



**Improvement on Subject Registration and Drop
Process Using Value Stream Mapping Technique:**

**A Case Study in the School of Manufacturing
Engineering**

by

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Penambahbaikan Pada Pendaftaran Subjek dan Proses Titisan Menggunakan Peta Aliran Nilai: Kajian Kes di Fakulti Kejuruteraan Pembuatan

ABSTRAK

Konsep "*lean*" sentiasa menitikberatkan perihampuran dalam pembaziran, peningkatan kualiti dan pengurangan masa kitaran. Menjadi pengetahuan umum secara global, teknologi "*lean*" mula di perkenalkan di Kilang Pembuatan Toyota. Sejak itu, pelaksanaan ini telah di patuhkan di gunapakai oleh organisasi pembuatan yang lain. Kajian ini menjurus untuk mengkaji pelaksanaan konsep "*lean*" dalam industri pendidikan dimana kajian kes akan dilaksanakan di pejabat pentadbiran Fakulti Kejuruteraan Pembuatan Universiti Malaysia Perlis. Kajian ini bertujuan untuk menilai proses semasa pendaftaran dan menggugurkan kursus yang dikendalikan oleh pejabat pentadbiran, secara tidak langsung membangunkan keadaan semasa dan nilai masa depan melalui sistem pemetaan aliran proses dan akhirnya memeriksa dan menilai kecekapan teknik "*lean*" yang baru. Untuk berbuat demikian, nilai teknik pemetaan aliran digunakan untuk meletakkan langkah-langkah yang berbeza dalam proses itu dengan masa yang berkaitan diperlukan untuk mencapai setiap langkah dan menentukan aktiviti nilai dan bukan nilai tambah. Peningkatan di periksa sepanjang proses dan tindakan yang diperlukan telah di ambil untuk menambah baik aliran proses, mengurangkan jangka masa penghasilan dan mengurangkan nilai-aktiviti yang tidak tambah. Peta aliran perbaikan masa hadapan yang baru kemudiannya di bina untuk menggambarkan aliran baru proses.

Improvement on Subject Registration and Drop Process Using Value Stream Mapping: A Case Study in the School of Manufacturing Engineering

ABSTRACT

Lean concept has been always concerning about waste reduction, quality improvement and cycle time minimization. As it is globally known, lean technology was first introduced in Toyota manufacturing plant. Since then, it has been followed and adopted by other manufacturing organizations. This research is studying the implementation of lean concept in the educational industries taking the administration office of the manufacturing school of Universiti Malaysia Perlis as a case study. Mainly, this study aims to evaluate the current process of registration and drop of the courses handled by the administration office, develop a current state and future state value stream mapping for the process and eventually to examine and evaluate the efficiency of the new implemented lean technique. To accomplish the objectives, Value Stream Mapping (VSM) technique is used to lay out the different steps in the process with the associated time needed to accomplish each step and determine the value and non-value added activities. Improvement vacant is examined throughout the process and needed actions are taken to improve the process flow, reduce the lead time and minimize the non-value added activities. Future state value stream map is then constructed to visualize the new flow of the process.

Key words: *Lean implementation, process flow, cycle time, lead time, value stream mapping*

CHAPTER 1

INTRODUCTION

1.1 Introduction

The principle of lean is to eliminate the waste from the system. However, several proofs certify that the application of lean principles in service sectors has produced a tremendous and beneficial results caused some changes and improvements in the services level, time of processing and getting more outcomes with less resources (Peter Hines & Sarah Lethbridge 2008). The purpose of this research is to study lean implementation in service center taking the administration office in the school of manufacturing engineering, Universiti Malaysia Perlis as a case study.

The research will be focusing on the application of lean thinking as well as critical success factors and challenges of lean implementation. The research design which is a case study follows the interpretive and constructive research philosophies. Qualitative study with the semi-structured interviews and observations is to be applied for data collection at the administration office of the school of manufacturing engineering in Universiti Malaysia Perlis (UniMAP). Based on the interviews, current practices are to be examined. Relevant and applicable lean tools and techniques are required to improve the performance and reduce the waste.

1.2 Problem Statement

When we think about lean, we always think of eliminating waste, reducing time and enhancing quality. Undoubtedly, in any organization there is always a potential to make some improvements considering the lean thinking aspects. School of manufacturing engineering in Universiti Malaysia Perlis (UniMAP) is practicing some lean techniques currently such as 5S. However, level of lean practiced in the school is not satisfying yet since the practice of 5S is only related to the logistic element. There is a need for more Improvements in the different elements, such organization, process flow and others. The administration office of the school complains that, the process of manual courses' registration, courses' drop, and registration slip verification is a time consuming process. The current process has to be evaluated, standardized and the time of the process is to be shortened.

1.3 Purpose of the Study

The purpose of this research is to study lean implementation in educational organizations taking school of manufacturing engineering in Universiti Malaysia Perlis as a case study. The research is focusing on the application of lean thinking using the various lean tools and techniques to enhance the performance of the administration office. Besides that, critical success factors and challenges of lean implementation is examined thoroughly.

1.4 Objectives of the Study

The research is carried out aiming to achieve few objectives in mind, which most important are;

1. Evaluate the current process of registration and drop of the courses handled by the administration office.
2. Propose a current state and future state value stream mapping for the process of registration and drop of the courses.
3. Examine and evaluate the efficiency of the Value Stream Mapping technique.

