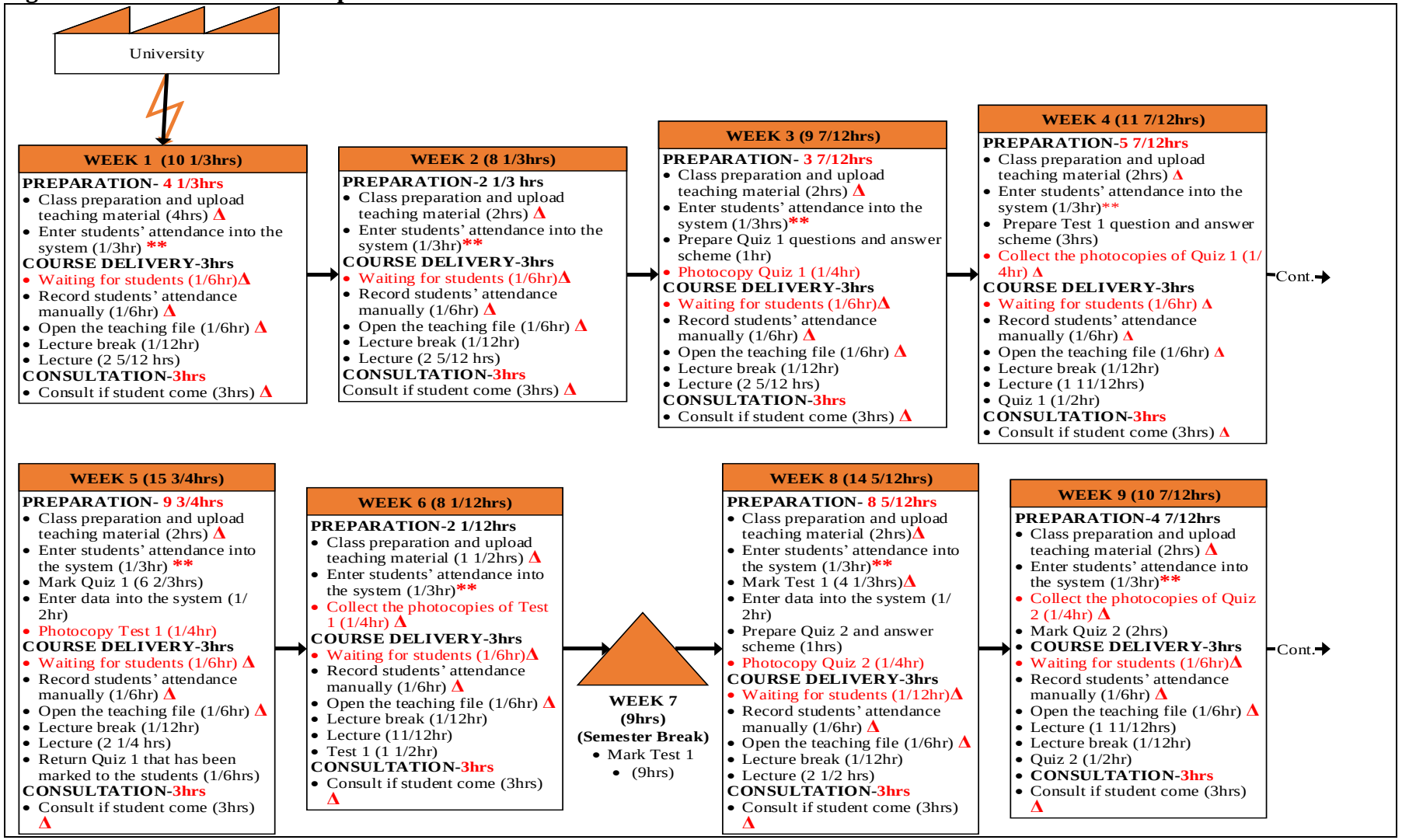
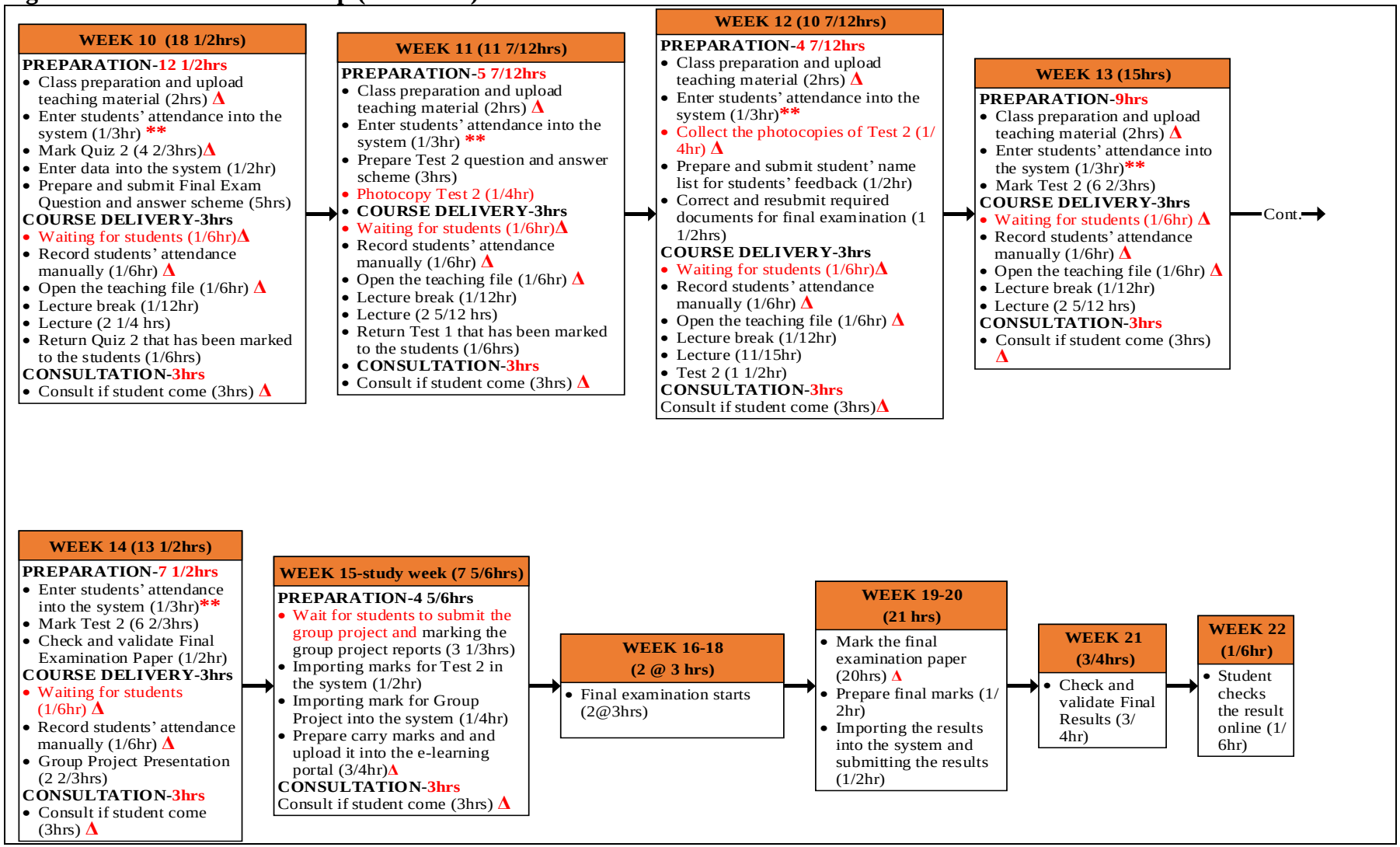


Figure 6.3: Current-state map (continued)



6.5.2.1 Value Stream Mapping Data Set for Course Planning and Delivery Process

The overall time duration for the Semester I (September) is about 22 weeks, which includes 14 weeks of study term, a week of study week (revision week), three weeks of final examination and four weeks of semester break. The process has been mapped according to each of the week in Semester I. The time allocated per week for a course is stated as follows:

- Class preparation = 3 hours per week
- Course delivery = 3 hours per week
- Consultation = 3 hours per week
- Total time allocated for a course = 9 hours per week

Then, the cycle time for each activity is collected. Cycle time is the time duration to complete each of the activities. This data have been prepared based on a total of 40 students per class as agreed by the VSM team which consists of the lecturer, head of department and dean of the faculty. The information is collected as follows:

1. Class Preparation

   The total time allocated for the class preparation is three hours per week. During the class preparation, the lecturer prepares all of the materials needed for the course, such as preparing the teaching notes for the next lecture session, uploading the notes in the e-learning portal, marking quizzes, tests and others. Below is the cycle time for all of the activities during class preparation:

- Cycle time for preparing teaching plan and portfolio = 2 hours
- Cycle time for preparing and uploading teaching material = 2 hours/week
- Cycle time for importing students' attendance into the system = 10 minutes. The three hours of lecture is split into two different classes, the total cycle time for importing students' attendance into the system is 20 minutes per week (2 classes x 10 minutes)
- Cycle time for preparing the questions and answer scheme for a quiz = 1 hours
- Cycle time for preparing the questions and answer scheme for a test = 3 hours
- Cycle time for photocopying a quiz = 1/4hour
- Cycle time for photocopying a test = 1/4hour
- Cycle time for collecting the photocopies of a quiz = 1/4hour
- Cycle time for collecting the photocopies of a test = 1/4hour
- Cycle time for marking a quiz = 10 minutes x 40 students = $6\frac{2}{3}$ hours.
- Cycle time for importing students' marks into the system = ½ hour
- Cycle time for marking a test= 20 minutes x 40 students = $13\frac{1}{3}$ hours
- Cycle time for preparing the questions and answer scheme for the final examination question= 5 hours
- Cycle time for preparing and submitting students' names list for the end course feedback = ½ hour
- Cycle time for correcting and resubmitting the required documents for final examination = 1 ½ hours

- Cycle time for importing students' marks for a Group Project into the system = 1/4hour
- Cycle time for preparing carry marks and uploading into e-learning portal = 3/4hour
- Cycle time for marking the final examination paper = 30 minutes x 40 students =20hours
- Cycle time for preparing final marks = 1/2 hour
- Cycle time for importing and submitting the results = 1/2hour
- Cycle time for checking and validating final results = 3/4hour

2. Course Delivery

The course delivery duration provided for a three credit hour course is three hours. Below is the cycle time for all of the activities during course delivery:

- Cycle time for lectures depends on other activities on that week in course delivery as below:
- Cycle time for taking attendance manually = 1/12hour per class, for a week = 1/12hour x 2 classes = 1/6hour per week
- Cycle time for a quiz = 1/2hour
- Cycle time for a test = 1 1/2hours

3. Consultation

Normally, three hours of consultation sessions for each subject have been allocated per week. Students can also make reservation for a consultation session

through email if the session is needed at any time other than the fixed scheduled consultation hours.

- Time allocation for consultation is 3 hours. The actual cycle time normally is less than 3 hours except in certain times when it is getting close to exam week.

4. Mid-term break week

   There is a mid-term break which is a week break for the students after eight weeks of study term. During this week, the lecturer uses the time allocation for a course which is 9 hours per week to mark the answer scripts of Tests.

5. Final Examination

   The final examination starts after the study week and can take up to three weeks. The time duration for a final examination session (one paper of final examination) is 2 or 3 hours, depending on the course or programme requirement.

   - Cycle time for final exam = 2-3 hours.

6. Results

   Results are released to the students 3 weeks after the last day of the final examination.

6.5.2.2 Identifying Waste in Course Plan and Delivery Process

In HEI, eliminating waste is eliminating something that is not valued by the students who receive the main or core services (Tapping and Shuker 2003). Figure 6.4 shows the

problems and wastes that occurred in the course planning and delivery that have been identified through several methods. The process of identifying the waste in this study has been conducted similar to the analysis of previous studies. Besides that, the data that have been collected through the exploratory study were also used to identify the wastes that occurred in the process. These data have been used together to analyse the current state map and also in finding the root cause of the problems.

There are seven types of waste that occurred in the work process (Locher 2008). The waste can be categorised as inventory, defects, overproduction, motion, waiting, transportation and processing. In the higher education sector, Maguad (2007) discussed about seven types of waste in the higher education sector:

1. Inventory waste

Inventory waste is a waste that happens when surplus stocks exist. The stocks are not necessary at the present time and are stored to be used next time. Hence, the cost to keep the stocks will increase. Besides that, it will also increase the possibility of the stocks cannot be used due to their expiry dates. In HEI, the possible inventory waste includes printing or photocopying the final examination question papers more than are required.

2. Defect waste

The defect may occur when work is not done correctly at the first time and it has to be repeated. The cost that will be incurred is reworked cost such as labour, time and etc. For instance in HEI, the defect can happen when the lecturer has

mistakenly transferred the students' marks into the system and need to correct this again.

3. Overproduction waste

Overproduction waste occurs when something has been produced more than what is required and earlier than required. An example is printing the meeting agenda before it is needed.

4. Motion waste

This waste refers to the worthless movement of people that happens during the work process. Waste in motion occurs when unnecessary activities exist in the work processes, for example, the lecturer needs to walk to the centre of a photocopier to photocopy his/her documents.

5. Waiting waste

This waste occurs when waiting for something or when any delayed work is occurring. For example, the students have to wait to receive the confirmation letter for their practicum. This will lead to time waste and delay the process for the next job.

6. Transportation waste

Transportation waste is the unneeded movement of things within the work process, such as the movement of materials and information. Besides that, temporarily locating, filing, stocking, or stacking material or information can also

be classified as transportation waste. One example is the unnecessary movement of paper work for students' activities to get the approval and signatures.

7. Processing waste

Processing waste occurs when dealing with something more than is required and worse still redundant. One example of this waste is when a similar work is performed by two workers due to misunderstanding or miscommunication.

Identifying the wastes in the process first is very important to know the exact waste that has disrupted the process flow. It is also believed that the wastes in this study might be different from the wastes that have been identified in manufacturing organisations or other HEI. It may be different because the nature of the work process obviously differs between those organisations and the organisations involved in this study. The identification process is illustrated in Figure 6.4.

Figure 6.4: Wastes and Perceived Problem in Course Planning and Delivery Process

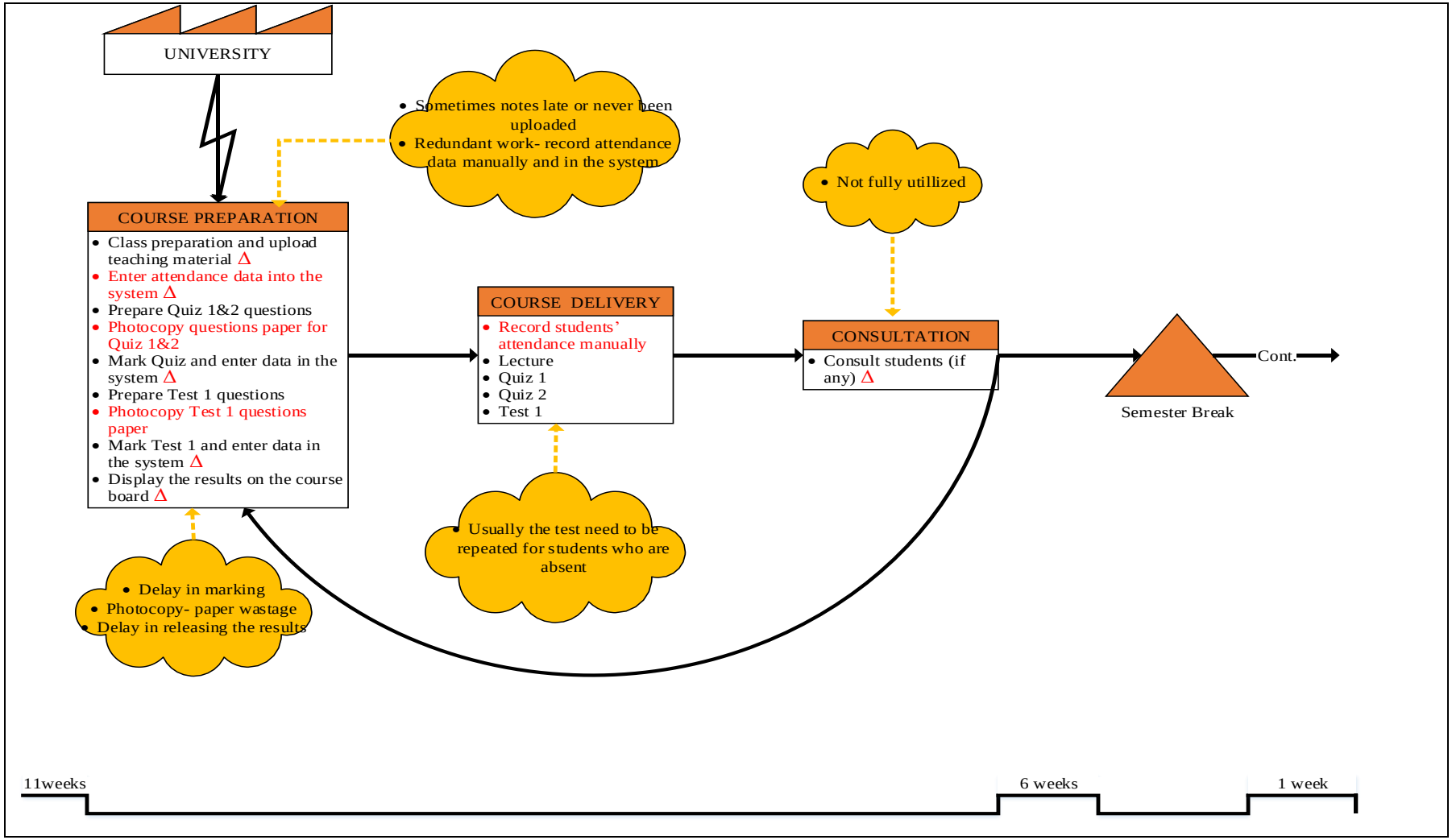


Figure 6.4: Wastes and Perceived Problem in Course Planning and Delivery Process (continued)

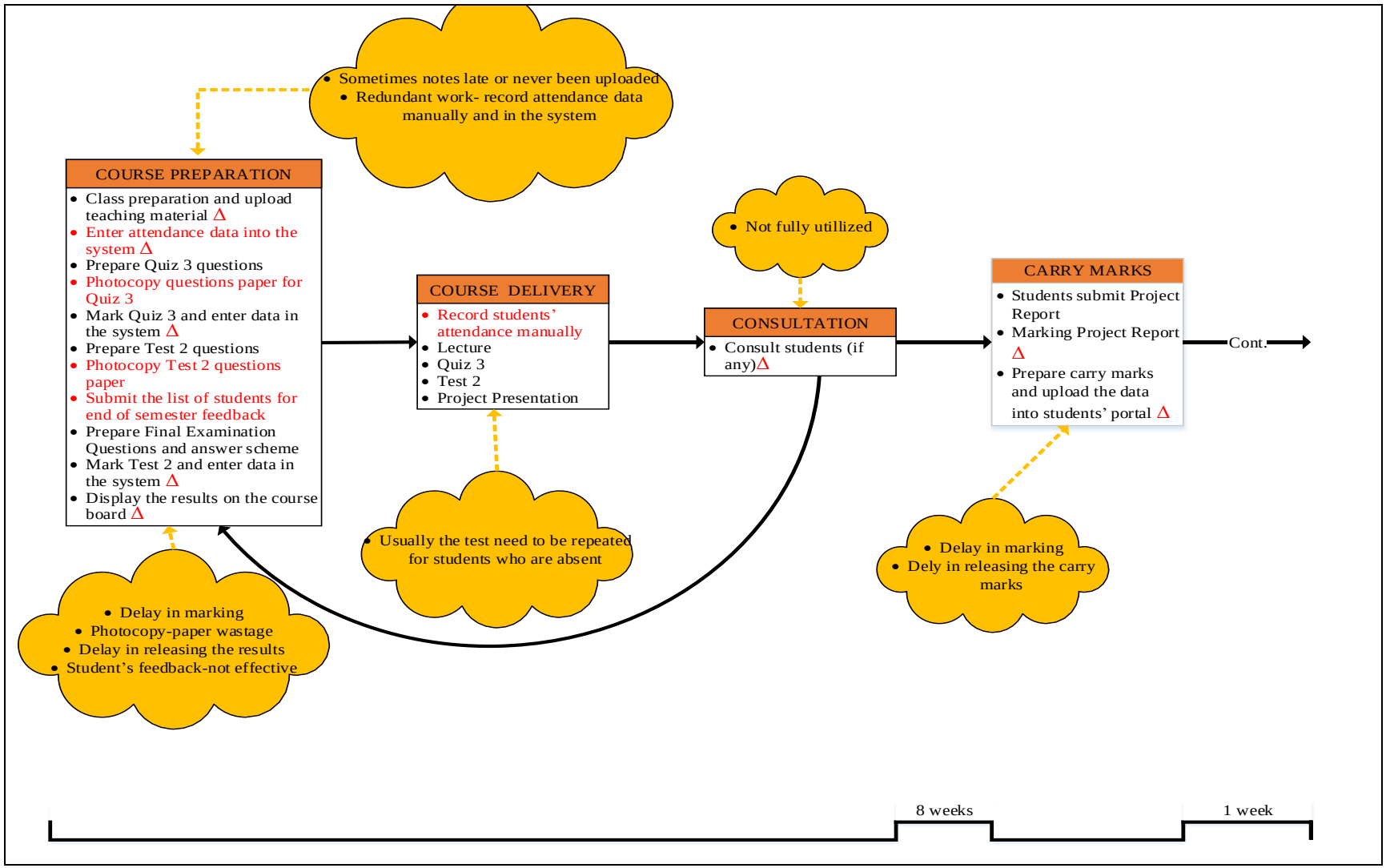


Figure 6.4: Wastes and Perceived Problem in Course Planning and Delivery Process (continued)

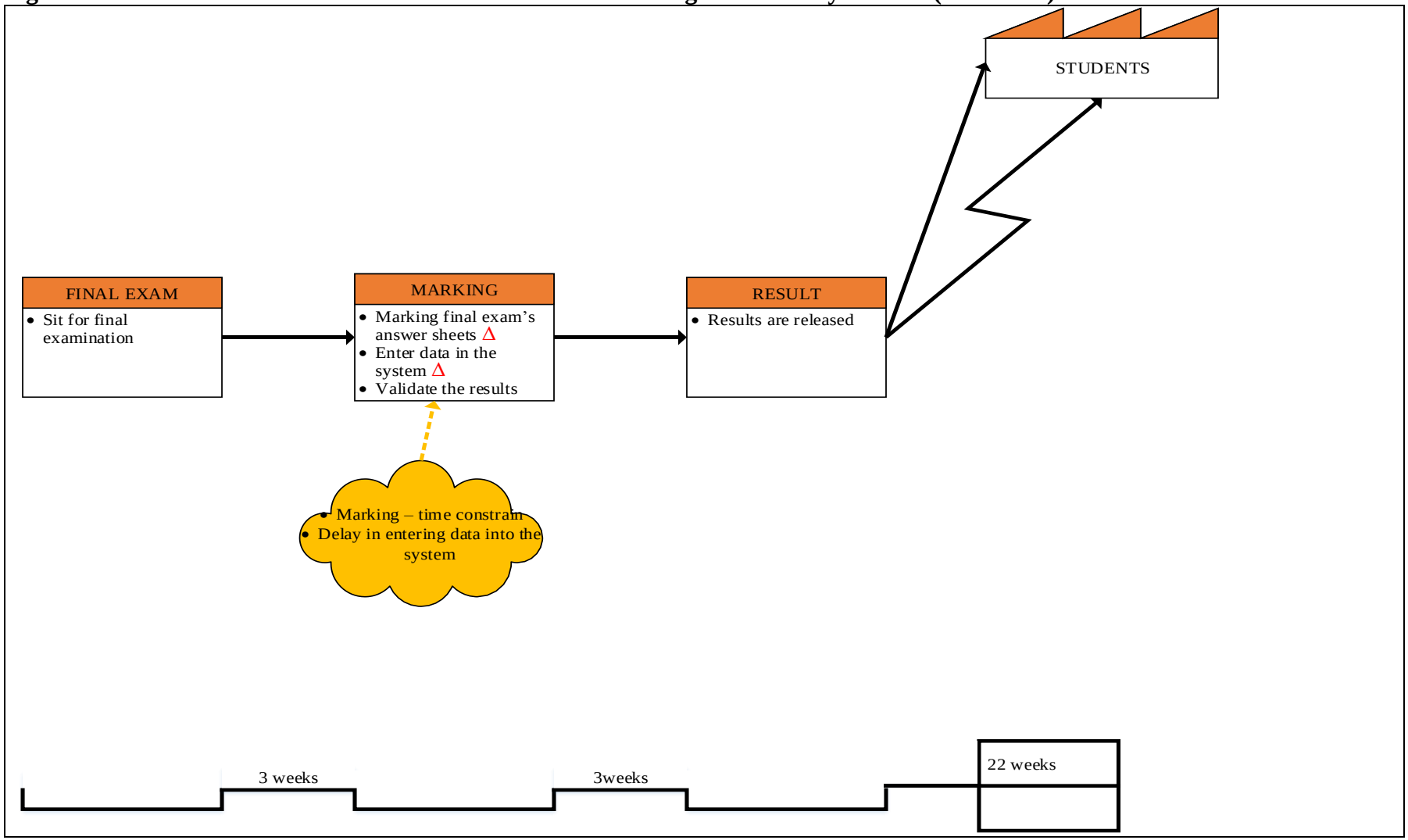


Table 6.2: Perceived problem and waste in course planning and delivery process

NO.	PROBLEM AND WASTE
1	Waiting – Sometimes, the lecture notes are late or never been uploaded
2	Waiting for students before lecture
3	Redundant work- record attendance data manually and in the system
4	Lateness in marking
5	Photocopy-paper wastage
6	Waiting-Delay in releasing the results
7	Sometimes the test need to be repeated for the students who are absent
8	Student's feedback-not effective and did not receive full cooperation
9	Waiting-Delay in releasing the carry marks
10	Consultation sessions were not fully utilized

Table 6.2 shows the summary of problems and wastes that have been identified in the course planning and delivery process of this study through the analysis of current state map. Based on this information, the root cause of the problems and wastes is examined in the next section by using five why analysis.

6.5.2.3 Identifying the Root Causes of Waste

Understanding the root cause of the waste is very important to identify what has triggered the problem. This process is important to solve the problem based on the cause of the waste and to apply the appropriate solution. In order to identify the root cause of the waste occurring in the course planning and delivery process, the five why technique was used.

Table 6.3: The 5 Why's Analysis

No.	Waste	Analysis – 5 Why
1	Waiting -Sometimes lecture notes are late or never been uploaded	• Why there are delays in uploading the notes? *Does not have enough time* • Why the time is not enough? *No proper plan for work preparation and time management*
2	Lateness in marking the assessment	• Why there are delays in marking? *Does not have enough time* • Why the time is not enough? *There are too much papers to mark in a short time period* • Why there are too many papers to mark in a short time? *The lecturer also has other courses to teach*
3	Waiting-Delay in releasing the results	• Why there are delays? *Lateness in marking* • Why the lateness in marking happen? *Does not have enough time* • Why the time is not enough? *-refer No. 2-*
4	Waiting for students before lecture	• Why the lecturer waits for the students before lecture? *The students have another class and need time to reach the second class* • Why they need time? *There is no time gap between the classes to walk from the previous classroom*
5	Redundant work -record attendance data manually and electronically in the system	• Why the attendance needs to be recorded electronically? *To ease the analysis of students' attendance for further action such as to give warning to students who are absent more than permitted days*

No.	Waste	Analysis – 5 Why
		• Why the attendance has been recorded redundantly? *Does not have enough time to record the attendance electronically in the class*
6	Photocopy-paper wastage	• Why the paper wastage happen? *Use more paper for photocopy quizzes, test, final exam etc. and produce more than needed* • Why produce more than needed? *For reservation*
7	Sometimes the test need to be repeated	• Why sometimes a test needs to be repeated? *Sometimes there are some students who are absent on the day the test was conducted* • Why are they absent on that day? *Apart from students that have legal excuse, there are some of the students absent for personal reason* • Why they have personal reason on that day? *The test took place out of class time* • Why the test took place out of class time? *There is no available place on the test date* • Why there is no available place on the test date? *No proper plan at the beginning of semester*
8	Student's feedback-not effective	• Why the student's feedback not effective? *There is no opportunity to improve during the study term* • Why there are no opportunities to improve during the study term? *It was conducted only once in a study term which is at the end of semester*

No.	Waste	Analysis – 5 Why
9	Waiting-Delay in releasing the carry marks	• Why there is delay in releasing the carry mark? *Does not have enough time to prepare the assessment's mark* • Why there is not enough time to mark the assessment? *Some of the students were late in submitting group project's report* • Why the students are late in submitting group project's report? *Some of the students prepare the report last minute* • Why the students prepare the report last minute? *The report submission is usually at the end of semester, a week before final exam*
10	Consultation was not fully utilized	• Why the consultation was not fully utilised? *Some of the students did not come* • Why the students did not come? *Sometimes the consultation hours overlapped with other class schedule*

Table 6.3 shows the root cause analysis of 5 whys according to the wastes that have been identified in the course planning and delivery process. It is very important to examine the root cause of the wastes in this study to ensure that at least the waste can be reduced or if possible, eliminated totally from the process. According to Balzer (2010), analysing the root cause of the waste or problem will help to determine the appropriate Lean techniques or methods to be implemented. In addition, it will also provide a greater chance of success in reducing or eliminating the waste. This is because the waste needs to be treated from the root or the source of the waste.

6.5.3 Third Step: Draw the Future State Map

The main objectives of future state map are to be achievable and closer to the perfect state (Jimmerson 2010). However, it does not have to be perfect and covers everything at the first sight or time (Keyte and Locher 2004). The most important thing to achieve it is to continuously repeat the process of mapping to remove the identified waste. In this study, the future state map has been drawn to remove or reduce the waste that occurred in the process to develop a continuous work flow (Tapping and Shuker 2003). To accomplish the coveted continuous work flow, students' problems and expectations have to be examined to understand the situation. It is very important to consider the customer's voice to draw the smooth future state map and to satisfy them (Emiliani 2015). The data and information have been identified from the analysis of the current state map in the previous step of VSM (refer Figure 6.4).

Figure 6.5: Solutions to Reduce or Eliminate Wastes and Perceived Problem in Course Plan and Delivery Process

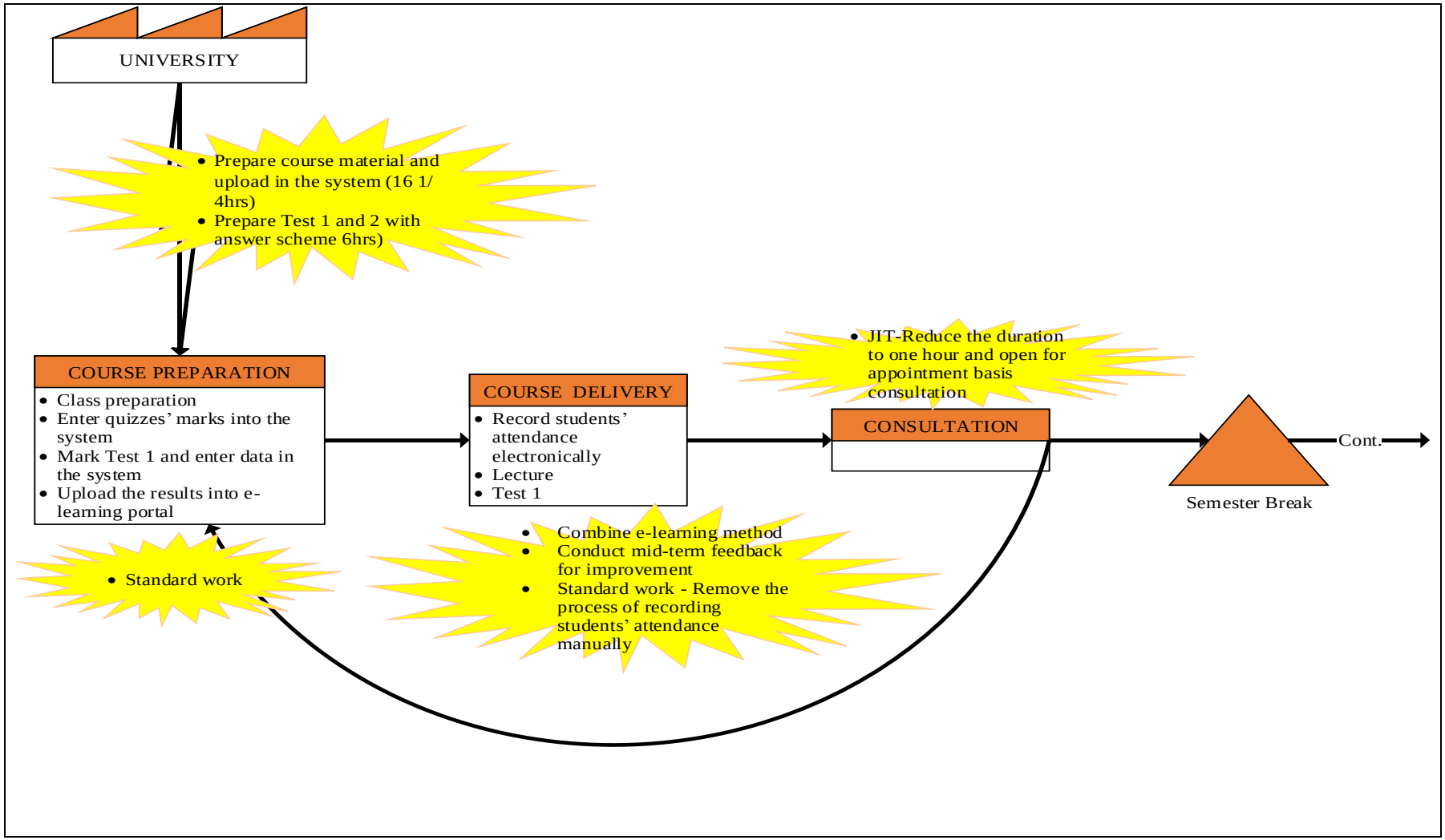


Figure 6.5: Solutions to Reduce or Eliminate Wastes and Perceived Problem in Course Plan and Delivery Process (continued)

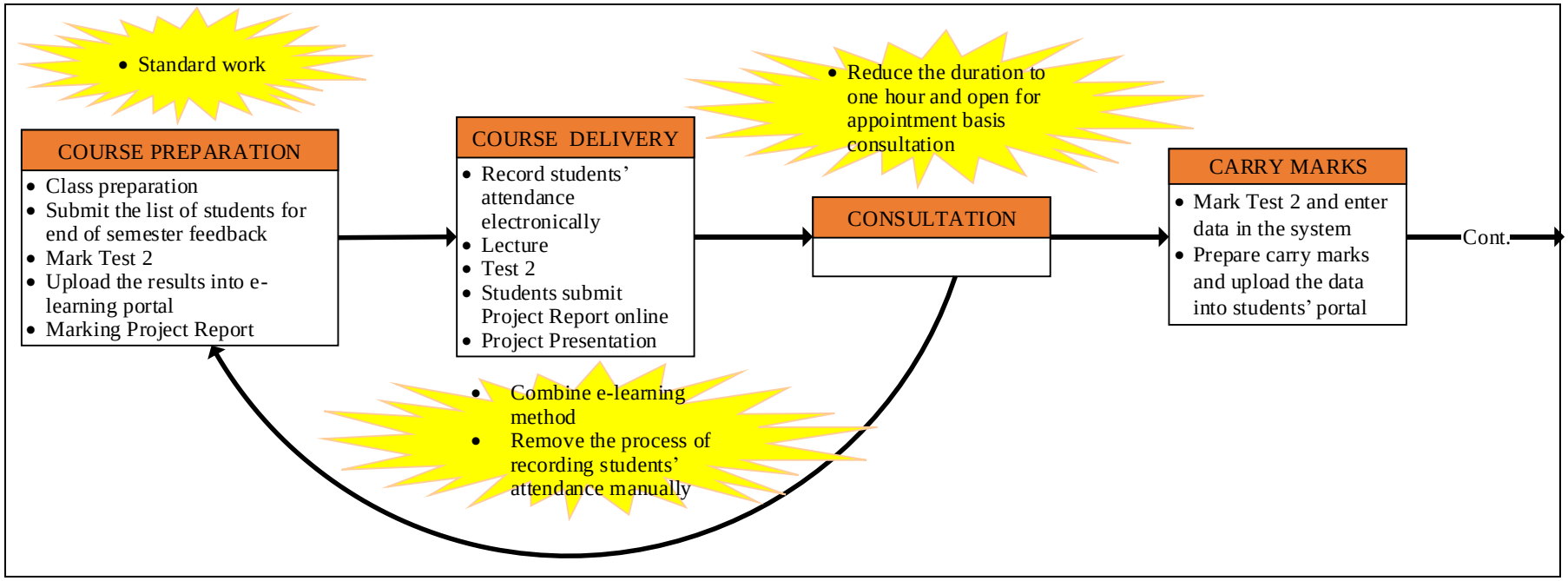
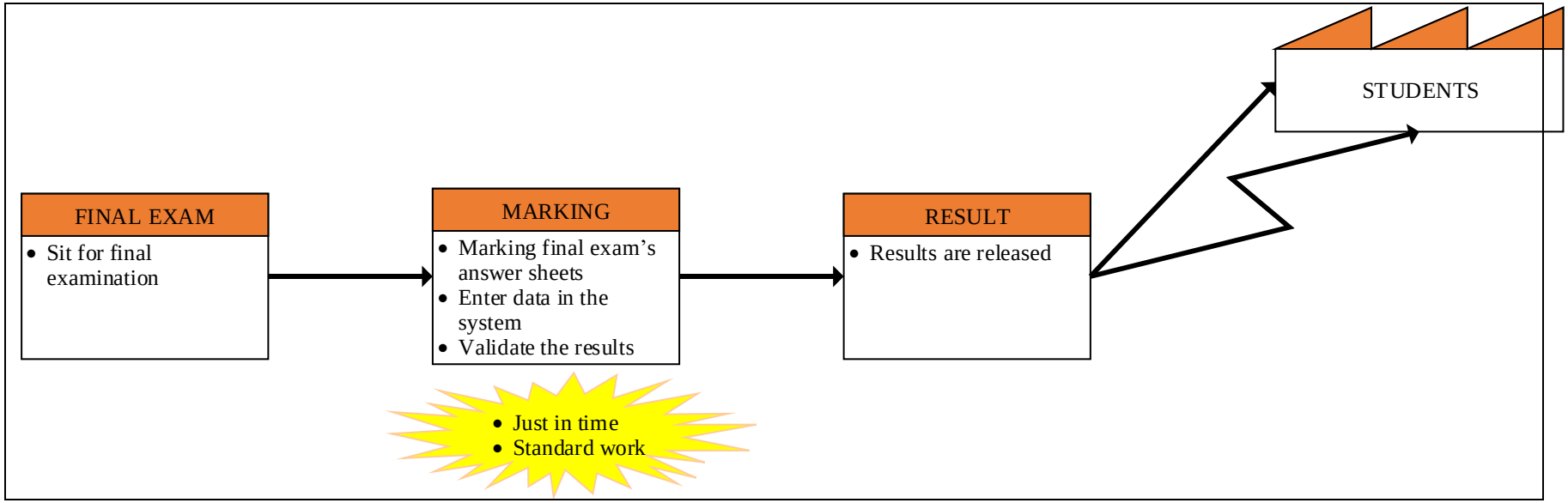


Figure 6.5: Solutions to Reduce or Eliminate Wastes and Perceived Problem in Course Plan and Delivery Process (continued)


FINAL EXAM
Sit for final examination
MARKING
Marking final exam's answer sheets
Enter data in the system
Validate the results
RESULT
Results are released
STUDENTS
Just in time
Standard work

6.5.3.1 Continuous Flow-Reduce the Waiting Time and Delay

In this step, the appropriate Lean tools have been applied based on the problems or wastes that occurred in the process, to improve the process flow. Figure 6.5 shows some of the Lean tools that have been applied in the process to reduce or eliminate wastes and also perceived problem in the course planning and delivery process.

1. 5S

Naftanaila and Mocanu (2014a) said that 5S is an approach that is built from 5 Japanese words that start with the letter "S". They are seiri, seiton, seiro, seiketsu, and shitsuke, which means to sort, stabilise, shine, standardise and sustain, respectively. Tapping and Shuker (2003) and Balzer (2010) have defined 5S as an improvement process that includes 5 activities which are sort, set in order, shine, standardize and sustain. 5 S was implemented in this study to cLean and organise the workplace of the lecturers so much so that waste in the work process can be reduced or eliminated. The processes are as follows:

i. Sort- all the items have been sorted by removing the unimportant or inappropriate items such as computer files, stationery and books to avoid mistake and waste.

ii. Set in order- all the important items have been arranged in order to ease the use of an item. One example of an item is course materials (such as books, note and handouts), computer files, e-learning portal and etc.)

iii. Shine- at this stage, cLeaning has taken place to make the work area cLean and maintained.

iv. Standardized- a procedure has been setup such as all the items taken, should be placed back to the same place. A label or guideline has been used to avoid confusion and to provide easy viewing

v. Sustain- a work list has been made as a guideline to maintain the cLean and organise the work place

2. Reduce changeover time

The changeover time, which is the semester break at the end of each semester, has been reduced by doing the preparation for the next semester instead of waiting for the semester to begin. The lecturer will use the changeover time to prepare the subjects' materials and upload them into the e-learning portal. Besides that, the question set for Test 1 and 2 and the answer scheme should also be prepared during this time.

There is also another waiting waste happening in this process. Normally, the students would take a few minutes of walk to the class because they had other previous class. The lecturer had to wait for them before the lectures can get started. Instead of waiting for the students, the lecturer can reduce the time by opening the lecture's slides and log on to the online students' attendance application. In addition, the redundant work which is recording the attendance manually has been eliminated from the work process. This is because the attendance has been recorded electronically during the lecture break.

3. Introduction of technology

Introduction of technology is very important nowadays in the higher education sector to reduce the process time and error (Balzer 2010). Moreover, Emiliani (2015) explained that the use of technology in the university process will provide continuous flow and will help in smoothing the process flow particularly when done in combination with Lean management. In this study, online quizzes and project submission have been introduced to improve the process flow by reducing the delay in marking and returning the results. Students will get the quizzes' score immediately after answering the quizzes. Not only that, the motion waste and paper wastage can also be reduced since there is no movement needed to photocopy the question. The amount of paper used to photocopy the questions can also be reduced.

In terms of project submission, some students are late in submitting their reports. This situation happened because of poor time management. Usually, the submission date for project report is at the end of semester and this has led the students to procrastinate, that is, put less priority in preparing the report. Consequently, the report is being prepared at the last minute. The lateness of project report submission has caused delay in releasing students' carry marks.

Besides that, the delay in the marking process has resulted in most of the students not able to collect their report back as they are busy preparing for their final examination. Hence, the online submission has been applied in this study to reduce the waste. With this, the students will be more responsible to submit their

report on time before the last date to submit. The system will not allow them to submit their reports after the dateline. This will also help to reduce the amount of paper used. In addition, a standard manual for the report format such as how to write the report and how the report will be assessed with the marks criteria should be provided to the students to ease them in doing the assignment since the students have known the requirements of the report clearly (Emiliani 2004a).

4. Just In Time

Consultation session is one of the important activities in course planning and delivery. This session provides the student with an opportunity to ask question or to solve the problem that they have. Normally, the lecturer will allocate three hours of consultation session per week for a three credit hour course. Based on the analysis of current state map, the consultation session was not effective and therefore was not fully utilised. Among the factors that have caused this is sometimes the scheduled sessions clashed with the students' available time. This situation has made the consultation session as not effective and underutilised. This has led to waste in terms of waiting by the students. To overcome this problem, Just in Time has been applied since it is the most suitable tool where the pull systems and demand levelling can be used to control the situation. According to Balzer (2010), JIT can be applied to overcome the universities' problem where they always produce services or goods before they are needed by the customers. Universities produce something based on what they have planned which caused wastes to be occurred in the process. In this study, consultation session has been determined as one hour per week as a walk-in session to reduce the waiting waste.

The consultation session can also be organised by appointment as and when required. The lecturer can set the minimum and maximum session per week based on how many students they are able to handle.

5. Standardised Work

Standard work is very important in this study to reduce the waste in the course planning and delivery process. A standard course planning helps the lecturer to reduce variety of wastes by planning all the activities with the proper date and place. Usually, the lecturers have problems in scheduling the test dates and places because they did not set them at the beginning of the semester. Apart from that, the tests are usually conducted beyond the lecture time, which is at night, in order to get available places and suitable dates. Sometimes, the test needs to be repeated since some of the students were not available on that date. This has led the waste to occur since the tests were conducted more than once and the lecturer also needs to prepare another equivalent test questions. Besides that, most of the lecturers have to mark the assessments or do the course preparation at home, which is beyond the office hour and would have disturbed their personal life. The standard work helps in reducing this waste by scheduling all of the activities of course planning sequentially including the time, date and place of the activities within the available time. Hence, this will provide the lecturer with a proper guideline to ensure the work has been carried out smoothly as planned.

The lateness of marking the course assessment can also be reduced by standardising the marking process. It is important to respect for people who are

able to reduce the waste by way of respecting their time (Emiliani 2004a). This can be done by marking and returning the course assessment on time. It can also help the lecturer to reduce the lateness in releasing the carry mark before the final examination starts since all of the assessments have been marked and returned on time.

6. Continuous Improvement

Student's feedback is very valuable because it provides information about the student's responses regarding the course planning and delivery process, based on his or her experience. This information is very important to the lecturers as they will use it as a benchmark to improve their performance. Unfortunately, the lecturer only has the opportunity to do the improvement for the future of the next batch of students based on the student's feedback. This happens because the survey was conducted at the end of semester. In fact, the students also did not have the chance to see the changes that have been done based on their feedback. Additionally, there are also some lecturers who do not take any action to improve and are resistant to change (Emiliani 2015). The agreed solution for this problem is by collecting the students' feedback not only at the end of semester, but also at the mid of semester or anytime during the study term for continuous improvement. This is also one of the respects for the people approach that has been underlined in the Lean management. That is, appreciating all of the views in an organisation.

Figure 6.6: Future-State Map

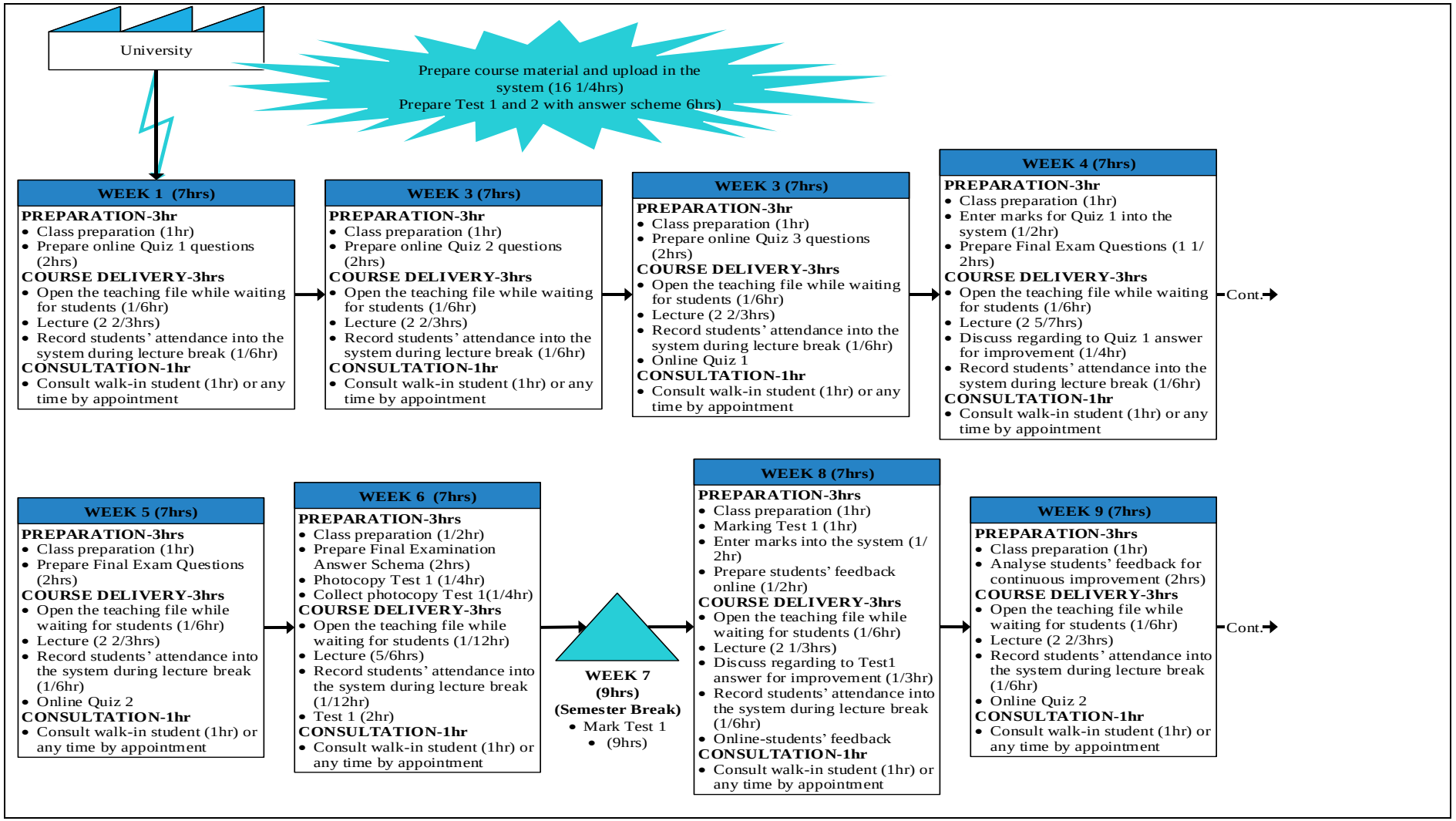
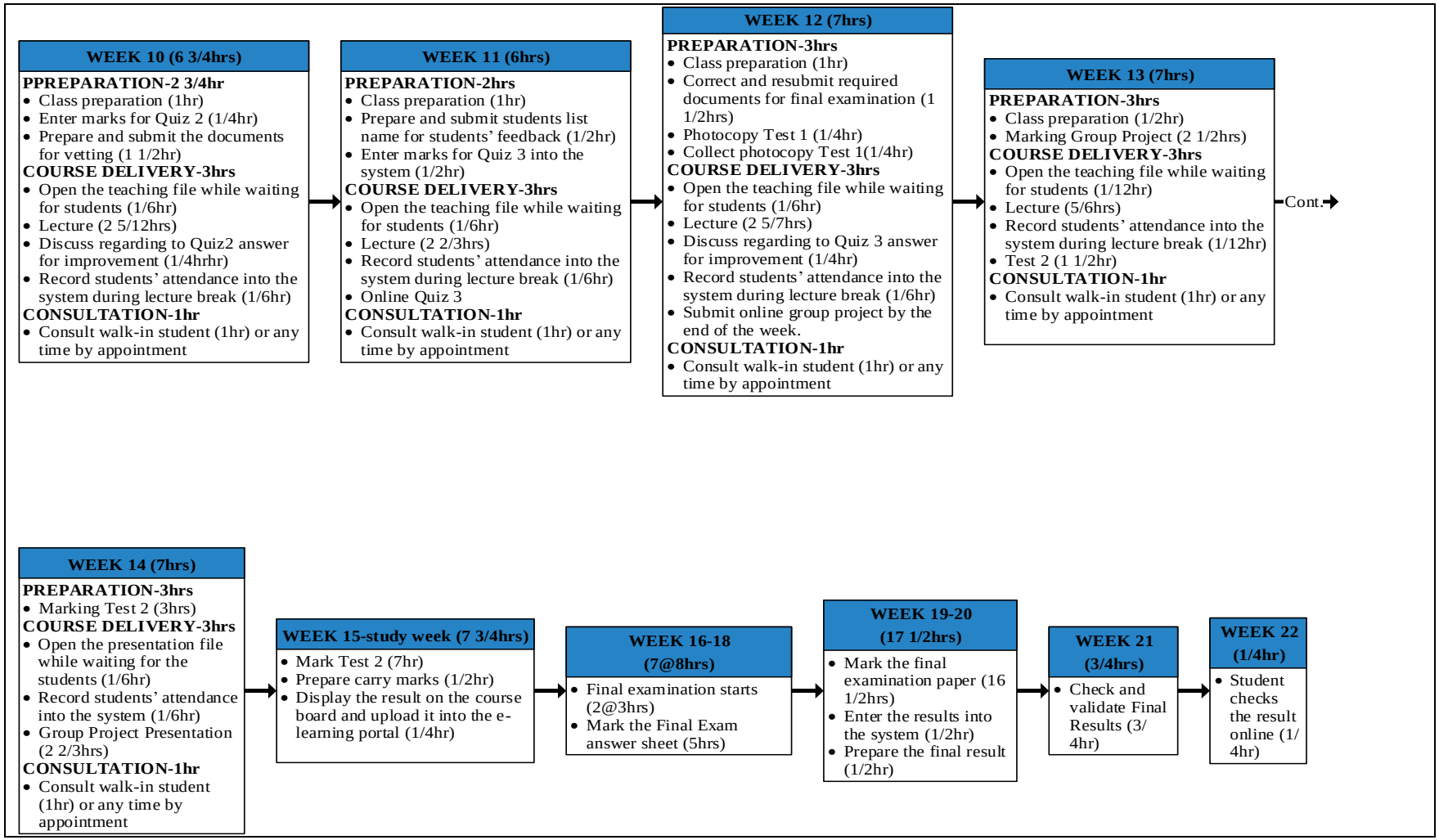


Figure 6.6: Future-State Map (continued)



6.5.4 Fourth Step: Work Plan and Implementation

In this step, the goals and targets of VSM are clearly defined. Defining the goals and planning for the implementation will help to ease the implementation process and increase the effectiveness (Tapping and Shuker 2003; Balzer 2010). Hence, several goals have been set up to ease the implementation of VSM. The goals of VSM for this study are as follows:

i) To reduce the course planning time according to the available time per week (e.g. 9 hours)

ii) To reduce consultation time to one hour and also based on appointment.

iii) To reduce waiting time by utilising the e-learning portal.

iv) To return the students' mark on time.

v) To do the improvement continuously by collecting the students' feedback information during the study term to improve the process.

In order to implement the plan, the communication factor is also very important. Communicate the plan and process to each people in the upstream and downstream, and this should be done repeatedly to make sure that all of the information have been delivered correctly and clearly (Balzer 2010). Besides that, it will also help to reduce the difficulty to do the changes since most people tend to resist to change (Tapping and Shuker 2003).

Table 6.4: Value Stream Mapping Plan

No.	Work plan	Person in charge	June	July	August	September	October	November	December	January
1	Reduce changeover time									
2	Utilise e-learning portal									
3	Standardised work									
4	Continuous Improvement									

In this study, the plan has been communicated regularly to ensure that all people understand and are at ease in doing the changes. The VSM plan has been created to provide guideline in implementing the Lean application, in the course planning and delivery process. This plan includes the work plan that will be implemented, the people who will be responsible to implement the work, and also the start and end date of the implementation of the work plan. The plan has been scheduled as in Table 6.4 to help in implementing the future state map.

6.5.5 Analysis of VSM

Besides that, the value added, non-value added and non-value added but necessary activities also have been determined. According to Hines and Rich (1997), value added activities is activities that add value to customer such as painting and assembly the parts. Non-value added is an activity that does not add value to the customer, such as delay and waiting. The non-value added but necessary is an activity that does not add value but necessary to do such activity as walking to the store to because the car broke down..

Based on the current and improved process, the value added, non-value added and non-value added but necessary activities have been recognized as follows:

1. Value added activities:
    - class preparation and upload the teaching material
    - lecture
    - consultation
    - preparing Quiz 1, 2 and 3 (including the answer scheme)
    - preparing Test 1 and 2 (including the answer scheme)
    - preparing the final exam questions and answer scheme
    - marking the assessments (including the quizzes, tests, assignments and final examination)
    - importing the results in the system
    - return the results (including the quizzes, tests, assignments and final examination)
    - preparing the carry marks and upload them into e-learning portal

2. Non-value added activities:
    - recording students' attendance manually
    - waiting for students before class/consultation

3. Non-value added activities but necessary:
    - entering students attendance on the system
    - opening the teaching file
    - lecture break
    - photocopying Quiz 1,2 and 3; test 1 and 2
    - collecting the photocopies
    - check and validate final examination paper
    - check and validate final results

Table 6.5: Value Added, Non-Value Added but Necessary and Non-Value Added Activities

Activity	Current Process		Improved Process	
	Time (Hrs)	**Percentage (%)**	**Time (Hrs)**	**Percentage (%)**
Value Added	157	78 2/5	124	94 2/7
Non-Value Added but Necessary	10 7/12	5 2/7	7 1/12	5 5/7
Non-Value Added	32 2/3	16 1/3	0	0
Total	**200 1/6**	**100**	**131 1/2**	**100**

Table 6.5 above shows the value added, non-value added and non-value added but necessary time and percentage for current and improved process. The improved process has increased in terms of the percentage of value added activity. In terms of total time of non-value added but necessary activity, the improved process is lower than current process by 3 ½ hours. Besides that, the improved process has also eliminated the non-value added activity in the current process.

Table 6.6: Reduction Time for Each Week

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Reduction (Hrs)	Reduction (%)
1	Preparation	3	4 1/3	3	1 1/3	30.8
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	10 1/3	7	3 1/3	32.3
2	Preparation	3	2 1/3	3	- 2/3	-28.6
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	8 1/3	7	1 1/3	16.0
3	Preparation	3	3 7/12	3	7/12	16.3
	Course delivery	3	3	3	0	0.0

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Reduction (Hrs)	Reduction (%)
	Consultation	3	3	1	2	66.7
	Total	9	9 7/12	7	2 7/12	27.0
4	Preparation	3	5 7/12	3	2 7/12	46.3
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	11 7/12	7	4 7/12	39.6
5	Preparation	3	9 3/4	3	6 3/4	69.2
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	15 3/4	7	8 3/4	55.6
6	Preparation	3	2 1/12	3	- 11/12	-44.0
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	8 1/12	7	1 1/12	13.4
7	Midterm break	9	9	9	0	0.0
8	Preparation	3	8 5/12	3	5 5/12	64.4
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Reduction (Hrs)	Reduction (%)
	Total	9	14 5/12	7	7 5/12	51.4
9	Preparation	3	4 7/12	3	1 7/12	34.5
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	10 7/12	7	3 7/12	33.9
10	Preparation	3	12 1/2	2 3/4	9 3/4	78.0
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	18 1/2	6 3/4	11 3/4	63.5
11	Preparation	3	5 7/12	2	3 7/12	64.2
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	11 7/12	6	5 7/12	48.2
12	Preparation	3	5 1/12	3	2 1/12	41.0
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	11 1/12	7	4 1/12	36.8
13	Preparation	3	9	3	6	66.7

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Reduction (Hrs)	Reduction (%)
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	15	7	8	53.3
14	Preparation	3	7 1/2	3	4 1/2	60.0
	Course delivery	3	3	3	0	0.0
	Consultation	3	3	1	2	66.7
	Total	9	13 1/2	7	6 1/2	48.1
15 (study week)	Preparation	-	4 5/6	7 3/4	-	-
	Consultation	-	3	-	-	-
	Total	9	7 5/6	7 3/4	-	-
16-18 (exam week)	Final exam	-	2 1/2 - 3 1/2	2 1/2 - 3 1/2	-	-
	Marking	-	-	5	-	-
19-20	Marking and prepare results	10 days	21 1/2	16 1/2	-	-
21	Results' validation	-	3/4	3/4	-	-
22	Student checks result	-	1/4	1/4	-	-

Table 6.6 shows the duration and percentage of time reduction for each week after Lean management has been applied. The time reduction has been measured every week of the study term, which starts from Week 1 until Week 14. Based on the Table 6.5, most of the preparation times for the current state exceed the available time which is 3 hours for each week. Then, the improved process showed that, the time has been reduced every week to meet the available time per week. Besides that, there are negative values in the reduction column (Week 2 and 6). Although the values are negative, they do not exceed the available time.

Table 6.7 shows the utilization percentage of each week for both the current and improved process. The current process shows that the total utilization percentage of each week is mostly over utilized. This has burdened the lecturers and led them to work overtime. In contrast, the improved process are under or meeting 100% utilization. This has provided the lecturer with extra hours to do other work, such as research and social services.

Table 6.7: Utilization for Each Week

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Utilization Current Process (%)	Utilization Improved Process (%)
1	Preparation	3	4 1/3	3	144.4	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	10 1/3	7	114.8	77.8
2	Preparation	3	2 1/3	3	77.8	100.0

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Utilization Current Process (%)	Utilization Improved Process (%)
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	8 1/3	7	92.6	77.8
3	Preparation	3	3 7/12	3	119.4	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	9 7/12	7	106.5	77.8
4	Preparation	3	5 7/12	3	186.1	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	11 7/12	7	128.7	77.8
5	Preparation	3	9 3/4	3	325.0	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	15 3/4	7	175.0	77.8
6	Preparation	3	2 1/12	3	69.4	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	8 1/12	7	89.8	77.8
7	Midterm break	9	9	9	100.0	100.0
8	Preparation	3	8 5/12	3	280.6	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	14 5/12	7	160.2	77.8
9	Preparation	3	4 7/12	3	152.8	100.0
	Course delivery	3	3	3	100.0	100.0

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Utilization Current Process (%)	Utilization Improved Process (%)
	Consultation	3	3	1	100.0	33.3
	Total	9	10 7/12	7	117.6	77.8
10	Preparation	3	12 1/2	2 3/4	416.7	91.7
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	18 1/2	6 3/4	205.6	75.0
11	Preparation	3	5 7/12	2	186.1	66.7
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	11 7/12	6	128.7	66.7
12	Preparation	3	5 1/12	3	169.4	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	11 1/12	7	123.1	77.8
13	Preparation	3	9	3	300.0	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	15	7	166.7	77.8
14	Preparation	3	7 1/2	3	250.0	100.0
	Course delivery	3	3	3	100.0	100.0
	Consultation	3	3	1	100.0	33.3
	Total	9	13 1/2	7	150.0	77.8
15 (study week)	Preparation	-	4 5/6	7 3/4	-	-
	Consultation	-	3	-	-	-
	Total	-	7 5/6	7 3/4	-	-
16-18	Final exam	-	2 1/2 - 3 1/2	2 1/2 - 3 1/2	-	-

Week	Activity	Available Time	Current Duration (Hrs)	Improved Duration (Hrs)	Utilization Current Process (%)	Utilization Improved Process (%)
(exam week)	Marking	-	-	5	-	-
19-20	Marking and prepare results	10 days	21 1/2	161/2	-	-
21	Results' validation	-	¾	3/4	-	-
22	Student checks result		¼	1/4		

Table 6.8 below shows the overtime cost and paper usage after current process has been improved through VSM and Lean implementation. The improved process has succeeded in reducing the cost that incurred during the current process implementation.

Table 6.8: Overtime Cost and Paper Usage

	Current Measurement	Improved Measurement
Overtime Cost (Ringgit Malaysia, RM)	2 staff x RM 5.50 x 3hrs = RM 33 (For each test that has been performed beyond the office hour)	Overtime cost = 0 (No test will be performed beyond office hours)

	Current Measurement	Improved Measurement
Paper Usage for quizzes	40 students x 2 paper sheets x 3 quizzes = 240 sheets	Online quizzes (No paper will be used for quizzes)

6.6 Summary

Jimmerson, Weber, and Sobek (2005) explained that waste reduction and efficiency are the outcomes of Lean implementation. It will help in increasing the quality of the product. This is in parallel to Kruskal et al. (2012) where they said that Lean application in improving the performance and efficiency is one of the efforts to achieve quality**.** Efficiency, as defined by Cambridge Dictionary (2016) is utilising the time and other sources wisely without waste.

Based on this study, the efficiency of the work process has been increased by reducing the waste and time as resulted from applying the VSM and Lean kaizen application. The reduction of time was presented in Table 6.5 and 6.6 where the time of each activity has been reduced in ways that each activity has been performed based on the available time per week after Lean application. Not only time saved, the overtime cost and paper usage have been reduced as well, as showed in Table 6.7.

CHAPTER 7

STATISTICAL ANALYSIS AND RESULTS

7.0 Introduction

This chapter presents the analysis and results in an attempt to determine the student's feedback at the end of the semester after a course has been delivered. The data were collected at the end of the semester of the particular study term. There are two groups involved in this study, which are treatment group (a group with Lean application) and control group (a group without Lean application). The data were collected from both groups of students to determine their satisfaction level on a taught course. The appropriate tests have been carried out to test the research hypotheses by using the SPSS 22 version. In the previous chapter, we have discussed the methodology of the survey. The wastes that occurred in the process have been identified through value stream mapping. Then, they have been reduced or removed from the course planning and delivery process in order to improve the flow. Finally, the improved future state map was implemented in the chosen courses during the semester for both university X and Y in Malaysia.

7.1 Overview of the Variables

Previous chapters have discussed the questionnaire design and the variables that are involved in examining the students' satisfaction. As a result, five variables were identified

to measure students' satisfaction in relation to the taught course. Those five variables are course planning, course delivery, course assessment, lecturer and course material. Several items have been developed to measure all of the variables. Table 7.1 below shows the list of the items used to measure each of the variables that are involved in this study. All of the items have been tested by using Cronbach's alpha test to measure the reliability of each variable (refer Chapter 4).

Table 7.1: Variables and Items in Course Planning and Delivery Process

No.	Variables	Items
1.	**Course Planning**	The course planning has been discussed at the beginning of semester
		The syllabus is understandable
		E-learning in course planning is effectively used
		The teaching sessions have been well prepared
		Presentations have a well-defined scheme
		The course's consultation has been well prepared
2.	**Course Delivery**	The course plan has been distributed uniformly throughout the academic period
		The learning outcomes have been informed before the class starts
		Course delivery is effective
		Students' participation has been encouraged during the course
		Summarisation of the lectures main points is satisfactory
		Course consultation has been implemented effectively
		Student feedback conducted at the mid-term of semester provides opportunity to the students to give comments in improving the course delivery process
3.	**Course Assessment**	The assessment is consistent with the course contents
		The information about the assessment requirement was clear
		The feedback of assessment help the students to understand the course content

No.	Variables	Items
		The assessment results were given on time
		Marks given are fair
4.	**Lecturer**	Positive attitude towards students
		Easy to contact
		Expert in course taught
		Responds with accuracy to the questions asked
		Ability to make the course interesting
		A good public speaker
5.	**Material**	The material is consistent with the course content
		Online materials are well provided
		Reference source is compatible with the requirements of the course
		The reading material helps to understand the course
		Course remembrance is satisfactory
		Teaching aids used in the classes are satisfactory

7.2 Data Analysis and Results

Data analysis is important in this study to answer the research questions. The research hypotheses of this study have been tested using the SPSS version 22 software. The first step is to examine the data, whether the data can be categorised as parametric or nonparametric data. The purpose of determining the data whether they are parametric or not is in choosing the correct statistics procedure to analyse the data. Parametric statistics procedure is more powerful than nonparametric statistics procedure (Cooper and Schindler 2008). According to Sekaran (2003), there are two assumptions in using the parametric statistics:

a) The population from which the sample is drawn is normally distributed.

b) The data are collected on an interval or ratio scale.

The rating scale for all of the items in each of the variables is 7-Likert ordinal scale. However, according to Brown (2011), the Likert scales can be treated as interval scales when it involves multiple items. In this study, the variables have been measured by taking the average rating of all of the related elements. Hence, the type of scale for all the five variables in this study can be classified as interval scale and met the second assumption of parametric statistics. It can be analysed by using the parametric statistics procedure if the normality assumption is met, which will be tested in the coming section.

7.3.1 Respondent's Background

This section discusses about the background of the respondents for each programme in each university. There are three different programmes from the two different universities involved in this study. The programmes have been coded as 1, 2 and 3, and the university as University X and Y. There are also two groups involved in this study, which are a group with Lean application (treatment group) and a group without Lean application (control group) for each of the three programmes.

Figure 7.1: Total Respondents Based on Group and Programme for University X

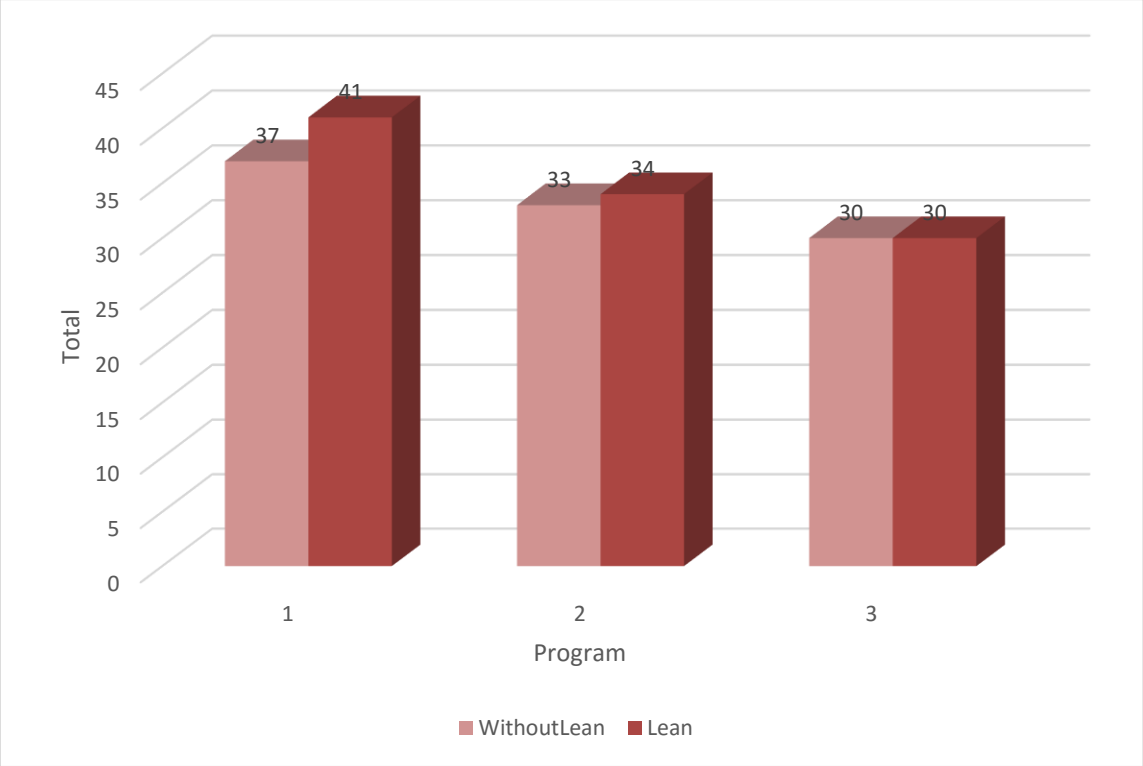


Figure 7.1 shows the total respondents from University X according to the groups and programmes. There are 205 respondents involved in this study, which consists of 78 (38%) respondents coming from programme 1, while 67 (33%) respondents are from programme 2 and 60 (29%) respondents come from programme 3. There are two groups from each programme which are a group with the Lean application and a group without the Lean application. Programme 1 consists of 37 respondents from the group without Lean application and 41 respondents from the group with the Lean application. Programme 2 consists of 33 respondents from the group without Lean application and 34 respondents from the group with the Lean application. Lastly, Programme 3 consists of 30 respondents from each group.

Figure 7.2: Total Respondents Based on Gender, Group and Programme for University X

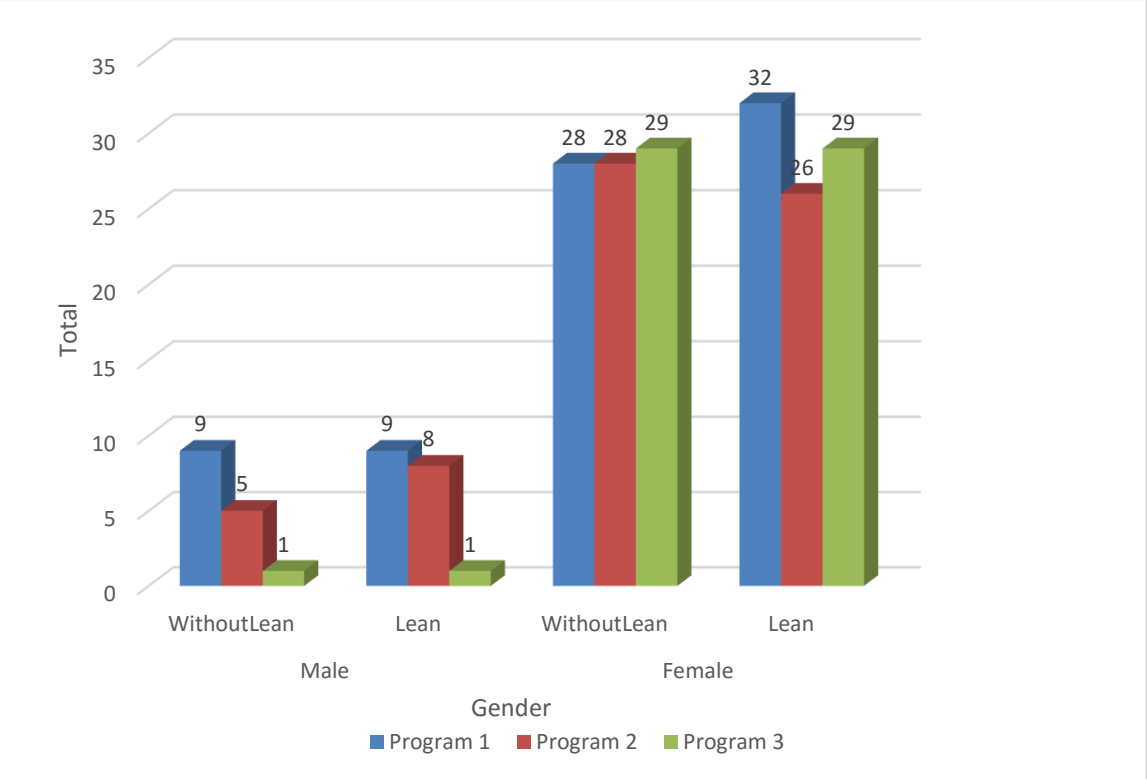
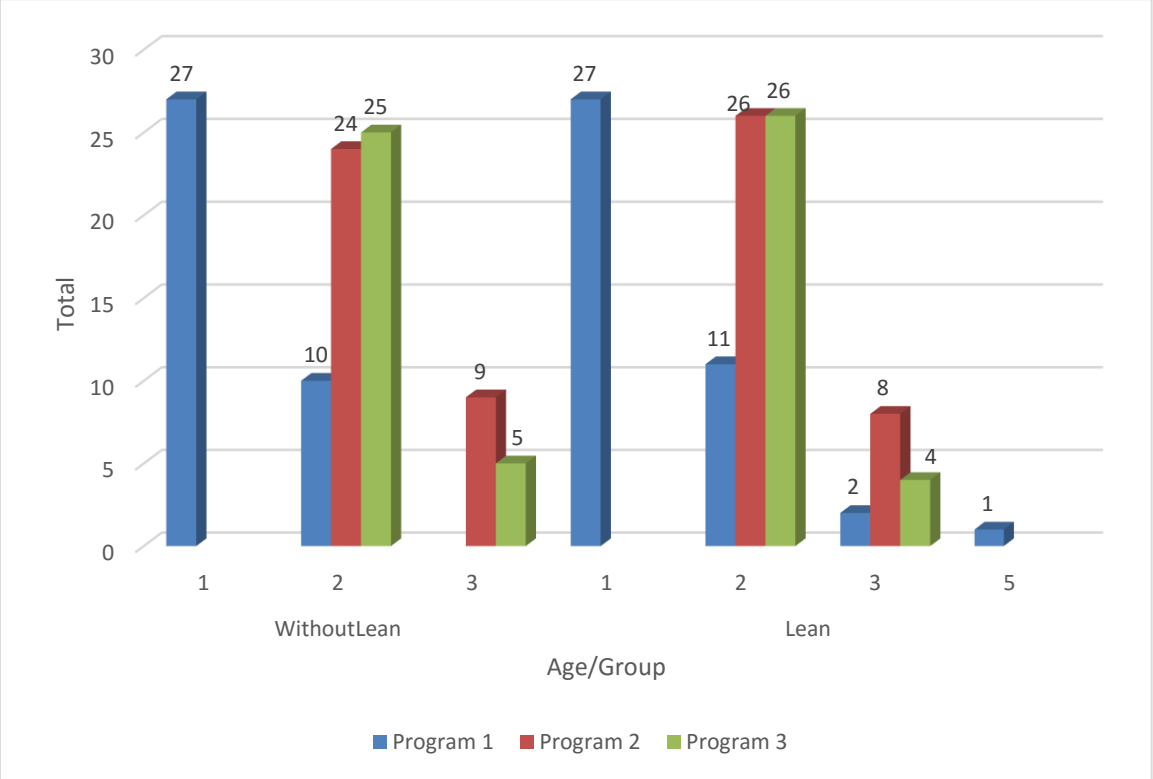


Figure 7.2 shows the gender of the respondents from university X, according to their programmes and groups. Based on the chart, majority of the respondents that are involved in this study are female for both groups. For programme 1, 75.6% of the respondents are female for the group without Lean, while for the group with the Lean application, 78% of the respondents are female. For programme 2, 84.8% of the respondents are female for the group without Lean, while 26 out of 34 respondents are female from the group with the Lean application. For programme 3, almost all of the respondents are female, where only one of the respondents is male for both groups.

Figure 7.3: Total Respondents Based on Age, Group and Programme for University X



Legend for age
1 : 18 – 20 years old
2 : 21 – 23 years old
3 : 24 – 26 years old
4 : 27 – 29 years old
5 : above 30 years old

Based on Figure 7.3, the bar chart indicates the age groups of the respondents from university X according to the Lean and without Lean application group. Most of the respondents from Programme 1 are aged between 18 and 20 years old for both groups, which is 27 out of 37 for the group without Lean and 27 out of 41 for the group with the Lean application. There is also one respondent in the Lean group that aged above 30 years old. For Programme 2, majority of the respondents (26 out of 34 respondents) are aged between 21-23 years old for the group with the Lean application and the rest is in the third

age group which is between 24-26 years old. Likewise, majority of the respondents (24 out of 33 respondents) for the group without Lean are aged between 21-23 years old while for the group with Lean application and the rest are in the third age group which is between 24-26 years old. For Programme 3, majority of the respondents are aged between 21-23 years old and the rest is in the third age group which is between 24-26 years old for both groups.

Figure 7.4: Total Respondents Based on Group and Programme for University Y

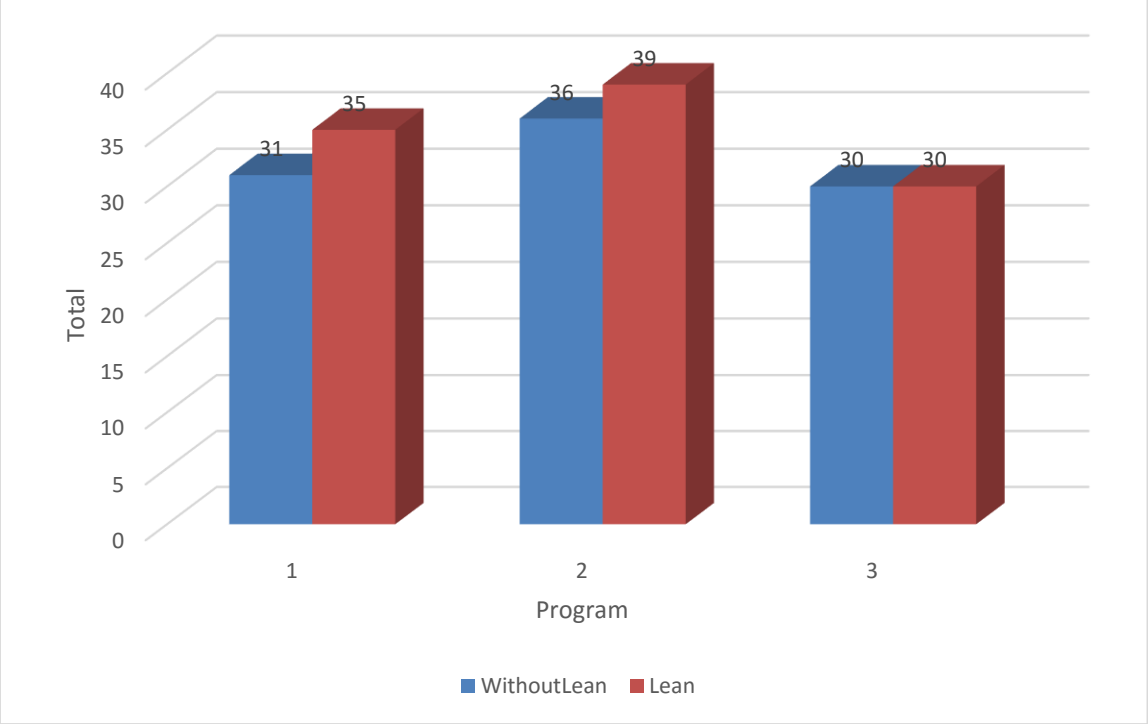
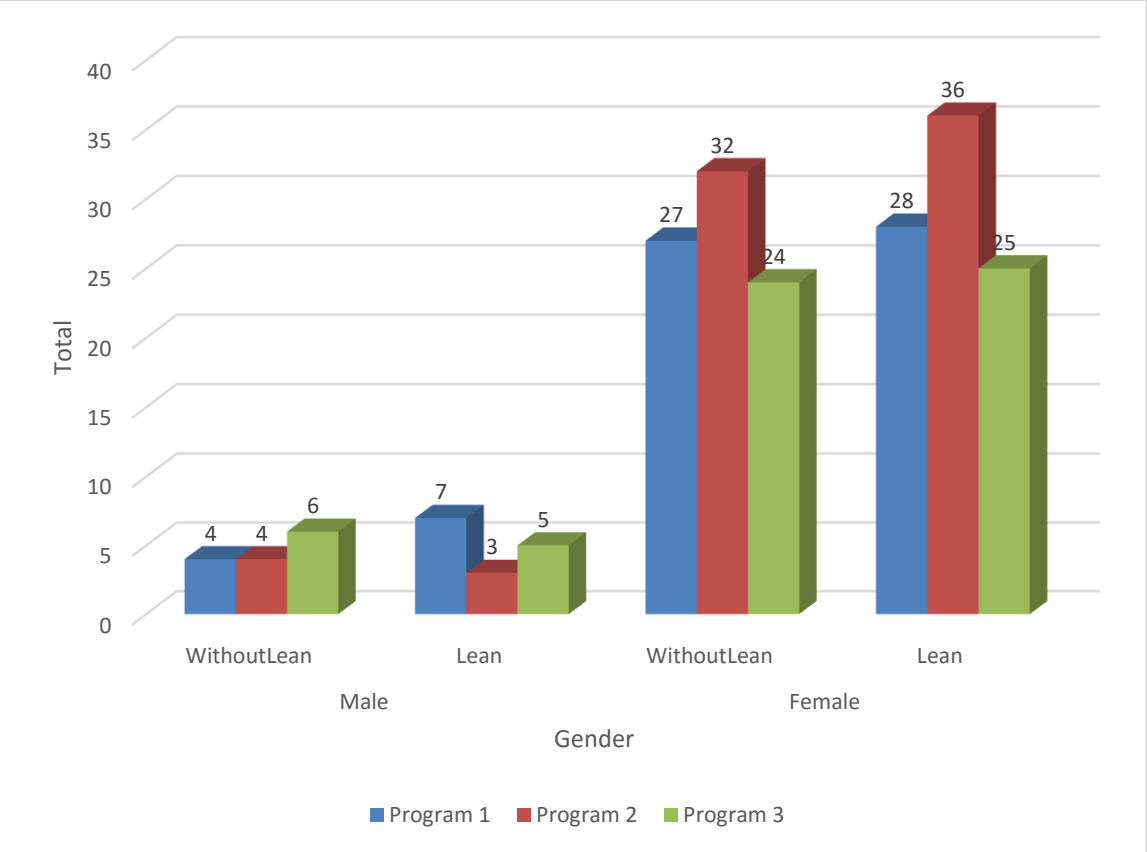


Figure 7.4 shows the total respondents from University Y according to the groups and programmes. Slightly less than University X, total respondents of University Y that involved in this study is 201. About 33% of the respondents are from Programme 1, where 31 respondents are from the group without Lean and 35 respondents are from the group of Lean application. About 37% of the total respondents are from Programme 2 which

consists of 36 respondents from the group without Lean and 39 respondents from the group with the Lean application. Lastly, this study consists of 60 respondents (30%) from Programme 3, where there are 30 respondents from each group.

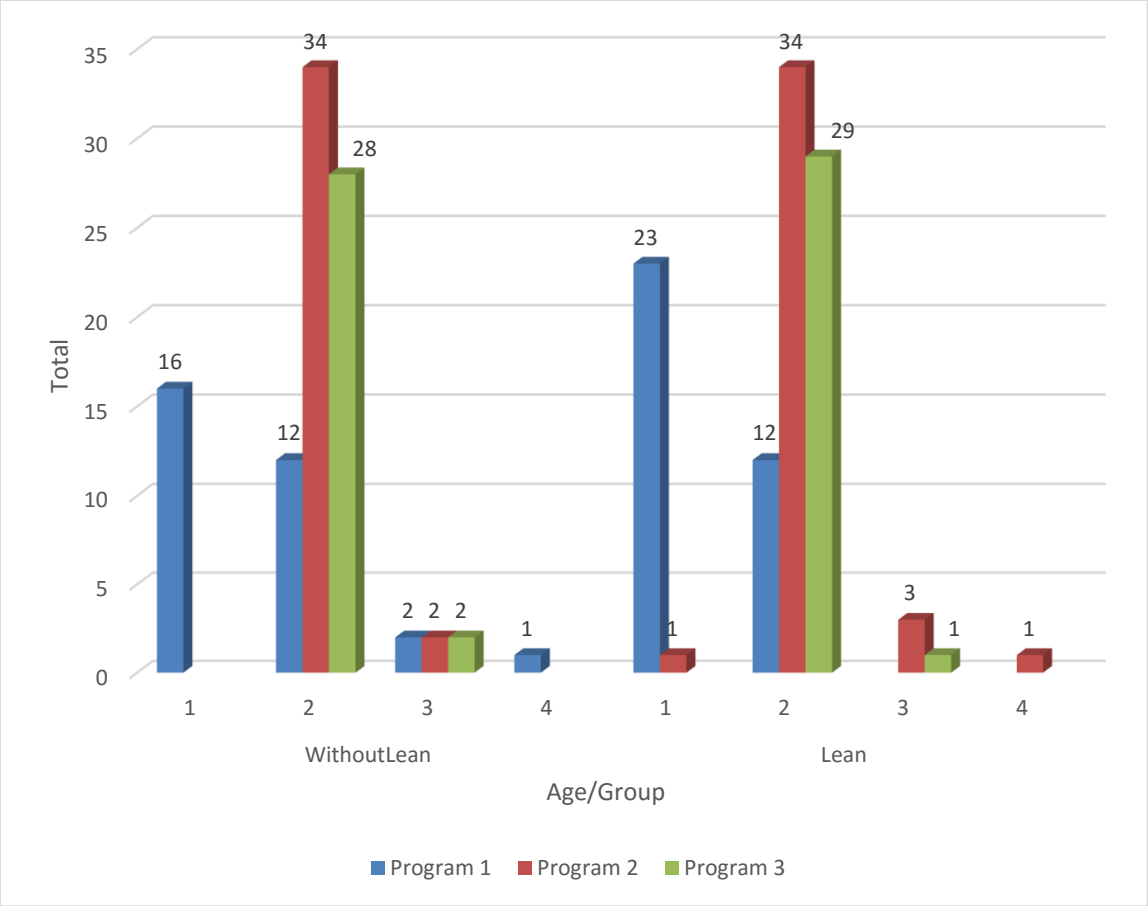
Figure 7.5: Total Respondents Based on Gender, Group and Programme for University Y



The bar chart in Figure 7.5 shows the gender of the respondents from University Y according to their programmes and groups. Based on the chart, majority of the respondents that are involved in this study are female for both groups. For Programme 1, only 12.9% of the respondents are male for the group without Lean, and 20% of the respondents are male from the group with the Lean application. For Programme 2, 88.9% of the respondents are female for the group without Lean, and 92.3% of the respondents

from the group with the Lean application are female. For Programme 3, only 6 out of 30 respondents are male for the group without Lean application and 5 out of 30 respondents (16.7%) are male for the group without Lean application.

Figure 7.6: Total Respondents Based on Age, Group and Programme for University Y



Legend for age
1 : 18 – 20 years old
2 : 21 – 23 years old
3 : 24 – 26 years old
4 : 27 – 29 years old
5 : above 30 years old

Based on Figure 7.6, the bar chart indicates the age groups of the respondents for University Y. Most of the respondents from Programme 1 are aged between 18 and 20

years old for both groups, which is 16 out of 31 for the group without Lean and 23 out of 35 for the group with the Lean application. For Programme 2 and 3, majority of the respondents are aged between 21 and 23 years old for both groups.

7.3.2 Independent Sample t-Test

Independent sample t-test is a test that is conducted to test whether the means of two populations are derived from the same population (Cooper and Schindler 2008). Thus, independent sample t-test is a suitable analysis to test the mean difference in student's satisfaction level between a group with Lean and a group without Lean application. Firstly, the assumptions of the test were tested to check if the t-test is applicable. The assumptions are as follows:

1. The data is normally distributed.

2. The variance of both variables is equal or homogeneous.

The assumptions of t-test are checked by using the skewness value to test for normality, and homogeneity test to check for the variances.

1. Normality test:

   If the ratio of skewness value to its standard error is within ± 2.58, then the normal distribution is assumed (Hortobagyi et al., 1995 and Hair et al., 1995). According to Kim (2013), if n is less than 50, then if absolute z-score which is skewness value divided by its standard deviation is larger than 1.96 ($\alpha = 0.05$), the null

hypothesis will be rejected and it can concluded that the distribution of the sample is non-normal.

2. Homogeneity test:

   Hypothesis for homogeneity test:

   Ho: $\sigma a = \sigma b$

   H_1: $\sigma a \neq \sigma b$

   where,

   σa^2 = population variance for a group with Lean application

   σb^2 = population variance for a group without Lean application

   If the p-value is greater than alpha (α=0.05), Ho will be accepted. It can be concluded that the variances for both populations are homogeneous.

7.3.2.1 Analysis for Programme 1 (P1) of University X (X)

Below are the assumptions checking and the result for t-test for all the variables of Programme 1 in University X between the group with Lean and the group without Lean application.

i) Normality Test

Table 7.2: Normality Test for Programme 1 in University X

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Course Planning	**Lean**	-0.486	0.369	-1.32
	Without Lean	0.095	0.388	0.24
Course Delivery	**Lean**	-0.556	0.369	-1.51
	Without Lean	0.301	0.388	0.78
Course Assessment	**Lean**	-0.551	0.369	-1.49
	Without Lean	-0.673	0.388	-1.73
Lecturer	**Lean**	-0.515	0.369	-1.40
	Without Lean	-0.249	0.388	-0.64
Material	**Lean**	-0.275	0.369	-0.75
	Without Lean	-0.296	0.388	-0.76

Table 7.2 shows the skewness value for Programme 1 in University X. Based on the ratio of skewness values to its standard errors, Ho cannot be rejected. Hence, all of the five variables which are Course Planning, Course Delivery, Course Assessment, Lecturer and Material are normally distributed since the z-scores are less than 1.96. Thus, the first assumption for independent sample t-test is met.

ii) Homogeneity Test

Hypothesis for homogeneity test:

Ho: $\sigma a = \sigma b$

H_1: $\sigma a \neq \sigma b$

where,

σa^2 = population variance for a group with Lean application

σb^2 = population variance for a group without Lean application

Table 7.3: Homogeneity Test for Programme 1 in University X

Variable	**Levene's Test for Equality of Variances**
	Sig.
Course Planning	0.089
Course Delivery	0.551
Course Assessment	0.172
Lecturer	0.734
Material	0.254

Table 7.3 shows the Levene's test (homogeneity test) of Programme 1 in University X. Based on the p-value of Levene's test for all of the variables presented in Table 7.3, it can be concluded that the variances for both populations (with Lean and without Lean application groups) are homogeneous for all of the variables since they are greater than significant level, $\alpha = 0.05$. Thus, the second assumption for independent sample t-test is met.

iii) T-Test Analysis

Hypothesis for independent sample t-test:

Ho: $\mu a = \mu b$

Ho: $\mu a > \mu b$

where,

μa = population mean for a group with Lean application

μb = population mean for a group without Lean application

Table 7.4: Independent Sample t-test for Programme 1 in University X

Variable	**t-test for Equality of Means**	
	Sig. (2-tailed)	**Sig. (1-tailed)**
Course Planning	0.06	0.03
Course Delivery	0.048	0.024
Course Assessment	0.024	0.012
Lecturer	0.08	0.04
Material	0.006	0.003

Table 7.4 shows the results of independent sample t-test for Programme 1 in University X between the group with Lean and the group without Lean application. Since the p-values of t-test (one-tailed) for all of the variables are less than significant level, $\alpha = 0.05$, it can be concluded that there are significant differences in the means between the group with Lean and the group without Lean application for Course Planning, Course Delivery, Course Assessment, Lecturer and Material.

7.3.2.2 Analysis for Programme 1 (P1) of University Y (Y)

Below are the assumptions checking and the result for t-test for all the variables of Programme 1 in University Y between the group with Lean and the group without Lean application.

i) Normality Test

Table 7.5: Normality Test for Programme 1 in University Y

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Course Planning	**Lean**	0.054	0.398	0.14
	Without Lean	-0.144	0.421	-0.34
Course Delivery	**Lean**	-0.035	0.398	-0.09
	Without Lean	0.116	0.421	0.28
Course Assessment	**Lean**	0.059	0.398	0.15
	Without Lean	0.206	0.421	0.49
Lecturer	**Lean**	-0.583	0.398	-1.46
	Without Lean	0.209	0.421	0.50
Material	**Lean**	-0.074	0.398	-0.19
	Without Lean	0.193	0.421	0.46

Table 7.5 shows the skewness value for Programme 1 in University Y. Based on the ratio of skewness values to its standard errors, Ho cannot be rejected. Hence, all of the five variables which are Course Planning, Course Delivery, Course Assessment, Lecturer and Material are normally distributed since the z-scores are less than 1.96. Thus, the first assumption for independent sample t-test is met.

ii) Homogeneity Test

Hypothesis for homogeneity test:

Ho: $\sigma a = \sigma b$

H_1: $\sigma a \neq \sigma b$

where,

σa^2 = population variance for a group with Lean application

σb^2 = population variance for a group without Lean application

Table 7.6: Homogeneity Test for Programme 1 in University Y

Variable	Levene's Test for Equality of Variances
	Sig.
Course Planning	0.799
Course Delivery	0.354
Course Assessment	0.691
Lecturer	0.628
Material	0.643

Table 7.6 shows the Levene's test (homogeneity test) of Programme 1 in University Y. Based on the p-value of Levene's test for all of the variables presented in the Table 7.6, it can be concluded that the variances for both populations (with Lean and without Lean

application groups) are homogeneous for all of the variables since they are greater than significant level, $\alpha = 0.05$. Thus, the second assumption for independent sample t-test is met.

iii) T-Test Analysis

Hypothesis for independent sample t-test:

Ho: $\mu a = \mu b$

Ho: $\mu a > \mu b$

where,

μa = population mean for a group with Lean application

μb = population mean for a group without Lean application

Table 7.7: Independent Sample t-test for Programme 1 in University Y

Variable	**t-test for Equality of Means**	
	Sig. (2-tailed)	**Sig. (1-tailed)**
Course Planning	0.00	0.00
Course Delivery	0.00	0.00
Course Assessment	0.00	0.00
Lecturer	0.00	0.00
Material	0.00	0.00

Table 7.7 shows the results of independent sample t-test for Programme 1 in University Y between the group with Lean and the group without Lean application. Since the p-values of t-test (one-tailed) for all of the variables are less than significant level, $\alpha = 0.05$, it can be concluded that there are significant differences in the means between the group with Lean and the group without Lean application for Course Planning, Course Delivery, Course Assessment, Lecturer and Material.

7.3.2.3 Analysis for Programme 2 (P2) of University X (X)

Below are the assumptions checking and the result for t-test for all the variables of Programme 2 in University X between the group with Lean and the group without Lean application.

i) Normality Test

Table 7.8: Normality Test for Programme 2 in University X

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Course Planning	**Lean**	0.061	0.403	0.15
	Without Lean	0.581	0.409	1.42
Course Delivery	**Lean**	-0.765	0.403	-1.90
	Without Lean	-0.672	0.409	-1.64
Course Assessment	**Lean**	-0.596	0.403	-1.48
	Without Lean	-0.332	0.409	-0.81
Lecturer	**Lean**	-0.088	0.403	-0.22
	Without Lean	-0.129	0.409	-0.32
Material	**Lean**	-0.609	0.403	-1.51
	Without Lean	0.455	0.409	1.11

Table 7.8 shows the skewness value for Programme 2 in University X. Based on the ratio of skewness values to its standard errors, Ho cannot be rejected. Hence, all of the five variables which are Course Planning, Course Delivery, Course Assessment, Lecturer and Material are normally distributed since the z-scores are less than 1.96. Thus, the first assumption for independent sample t-test is met.

ii) Homogeneity Test

Hypothesis for homogeneity test:

Ho: $\sigma a = \sigma b$

H_1: $\sigma a \neq \sigma b$

where,

σa^2 = population variance for a group with Lean application

σb^2 = population variance for a group without Lean application

Table 7.9: Homogeneity Test for Programme 2 in University X

Variable	Levene's Test for Equality of Variances
	Sig.
Course Planning	0.186
Course Delivery	0.087
Course Assessment	0.886
Lecturer	0.064
Material	0.91

Table 7.9 shows the Levene's test (homogeneity test) of Programme 2 in University X. Based on the p-value of Levene's test for all of the variables presented in Table 7.9, it can be concluded that the variances for both populations (with Lean and without Lean application groups) are homogeneous for all of the variables since they are greater than significant level, $\alpha = 0.05$. Thus, the second assumption for independent sample t-test is met.

iii) T-Test Analysis

Hypothesis for independent sample t-test:

Ho: $\mu a = \mu b$

Ho: $\mu a > \mu b$

where,

μa = population mean for a group with Lean application

μb = population mean for a group without Lean application

Table 7.10: Independent Sample t-test for Programme 2 in University X

Variable	**t-test for Equality of Means**	
	Sig. (2-tailed)	**Sig. (1-tailed)**
Course Planning	0.00	0.00
Course Delivery	0.00	0.00
Course Assessment	0.00	0.00
Lecturer	0.003	0.0015
Material	0.00	0.00

Table 7.10 shows the results of independent sample t-test for Programme 2 in University X between the group with Lean and the group without Lean application. Since the p-values of t-test (one-tailed) for all of the variables are less than significant level, $\alpha = 0.05$, it can be concluded that there are significant differences in the means between the group with Lean and the group without Lean application for Course Planning, Course Delivery, Course Assessment, Lecturer and Material.

7.3.2.4 Analysis for Programme 2 (P2) of University Y (Y)

Below are the assumptions checking and the result for t-test for all of the variables of Programme 2 in University Y between the group with Lean and the group without Lean application.

i) Normality Test

Table 7.11: Normality Test for Programme 2 in University Y

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Course Planning	**Lean**	0.334	0.378	0.8836
	Without Lean	-0.346	0.393	-0.88
Course Delivery	**Lean**	-0.01	0.378	-0.0265
	Without Lean	0.699	0.393	1.77863
Course Assessment	**Lean**	-0.265	0.378	-0.7011
	Without Lean	-0.295	0.393	-0.7506
Lecturer	**Lean**	-0.402	0.378	-1.0635
	Without Lean	-0.21	0.393	-0.5344
Material	**Lean**	-0.175	0.378	-0.463
	Without Lean	-0.154	0.393	-0.3919

Table 7.11 shows the skewness value for Programme 2 in University Y. Based on the ratio of skewness values to its standard errors, Ho cannot be rejected. Hence, all of the five variables which are Course Planning, Course Delivery, Course Assessment, Lecturer and Material are normally distributed since the z-scores are less than 1.96. Thus, the first assumption for independent sample t-test is met.

ii) Homogeneity Test

Hypothesis for homogeneity test:

Ho: $\sigma a = \sigma b$

H_1: $\sigma a \neq \sigma b$

where,

σa^2 = population variance for a group with Lean application

σb^2 = population variance for a group without Lean application

Table 7.12: Homogeneity Test for Programme 2 in University Y

Variable	Levene's Test for Equality of Variances
	Sig.
Course Planning	.917
Course Delivery	.229
Course Assessment	.130
Lecturer	.068
Material	.801

Table 7.12 shows the Levene's test (homogeneity test) of Programme 2 in University Y. Based on the p-value of Levene's test for all of the variables presented in Table 7.12, it

can be concluded that the variances for both populations (with Lean and without Lean application groups) are homogeneous for all of the variables since they are greater than significant level, $\alpha = 0.05$. Thus, the second assumption for independent sample t-test is met.

iii) T-Test Analysis

Hypothesis for independent sample t-test:

Ho: $\mu a = \mu b$

Ho: $\mu a > \mu b$

where,

μa = population mean for a group with Lean application

μb = population mean for a group without Lean application

Table 7.13: Independent Sample t-test for Programme 2 in University Y

Variable	**t-test for Equality of Means**	
	Sig. (2-tailed)	**Sig. (1-tailed)**
Course Planning	.000	0.00
Course Delivery	.021	0.0105
Course Assessment	.000	0.00
Lecturer	.010	0.005

Variable	t-test for Equality of Means	
	Sig. (2-tailed)	Sig. (1-tailed)
Material	.000	0.00

Table 7.13 shows the result of independent sample t-test for Programme 2 in University Y between the group with Lean and the group without Lean application. Since the p-values of t-test (one-tailed) for all of the variables are less than significant level, $\alpha = 0.05$, it can be concluded that there are significant differences in the means between the group with Lean and the group without Lean application for Course Planning, Course Delivery, Course Assessment, Lecturer and Material.

7.3.2.5 Analysis for Programme 3 (P3) of University X (X)

Below are the assumptions checking and the result for t-test for all the variables of Programme 3 in University X between the group with Lean and without Lean application.

i) Normality Test

Table 7.14: Normality Test for Programme 3 in University X

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Course Planning	**Lean**	0.084	0.427	0.19672
	Without Lean	-0.008	0.427	-0.0187
Course Delivery	**Lean**	-0.726	0.427	-1.7002
	Without Lean	-0.275	0.427	-0.644
Course Assessment	**Lean**	0.076	0.427	0.17799
	Without Lean	-0.395	0.427	-0.9251

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Lecturer	**Lean**	-0.097	0.427	-0.2272
	Without Lean	0.12	0.427	0.28103
Material	**Lean**	-0.483	0.427	-1.1311
	Without Lean	0.455	0.409	1.11

Table 7.14 shows the skewness value for Programme 3 in University X. Based on the ratio of skewness values to its standard errors, Ho cannot be rejected. Hence, all of the five variables which are Course Planning, Course Delivery, Course Assessment, Lecturer and Material are normally distributed since the z-scores are less than 1.96. Thus, the first assumption for independent sample t-test is met.

ii) Homogeneity Test

Hypothesis for homogeneity test:

Ho: $\sigma a = \sigma b$

H_1: $\sigma a \neq \sigma b$

where,

σa^2 = population variance for a group with Lean application

σb^2 = population variance for a group without Lean application

Table 7.15: Homogeneity Test for Programme 3 in University X

Variable	Levene's Test for Equality of Variances
	Sig.
Course Planning	0.427
Course Delivery	0.798
Course Assessment	0.874
Lecturer	0.322
Material	0.452

Table 7.15 shows the Levene's test (homogeneity test) of Programme 3 in University X. Based on the p-value of Levene's test for all of the variables presented in Table 7.15, it can be concluded that the variances for both populations (with Lean and without Lean application groups) are homogeneous for all of the variables since they are greater than significant level, $\alpha = 0.05$. Thus, the second assumption for independent sample t-test is met.

iii) T-Test Analysis

Hypothesis for independent sample t-test:

Ho: $\mu a = \mu b$

Ho: $\mu a > \mu b$

where,

μa = population mean for a group with Lean application

μb = population mean for a group without Lean application

Table 7.16: Independent Sample t-test For Programme 3 in University X

Variable	**t-test for Equality of Means**	
	Sig. (2-tailed)	**Sig. (1-tailed)**
Course Planning	0.00	0.00
Course Delivery	0.00	0.00
Course Assessment	0.00	0.00
Lecturer	0.00	0.00
Material	0.00	0.00

Table 7.16 shows the result of independent sample t-test for Programme 3 in University X between the group with Lean and the group without Lean application. Since the p-values of t-test (one-tailed) for all of the variables are less than significant level, $\alpha = 0.05$, it can be concluded that there are significant differences in the means between the group with Lean and the group without Lean application for Course Planning, Course Delivery, Course Assessment, Lecturer and Material.

7.3.2.6 Analysis for Programme 3 (P3) of University Y (Y)

Below are the assumptions checking and the result for t-test for all the variables of Programme 3 in University Y between the group with Lean and without Lean application.

i) Normality Test

Table 7.17: Normality Test for Programme 3 in University Y

Variable	Group	Skewness	Std. Error of Skewness	z-score (skewness/ std.error)
Course Planning	**Lean**	-0.601	0.427	-1.40749
	Without Lean	-0.629	0.427	-1.47307
Course Delivery	**Lean**	-0.469	0.427	-1.09836
	Without Lean	0.354	0.427	0.82904
Course Assessment	**Lean**	-0.386	0.427	-0.90398
	Without Lean	-0.199	0.427	-0.46604
Lecturer	**Lean**	-0.507	0.427	-1.18735
	Without Lean	-0.579	0.427	-1.35597
Material	**Lean**	-0.797	0.427	-1.86651
	Without Lean	-0.073	0.427	-0.17096

Table 7.17 shows the skewness value for Programme 3 in University Y. Based on the ratio of skewness values to its standard errors, Ho cannot be rejected. Hence, all of the five variables which are Course Planning, Course Delivery, Course Assessment, Lecturer and Material are normally distributed since the z-scores are less than 1.96. Thus, the first assumption for independent sample t-test is met.

ii) Homogeneity Test

Hypothesis for homogeneity test:

Ho: $\sigma a = \sigma b$

H_1: $\sigma a \neq \sigma b$

where,

σa^2 = population variance for a group with Lean application

σb^2 = population variance for a group without Lean application

Table 7.18: Homogeneity Test for Programme 3 in University Y

Variable	Levene's Test for Equality of Variances
	Sig.
Course Planning	0.132
Course Delivery	0.834
Course Assessment	0.785
Lecturer	0.834
Material	0.305

Table 7.18 shows the Levene's test (homogeneity test) of Programme 3 in University Y. Based on the p-value of Levene's test for all of the variables presented in Table 7.18, it can be concluded that the variances for both populations (with Lean and without Lean

application groups) are homogeneous for all of the variables since they are greater than significant level, $\alpha = 0.05$. Thus, the second assumption for independent sample t-test is met.

iii) T-Test Analysis

Hypothesis for independent sample t-test:

Ho: $\mu a = \mu b$

Ho: $\mu a > \mu b$

where,

μa = population mean for a group with Lean application

μb = population mean for a group without Lean application

Table 7.19: Independent Sample t-test For Programme 3 in University Y

Variable	**t-test for Equality of Means**	
	Sig. (2-tailed)	**Sig. (1-tailed)**
Course Planning	0.103	0.052
Course Delivery	0.137	0.069
Course Assessment	0.208	0.104
Lecturer	0.110	0.055
Material	0.007	0.004

Table 7.19 shows the result of independent sample t-test for Programme 3 in University Y between the group with Lean and the group without Lean application. Since the p-value (one-tailed) for Material is less than significant level, $\alpha = 0.05$, it can be concluded that there is significant difference in means between the group with Lean and the group without Lean application. However, based on .p-value (one-tailed) for Course Planning, Course Delivery, Course Assessment and Lecturer, they are greater than significant level, $\alpha = 0.05$, so, we can conclude that, there are no significant differences in means between group with Lean and a group without Lean application, for the variables.

7.4 Lecturer's Feedback

Table 7.20: Lecturer's Feedback on Lean Application in Course Plan and Delivery

No.	Statement	Total	Percentage (%)
1	Reduce the work time and unnecessary work	11	91%
2	All the activities in the course planning and delivery process are more organized	9	75%
3	Provide an appropriate guideline for continuous improvement	8	67%

The feedback regarding the effect of Lean application in course planning and delivery process has been collected from six lecturers from both University X and University Y. Based on the improved course plan and delivery process, all of the lecturers that are involved in this study agree that Lean has helped them to reduce the wastes that occurred in the course plan and delivery process, specifically the lateness of returning the assessments, results and feedbacks to their students. Besides that, they also said that the

Lean has helped to improve the process flow by classifying the activities into three types which are value added, non-value added but necessary and non-value added activities.

Based on Table 7.20, 91% of the 12 lecturers said that Lean application has helped in reducing the work time especially in the marking process and teaching preparation. 9 out of 12 lecturers stated that Lean application has helped in organising their work and eased them. In addition, this study also provides them with an appropriate guideline for continuous improvement in the future (67%). They also agree that student's feedback should be carried out at least once in the middle of the semester to improve the course planning and delivery process instead of only conduct the feedback at the end of the semester. This will give an opportunity to the students to express their opinion and give comments or suggestions that may also help to improve their learning process, apart from their juniors' learning process.

7.5 Summary

The purpose of the analysis in this Chapter serves to answer the research questions of this study. To test the mean of satisfaction between the group with Lean application and the group without Lean application, independents sample t-test is the appropriate test that can be conducted to examine the difference between the two means group. According to Field (2009) and Sekaran (2003), independent sample t-test is a test to test the differences between the overall means of the two samples to determine whether the means of the two populations from which the samples are drawn, are significantly different.

Based on the results in section 7.3.2, the mean for each Course Planning, Course Delivery, Course Assessment, Lecturer and Material are significantly different between the group without Lean application and the group with Lean application for all of the programmes from University X. Likewise, in University Y analysis, there is also a significant difference in the means between the group without Lean application and the group with Lean application for all of the variables from Programme 1 and 2. However, the satisfaction mean for Programme 3 of University Y are not significantly different between the two groups, except for the item Material.

These results suggest that Lean application does have an effect on student's satisfaction level in both universities. Specifically, the results suggest that when the Lean is applied in course planning and delivery process, the student's satisfaction level will increase. These outcomes are parallel to Emiliani (2004a), where he found that student's satisfaction level at the end of the semester has increased after Lean has been applied in the course design and delivery process. Besides that, the adoption of Lean principles and practices in the University of Central Oklahoma and University of Minnesota has also led to an increase in student's satisfaction with the services offered by the institutions (Cristina and Felicia 2013).

CHAPTER 8

CONCLUSION AND RECOMMENDATION

8.0 Introduction

The ability of the Lean in reducing waste, particularly in the manufacturing sector, has attracted many sectors to adopt Lean management. Among those sectors are healthcare, airline, education, banking and administration. The aim of the adoption is to improve their work processes, performance and to gain more profit or customers' satisfaction. This study has also applied the Lean management in one of the work processes in HEI, in order to increase the efficiency and satisfaction of the customers, which are the students. The aim of this study is to examine the effect of applying the Lean in the course planning and delivery process on students' satisfaction. This study has been carried out to identify any invaluable activity or waste in the academic work process that has interrupted its smooth and productive flow, and efficiency.

8.1 Conclusion

Course planning and delivery process is one of the academic processes that is a part of the primary or core services offered by a university. This study has involved three academic programmes offered in University X and University Y, in Malaysia. An experimental study has been conducted to examine the effects of Lean application. Firstly, an exploratory study was conducted to understand the problem areas and situation from

the view of the students and the lecturers. The results can be referred to the drawing of the value stream map for the current and future status. In this process, wastes have been identified or occurred and then these wastes reduced or eliminated, wherever possible. Then, the experimental study is conducted by applying the new work process to the treatment group and normal work process to the experimental control group.

Based on the value stream mapping analysis in Chapter 6, several wastes have been identified or occurred in the course planning and delivery process. The main waste that occurs in the process is related to time and waiting. Five whys analysis has been applied to analyse the root cause of the waste. The purpose of identifying the root cause of the waste is to eliminate the waste correctly and provide greater success in implementing Lean techniques (Balzer 2010). This finding has answered the first objective of this study which is to identify waste that exists in the process by using Lean techniques. This finding is also parallel to the other studies that have been conducted in various other sectors such as in the services sector, where Dahlgaard and Dahlgaard-Park (2006) have found that the lean application has helped to reduce waste in Danish service organisations.

By referring to Table 6.5 in Chapter 6, the results showed that most of the cycle time for the activities exceed the available time per week. The total allocation time for course preparation, course delivery and consultation is nine hours per week. However, the activities have taken more than the available time, and this has affected both the students and lecturers. The results of VSM showed that, after Lean techniques have been applied, the total time per week has been reduced to meet the available time. The consultation has been reduced to one hour per week instead of three hours because the former has not been

fully utilised. However, the students still can get the consultation session anytime based on appointment basis, which is more efficient. This is because the lecturer is able to have more time to do research or other activities instead of waiting for the students. Furthermore, the Lean application has also reduced the overtime cost and paper wastages (refer Table 6.7). There is about RM 33.00 (around £5.64) that has been saved by applying the new work process. That is, the overtime cost for two staff is incurred if the test is performed after office hours because of non-availability of assessment room or not conducted at an appropriate assessment time. The result also shows that the paper wastages can be reduced by 80 sheets for each quiz by performing online quizzes. These findings have answered the second objective of this study which is to reduce or eliminate waste in the course plan and delivery process by using Lean techniques. The finding is also parallel to Swank (2003) who has applied Lean in a financial service company and succeeded to reduce the average time of processing the issuance of insurance. As a result, the average processing time has been decreased by half, labour costs has reduced, reissue rate declined by 40% and 60% increase in the new annualised premiums of individual insurance in two years' time.

To respond to the last objective which is to examine the effect of Lean applications on course planning and delivery process in University X and University Y, the students' feedback have been collected at the end of the semester. An experimental study has been conducted where two groups are involved. One group received the new course planning and delivery process and another one group received the usual course planning and delivery process. Based on the findings in section 6.3.2, the mean for each Course Planning, Course Delivery, Course Assessment, Lecturer and Material are significantly

different between the groups without Lean application and the groups with the Lean application for all of the programmes from University X and Y, except for Programme 3 in University Y. That is, four variables which are Course Planning, Course Delivery, Course Assessment and Lecturer, are not significantly different between the two groups for Programme 3 in University Y although the means of the variables for the groups with the Lean application is higher than the groups without Lean application. These results have proven that there is an effect on students' satisfaction when Lean techniques have been applied in the HEI work process, especially in the academic area. The groups with the Lean implementation have a higher satisfaction level than the groups without Lean application.

This finding is parallel to Emiliani (2004a). He has applied Lean on the course design and delivery work process in Rensselaer Polytechnic Institute. He identified the wastes based on what have been perceived by the customers. He used the available students' feedback data that have been conducted by the university at the end of the semester. He monitored the feedback and the students' comments for several semesters and concluded that students' satisfaction have increased after the Lean implementation.

As a conclusion, this study has provided evidence that Lean application has helped in improving the HEI's work process by reducing and removing the wastes. Apart from the students' feedback, the management from both of the universities also agreed that Lean application has helped them in reducing the time wasting and providing them with a guideline to improve the flow of the work process to satisfy their students and themselves (lecturers).

8.2 Recommendation

Further research based on the findings of this study is necessary. Currently, there is a large gap in lean kaizen application in the Higher Education Sector, as discussed in Chapter 2. It appears that there is hardly any study that has implemented Lean methods in a full-time undergraduate academic programme, to the best of our knowledge. This study can be used as a guideline for other institutions to adopt the lean approach to improve their work process. It is recommended that future researches consider several factors below:

i) Repeating the process of mapping to remove the wastes in HEI as students' perception and expectation always change

ii) Examining the effect of Lean kaizen application on students' satisfaction level from various universities cross country

iii) Applying Lean kaizen application in the other academic work processes to improve the entire academic work processes continuously, such as add or drop courses process and new programme design process.

8.3 Limitations of the Study

The limitations of this study are as follows:

i) This study was done only in one whole semester to investigate the effect of Lean towards the course planning and delivery process due to time and resources constraints. A longer duration of study may be needed in the future to compare or to measure the effect of Lean application on students' satisfaction level involving different time frames.

ii) This study involved only two universities in Malaysia due to time and resource constraints. Nevertheless, this study has provided a lot of benefits to other HEIs. It has developed a lean framework as a guideline to implement Lean in higher education work process, particularly the academic areas.

iii) This study only focused on Lean application in course planning and delivery process instead of the whole or other academic processes due to time and resource constraints. Other investigations regarding the whole or other educational processes may be needed in the future to improve all of the academic work processes.

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Appendix A

FEEDBACK FORM

Thank you for spending your time to answer this survey. We highly appreciate your views and suggestions. This study aims to obtain your views on the extent of the course delivery elements are important to you and problems that occur during course delivery process. The result of this evaluation will be used to improve course delivery process in the future.

1. Background of respondent.

   a) Faculty: _____

   b) Program name: _____

   c) Semester (Please tick √): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
   ☐ 6 ☐ others: _____

   d) Sex: ☐ Male ☐ Female

   e) Age: ☐ 18 – 20
   ☐ 21 - 23
   ☐ 24 - 26
   ☐ 27 - 29
   ☐ 30 and above

2. In your opinion, to what extent the elements below, valued or important to you during the process of course delivery and learning. Please respond by circling the number based on scale 1 to 5.

   (Note: 1 - definitely not valued/not important, 2 – not valued/not important, 3 – neutral, 4 – valued/important, 5 – definitely valued/important)

No.	Elements of course delivery	1	2	3	4	5
1	Learning material:					
	a) syllabus	1	2	3	4	5
	b) textbook	1	2	3	4	5
	c) notes	1	2	3	4	5
	Others (please specify):	1	2	3	4	5
2	Lectures (3/4 hours per week)	1	2	3	4	5
3	Tutorial (1 hour per week)	1	2	3	4	5
4	Attendance	1	2	3	4	5
5	Consultation	1	2	3	4	5
6	Quizzes:					
	a) Printed quizzes	1	2	3	4	5
	b) Online quizzes	1	2	3	4	5
7	Tests:					
	a) Printed tests	1	2	3	4	5
	b) Online tests	1	2	3	4	5
8	Individual assignment	1	2	3	4	5
9	Group assignment	1	2	3	4	5
10	Assignment presentation					
	a) By group	1	2	3	4	5
	b) By individual	1	2	3	4	5

11	Marking and result	1	2	3	4	5
12	Carry marks	1	2	3	4	5
13	Soft skill assessment	1	2	3	4	5
14	Final exam	1	2	3	4	5
15	Student's feedback at mid semester	1	2	3	4	5
16	Students' feedback at the end of semester	1	2	3	4	5
17	Result and grade	1	2	3	4	5

3. The following question is about the problems faced by students during course delivery process. For each element, please respond by circling the number based on scale 1 to 5.

(Note: 1 – strongly not agree, 2 – not agree, 3 – neutral, 4 – agree, 5 – strongly agree)

NO.	**COURSE ELEMENTS**	**PROBLEMS**	**1**	**2**	**3**	**4**	**5**
1	Syllabus	ambiguous student expectations	1	2	3	4	5
		sometimes not followed as stated in the syllabus	1	2	3	4	5
		the syllabus too long	1	2	3	4	5
		common error that lead to lower grades are not identified and stated as students' reference	1	2	3	4	5

NO.	COURSE ELEMENTS	PROBLEMS	1	2	3	4	5
		sometimes the students have not been given the syllabus from their lecturer	1	2	3	4	5
		Others (please specify):	1	2	3	4	5
2	Reading material	not up to date	1	2	3	4	5
		voluminous	1	2	3	4	5
		quite complex	1	2	3	4	5
		notes late or never been uploaded	1	2	3	4	5
		routinized or customary learning approach	1	2	3	4	5
		most problems or laws are based on US cases	1	2	3	4	5
		Others (please specify):	1	2	3	4	5
3	Assessments: Quizzes Tests Assignments Presentations Final Exam	ambiguous with poorly define learning objectives	1	2	3	4	5
		a few assignments/quizzes/tests were done, students have no opportunity to improve their performance	1	2	3	4	5
		all individual or all team-based assignment	1	2	3	4	5
		too long assignment	1	2	3	4	5
		score of assessments were late given to the students	1	2	3	4	5

NO.	COURSE ELEMENTS	PROBLEMS	1	2	3	4	5
		no discussion after the quizzes and test	1	2	3	4	5
		carry marks were not issued before the exam	1	2	3	4	5
		Others (please specify):	1	2	3	4	5
4	Consultation	lecturers were not available during consultation hour	1	2	3	4	5
		student cannot come during the consultation hour (ie.: overlap with other lecture time)	1	2	3	4	5
		Others (please specify):	1	2	3	4	5
5	Soft-skill	students have not been given a clear explanation on how the implementation and evaluation	1	2	3	4	5
		not fully implemented	1	2	3	4	5
		no assessment and marks given	1	2	3	4	5
		Others (please specify):	1	2	3	4	5
6	Student feedback	only held at the end of the course	1	2	3	4	5
		students did not have the opportunity to provide comments or feedback about the lectures except at the end of semester	1	2	3	4	5
		Others (please specify):	1	2	3	4	5

NO.	COURSE ELEMENTS	PROBLEMS	1	2	3	4	5
7	Course remembrance	only provide lecturer notes, reading materials, graded tests and assignments	1	2	3	4	5
		Others (please specify):	1	2	3	4	5
8	Teaching and learning	only explained by using power point slides, usually just one-way lecture	1	2	3	4	5
		Others (please specify):	1	2	3	4	5

4. Is there any other element or anything else that is important in course delivery that can help to increase your satisfaction level in learning?

   _____

   _____

5. Please state any comments and or suggestions to help improve the course delivery process.

   _____

   _____

Thank you very much for your cooperation.

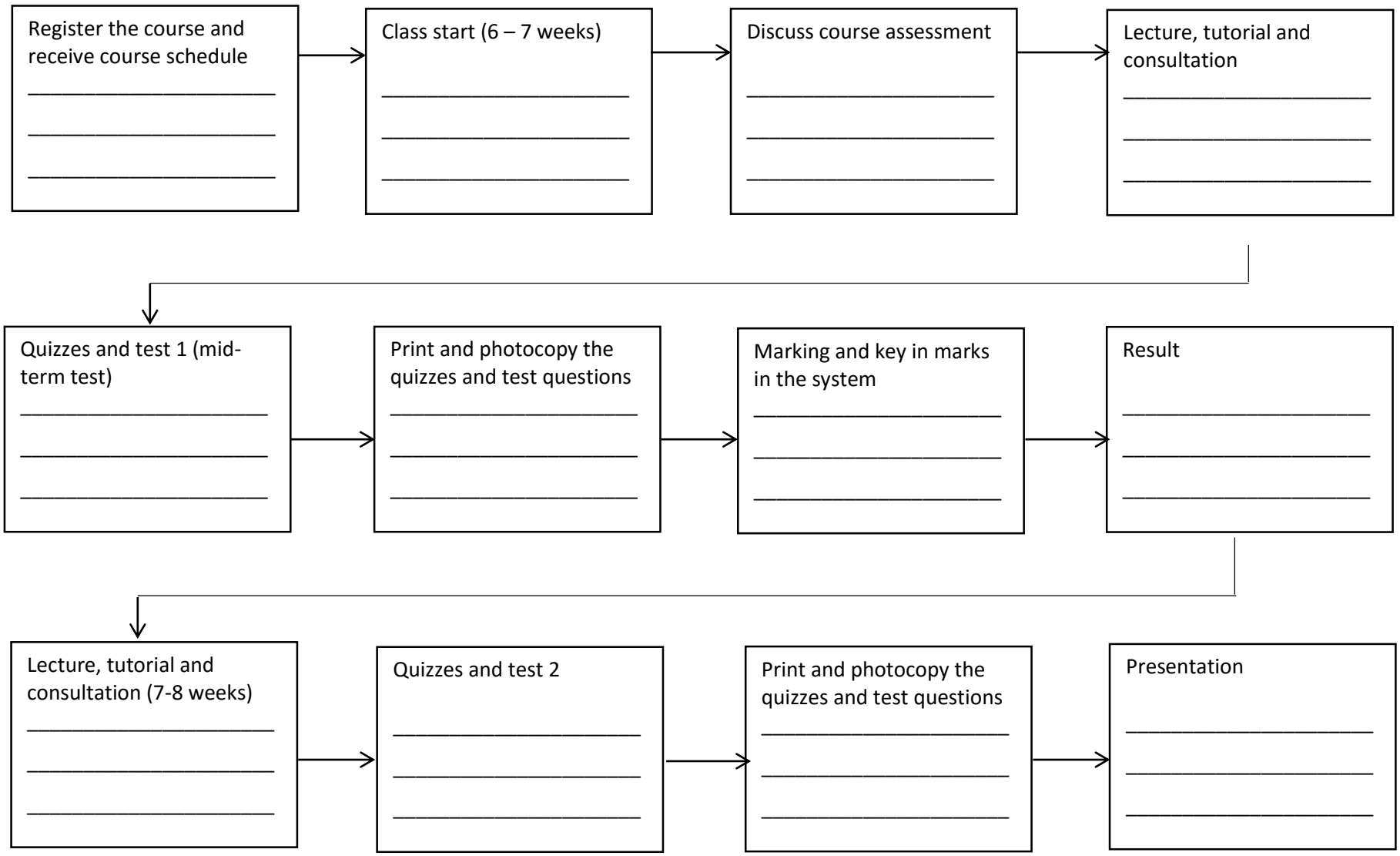
Appendix B

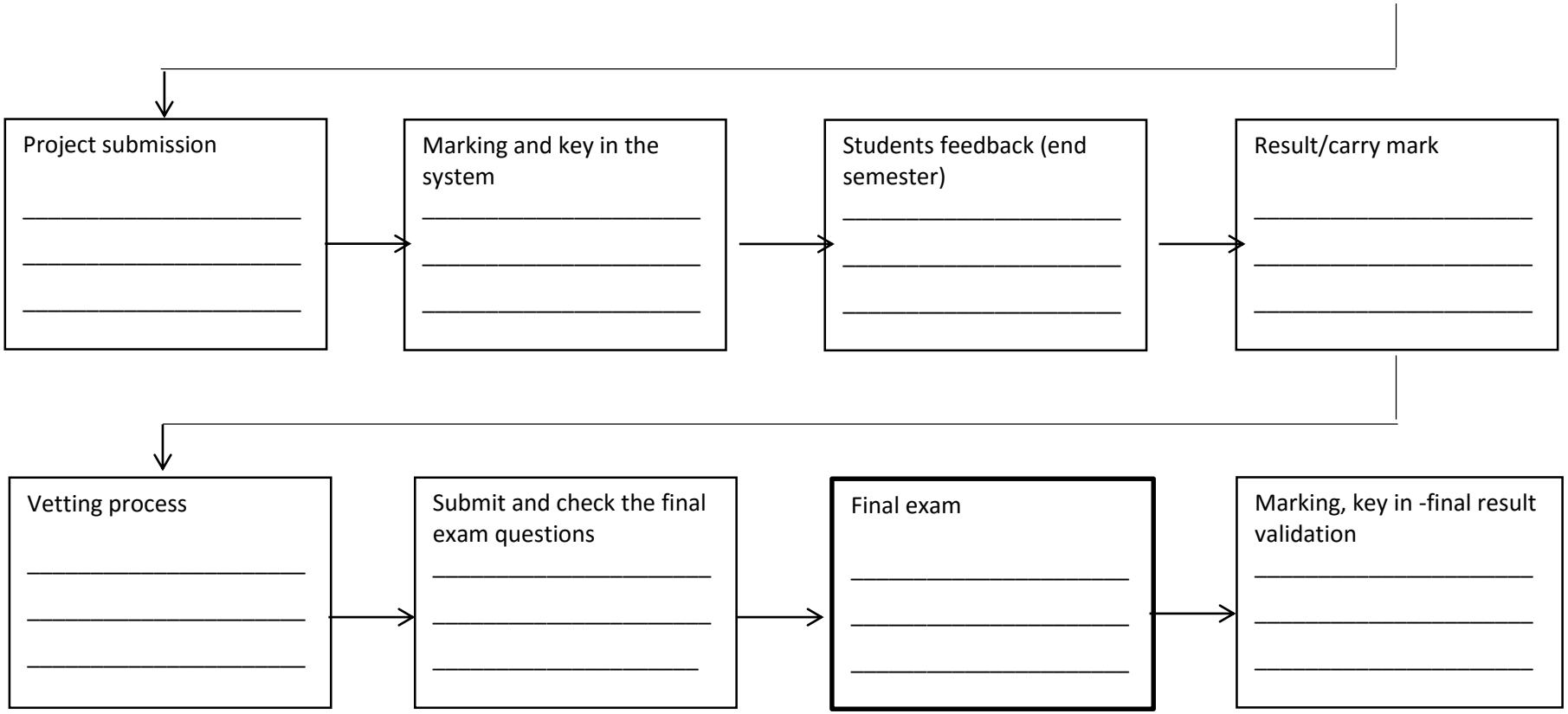
FEEDBACK FORM

Thank you for spending your time to answer this survey. We highly appreciate your views and suggestions. This study aims to obtain your views on the process and problems that occur during course delivery. The result of this evaluation will be used to improve course delivery in the future.

1. Background of respondent.
    a) Faculty: _____
    b) Qualification: ☐ Master ☐ PhD ☐ Others: _____
    c) Sex: ☐ Male ☐ Female
    d) Age: ☐ 30 or below
    ☐ 31 - 35
    ☐ 36 - 40
    ☐ 41 - 45
    ☐ 46 and above

2. The diagram below shows the process that occurs during course delivery. Based on your experience, please specify the problems commonly faced for each of the following work processes in the spaces provided.


Register the course and receive course schedule
Class start (6 – 7 weeks)
Discuss course assessment
Lecture, tutorial and consultation
Quizzes and test 1 (mid-term test)
Print and photocopy the quizzes and test questions
Marking and key in marks in the system
Result
Lecture, tutorial and consultation (7-8 weeks)
Quizzes and test 2
Print and photocopy the quizzes and test questions
Presentation


Project submission
Marking and key in the system
Students feedback (end semester)
Result/carry mark
Vetting process
Submit and check the final exam questions
Final exam
Marking, key in -final result validation

3. In your opinion, does the above processes are important in course delivery? Please state if there is any work process that should be removed or other work processes that should be included in this process flow diagram.

   _____

   _____

   _____

4. Please state any comments and or suggestions to help improve the course delivery process

   _____

   _____

   _____

Thank you very much for your cooperation.

Appendix C

Participant Information Sheet

The Effect of Lean Kaizen Application on Students' Satisfaction in Malaysian Higher Education Sector

I am a PhD student at Coventry University. My name is Nur Aishah binti Awi. This interview is part of a study about the effect of Lean Kaizen application on students' satisfaction in the Malaysian Higher Education Sector. The purpose of this study is to investigate the effect of applying Lean Kaizen principles in course design and delivery and to analyse how it affects students' satisfaction. We will distribute a self-administered questionnaire to the students from several faculties and programmes to obtain the data for the research. Besides that, we will also conduct a semi-structured interview with the chosen lecturers regarding Lean Kaizen application. Your course is one that has been chosen.

For students; we are therefore asking if you would agree to participate in our research by answering a questionnaire. The questionnaire should take about 5 to 10 minutes to complete. Your participation is voluntary only. NO personal information will be recorded. There are no risks associated with the project because there is absolutely NO sensitive data collection and NO recording of personal detail. Furthermore all participants will be over the age of 18.

For staffs; we will conduct a semi-structured interview and we will make notes. Your participation is voluntary only. NO personal information will be recorded. There are no risks associated with the project because there is absolutely NO sensitive data collection and NO recording of personal detail. Furthermore all participants will be over the age of 18.

This study will contribute to improving the teaching and learning process by reducing waste, and hence it will help to increase students' satisfaction. You may withdraw from the process at any time before 31st January 2015 and your data will be destroyed. The study is for academic purposes only and will be kept completely confidential. The result of the study will be used to help improve course delivery process in universities. If you have any questions, issues or complaints about this study, feel free to contact us:

Nur Aishah binti Awi (Researcher),
PhD (Strategy and Applied Management),
Faculty of Business, Environment and Society,
Coventry University, Priory Street,
Coventry CV1 5FB, United Kingdom.
(email: awin@uni.coventry.ac.uk)

Dr Zulfiqar (Zulf) Khan (Supervisor),
Director of MBA Courses,
Strategy and Applied Management,
Faculty of Business, Environment and Society,
Coventry University, Priory Street,
Coventry, CV1 5FB, United Kingdom.
(email: aa0011@coventry.ac.uk)

Informed Consent Form

The Effect of Lean Kaizen Application on Students' Satisfaction in Malaysian Higher Education Sector

Nur Aishah binti Awi (Researcher),
PhD (Strategy and Applied Management),
Faculty of Business, Environment and Society,
Coventry University, Priory Street, Coventry CV1 5FB, United Kingdom.
(email: *awin@uni.coventry.ac.uk*)

	Please initial
1. I confirm that I have read and understood the participant information sheet for the above study and have had the opportunity to ask questions	☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time before 31st January 2015 without giving a reason	☐
3. I understand that NO voice recorded will be involved and all the information I provide will be treated in confidence	☐
4. I agree for anonymised quotes to be used as part of the research project	☐
5. I agree to take part in the research project	☐

Name of participant: .....

Signature of participant: .....

Date: .....

Name of Researcher: .....

Signature of researcher: .....

Date: .....

FEEDBACK FORM

Thank you for spending your time to answer this survey. We highly appreciate your views and suggestions. This study aims to obtain your views on the problems that occur during teaching and learning process and how to improve it. The result of this evaluation will be used to improve teaching and learning process in the future.

1. Background of respondent.

e) Faculty: _____

f) Qualification: ☐ Master ☐ PhD ☐ Others: _____

g) Sex: ☐ Male ☐ Female

Age: ☐ 30 or below ☐ 31 – 35 ☐ 36 - 40 ☐ 41 – 45 ☐ 46 and above

2.

Elements	**Problems and why it happens**	**Lean kaizen tools**	**Improvement**
Lecture and tutorial			
Course planning			
Course delivery			
Student's attendance			

Elements	**Problems and why it happens**	**Lean kaizen tools**	**Improvement**
Consultation			
Others:			
Assessments			
Quizzes			
Tests			
Project (Individual/Group)			
Soft-skill evaluation			
Final examination			
Others:			
Students feedback			
Mid semester			
End of semester			
Others:			
Reading material			
Textbook			
Online notes			

Elements	**Problems and why it happens**	**Lean kaizen tools**	**Improvement**
References			
Others:			
Comments/suggestions			

Thank you very much for your cooperation.

Participant Information Sheet

The Effect of Lean Kaizen Application on Students' Satisfaction in Malaysian Higher Education Sector

I am a PhD student at Coventry University. My name is Nur Aishah binti Awi. This interview is part of a study about the effect of Lean Kaizen application on students' satisfaction in the Malaysian Higher Education Sector. The purpose of this study is to investigate the effect of applying Lean Kaizen principles in course design and delivery and to analyse how it affects students' satisfaction. We will distribute a self-administered questionnaire to the students from several faculties and programmes to obtain the data for the research. Besides that, we will also conduct a semi-structured interview with the chosen lecturers regarding Lean Kaizen application. Your course is one that has been chosen.

For students; we are therefore asking if you would agree to participate in our research by answering a questionnaire. The questionnaire should take about 5 to 10 minutes to complete. Your participation is voluntary only. NO personal information will be recorded. There are no risks associated with the project because there is absolutely NO sensitive data collection and NO recording of personal detail. Furthermore all participants will be over the age of 18.

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Nur Aishah binti Awi (Researcher),
PhD (Strategy and Applied Management),
Faculty of Business, Environment and Society,

Coventry University, Priory Street,
Coventry CV1 5FB, United Kingdom.
(email: awin@uni.coventry.ac.uk)

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Informed Consent Form

The Effect of Lean Kaizen Application on Students' Satisfaction in Malaysian Higher Education Sector

Nur Aishah binti Awi (Researcher),
PhD (Strategy and Applied Management),
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Coventry University, Priory Street,
Coventry CV1 5FB, United Kingdom.
(email: *awin@uni.coventry.ac.uk*)

	Please initial
1. I confirm that I have read and understood the participant information sheet for the above study and have had the opportunity to ask questions	☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time before 31st January 2015 without giving a reason	☐
3. I understand that NO voice recorded will be involved and all the information I provide will be treated in confidence	☐
5. I agree for anonymised quotes to be used as part of the research project	☐
6. I agree to take part in the research project	☐

Name of participant: .....

Signature of participant: .....

Date: .....

Name of Researcher: .....

Signature of researcher: .....

Date: .....

FEEDBACK FORM

Thank you for spending your time to answer this survey. We highly appreciate your views and suggestions.

1. Background of respondent.

   f) Faculty: _____

   g) Program name: _____

   h) Semester (Please tick √): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

   ☐ others: _____

   i) Sex: ☐ Male ☐ Female

   j) Age: ☐ 18 – 20 ☐ 24 – 26

   ☐ 21 – 23 ☐ 27 - 29

   ☐ 30 and above

2. To what extent do you agree with the statements below during the process of teaching and learning? Please respond by circling the number based on the scale of 1 to 7.

   Note:

   1 ----------4----------7

   Definitely not agree Neutral Definitely agree

NO.	ELEMENTS	1	2	3	4	5	6	7
A.	**COURSE PLANNING**							
1.	The course planning has been discussed at the beginning of semester	1	2	3	4	5	6	7
2.	The syllabus is understandable	1	2	3	4	5	6	7
3.	E-learning in course planning is effectively used	1	2	3	4	5	6	7
4.	The teaching sessions have been well prepared	1	2	3	4	5	6	7
5.	Presentations have a well-defined scheme	1	2	3	4	5	6	7
6.	The course's consultation has been well prepared	1	2	3	4	5	6	7
OTHERS (IF ANY):								
B.	**COURSE DELIVERY**							
1.	The course plan has been distributed uniformly throughout the academic period	1	2	3	4	5	6	7

2.	The learning outcomes has been informed before the class starts	1	2	3	4	5	6	7
3.	Course delivery is effective	1	2	3	4	5	6	7
4.	Students participation has been encouraged during the course	1	2	3	4	5	6	7
5.	Summarization of the lectures main points is satisfactory	1	2	3	4	5	6	7
6.	Course consultation has been implemented effectively	1	2	3	4	5	6	7
7.	Student feedback conducted at the mid-term of semester provides opportunity to the students to give comments in improving the course delivery process	1	2	3	4	5	6	7
OTHERS (IF ANY):								
C.	**COURSE ASSESSMENT**							
1.	The assessment is consistent with the course contents	1	2	3	4	5	6	7
2.	The information about the assessment requirement was clear	1	2	3	4	5	6	7
3.	The feedback of assessment help the students to understand the course content	1	2	3	4	5	6	7
4.	The assessment results were given on time	1	2	3	4	5	6	7
5.	Marks given are fair	1	2	3	4	5	6	7
OTHERS (IF ANY):								
D.	**LECTURER**							
1.	Positive attitude towards students	1	2	3	4	5	6	7
2.	Easy to contact	1	2	3	4	5	6	7
3.	Expert in course taught	1	2	3	4	5	6	7
4.	Responds with accuracy to the questions asked	1	2	3	4	5	6	7
5.	Ability to makes the course interesting	1	2	3	4	5	6	7
6.	A good public speaker	1	2	3	4	5	6	7
OTHERS (IF ANY):								
E.	**MATERIAL**							
1.	The material is consistent with the course contents	1	2	3	4	5	6	7
2.	Online materials were well provided	1	2	3	4	5	6	7
3.	Reference source is compatible with the requirements of the course	1	2	3	4	5	6	7
4.	The reading material help to understand the course	1	2	3	4	5	6	7
5.	Course remembrance is satisfactory	1	2	3	4	5	6	7
6.	Teaching aids used in the classes are satisfactory	1	2	3	4	5	6	7
OTHERS (IF ANY):								
Overall, I am satisfied with the quality of my learning experience in this course.		1	2	3	4	5	6	7

3. Please state your comments or suggestions (if any).
   _____
   _____

   _____
   _____

Thank you very much for your cooperation.

Appendix D ETHICS

To:Nur Awi <awin@coventry.ac.uk>;

Coventry University ETHICS

The following ethics request has been approved by Zulfiqar Khan. All the relevant documentation will be available for you to download within the next 24 hours. Please log back into Ethics and select the request from your listing. Select the Downloads tab to retrieve the documentation.

Please proceed with good ethics.

Ref:	P14648
Project Title:	Students' satisfaction in teaching and learning
Applicant:	Nur Awi
Supervisor:	Zulfiqar Khan
Module Code:	BESR007
Module Leader:	

Go to ethics.coventry.ac.uk to view this request in more detail.

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Ethics Request Updated

CU Ethics <omis@coventry.ac.uk>

Thu 27/06/2013 08:11

To:Nur Awi <awin@coventry.ac.uk>;

The following ethics request has been approved by Marylyn Carrigan. All the relevant documentation will be available for you to download within the next 24 hours. Please log back into Ethics and select the request from your listing. Select the Downloads tab to retrieve the documentation.

Please proceed with good ethics.

Ref:	P13433
Project Title:	The importance of elements and problem that occurs in course delivery
Applicant:	Nur Awi
Supervisor:	Zulfiqar Khan
Module Code:	BESR007
Module Leader:	

Go to ethics.coventry.ac.uk to view this request in more detail.

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Ethics Request Updated

CU Ethics <omis@coventry.ac.uk>

Wed 03/07/2013 09:04

To:Nur Awi <awin@coventry.ac.uk>;

Coventry University ETHICS

The following ethics request has been approved by Zulfiqar Khan. All the relevant documentation will be available for you to download within the next 24 hours. Please log back into Ethics and select the request from your listing. Select the Downloads tab to retrieve the documentation.

Please proceed with good ethics.

Ref:	P13381
Project Title:	Lecturers teaching evaluation
Applicant:	Nur Awi
Supervisor:	Zulfiqar Khan
Module Code:	BESR007
Module Leader:	

Go to ethics.coventry.ac.uk to view this request in more detail.

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Ethics Request Updated

CU Ethics <omis@coventry.ac.uk>

Wed 17/12/2014 10:31

To:Nur Awi <awin@coventry.ac.uk>;

The following ethics request has been approved by Caroline Moraes. All the relevant documentation will be available for you to download within the next 24 hours. Please log back into Ethics and select the request from your listing. Select the Downloads tab to retrieve the documentation.

Please proceed with good ethics.

Ref:	P29889
Project Title:	The Effect of Lean Kaizen Application on Student's Satisfaction in Malaysian Higher Education Sector
Applicant:	Nur Awi
Supervisor:	Zulfiqar Khan
Module Code:	BESR007
Module Leader:	

Go to ethics.coventry.ac.uk to view this request in more detail.

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Ethics Request Updated

CU Ethics <omis@coventry.ac.uk>

Mon 31/03/2014 13:55

To:Nur Awi <awin@coventry.ac.uk>;

The following ethics request has been approved by Marylyn Carrigan. All the relevant documentation will be available for you to download within the next 24 hours. Please log back into Ethics and select the request from your listing. Select the Downloads tab to retrieve the documentation.

Please proceed with good ethics.

Ref:	P13202
Project Title:	THE EFFECT OF LEAN KAIZEN APPLICATION IN COURSE DESIGN AND DELIVERY ON STUDENTS' SATISFACTION AND PERFORMANCE
Applicant:	Nur Awi
Supervisor:	Zulfiqar Khan
Module Code:	BESR007
Module Leader:	

Go to ethics.coventry.ac.uk to view this request in more detail.

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