1.5 Scope of the Study

This study is conducted in the administration office of the School of Manufacturing Engineering, Universiti Malaysia Perlis (UniMAP). Out of the several procedures that the office handle, the students' courses' registration is focused on during this study and the process is to be improved. The duration of the study was for four months starting in June 2014 until October 2014 as it's mentioned in the project milestone. Methodology followed in this study is the implementation of lean thinking tools and techniques such as "value stream mapping".

1.6 Thesis outline

The thesis is broken down into five chapters, the contents of each chapter is explained as follows:

Chapter 1: Introduction

The introduction chapter starts with giving a brief background about the study topic followed by the problem statement and the objectives. In addition, the purpose of the study has been discussed as well as the scope of the research has been set.

Chapter 2: Literature review

In the literature review chapter, more comprehensive materials have been presented for better understanding about lean technology and the implementation of lean service in the educational industries. Several case studies were reviewed thoroughly and the associated findings for each case study have been discussed.

Chapter 3: Methodology

This chapter presents the research methodology in details, starting with the survey distribution, followed by the semi-structured interview and ending with the data analysis tools and techniques including the value stream mapping and Pareto chart.

Chapter 4: Results and Discussion

Analysis started with laying out the results gained from the survey that was distributed among the students, followed by analyzing the interview feedback using the Pareto chart. After that, current state value stream map has been constructed and based on the constructed value stream map. The suggested improvement has been implemented. Eventually, future state value stream map has been developed to visualize the improvement.

Chapter 5: Conclusion

The conclusion chapter is summarizing up all the findings for the research in correlation with the pre-set objectives. It briefly shows the associated solutions that consist with the achievement of each objective.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter covers a detailed overview of the main elements in the literature on lean concept. It begins with discussing the sources and continuous development of Lean thinking, before touching its conceptual underpinnings and contingencies. A detailed examination on the contingent nature of lean was done by conducting analysis on how lean could be used in service operations and public organizations. Next, research opportunity with regards to Lean in Higher Education institutions is discussed to define the empirical focus of the thesis.

2.2 Background: Lean Thinking and Lean Production

The lean concept was originated from the Japanese car plant shop floors, Toyota (Liker 2004). After Second World War, Japan economy has suffered a shortage of qualified labor, raw materials and capital. It was blown out by the commanding attitude of the great United States producers, where the mass production systems realized and signifies the scale of economic. Nevertheless, problems were raised in traditional mass production too, which are the poor quality with high capital costs and inflexibility variety and volume of the product (Monden 1983; Ohno 1988). Toyota acquired a production scheme that was superior to Western mass production as it matched the

demand instantaneously and perfectly, and that was initially to turn the obstacle of constrained resources into competitive advantage (Seddon 2005). Nevertheless, it is a must to note, that the development of the Toyota Production System (TPS) was not a single-point intervention (Holweg 2007; like 2004). In 1948, Taiichi Ohno, the father of lean started testing new production concepts in the Toyota engine machining shop (Ohno 1988). From there, it took them more than ten years to build up a perfect production system and implement it at another Toyota production site.

In the late 1970s, western world started to concern about lean practice when the favourable position of the Japanese automobile manufacturers became threatening to its American and European competitors. An English journal on TPS, published in 1977 by Toyota engineers (Sugimori et al. 1977), defined its two building blocks as “elimination of waste results in reduction of the cost” by planning production, inventories is reduces and mistakes were prevented to found a continuous one-piece flow and as making “maximum utilization of the workers “capabilities” through involving them in the running and improvement of the works. Nevertheless, although there is an early literature in English Language, it takes business leader in the West more than a decade to mould reasons that underlie performance gap that increasingly widened. Holweg (2007) break up this mostly into focus and language that is highly technical and early accounts empirical weak fundamentals. In addition also to the hesitancy of many Western companies to assume that their problem is home-made and they demand to be taken care of (Womack & Jones 2003). However, Lean's production concept only indicates Lean's beginning evolution. Hines et al.(2004) explain how Lean's perception in the West has gradually developed and get adopted. Focus then continue to expand to understand lean manufacturing system. This system thinking

stress strategic alignment among all production system elements for better demand fit (Seddon 2005). Ultimately, the strategic of "Lean's thinking" (Womack & Jones 1996, 2003) or "Lean's behavior" (Emiliani 1998) have been extracted and its reasons from the perspective, contingency (Donaldson 1996) that Lean's core principles produced are adaptable for certain condition organization and diligence that is different.

2.3 Concept: Lean Thinking Three Levels

Due to different translations and academic interpretations and its continuous extension into new sectors, there is no ultimate definition of what Lean actually is and what exactly it encompasses (Shah & Ward 2007). With regards to the TPS, New (2007: 3547) even asserts: "we don't really understand what the TPS is, and it is possible we never will. Many have undertaken to capture the TPS, but none of the attempts seem to work on the nose". While the dissertation will not completely solve this problem, it tries to shed some light by distinguishing three levels of Lean thinking – the fundamental, strategic and operational level.

2.3.1 Fundamental level: Nature of lean

If we ask about the fundamentals, Lean could be defined as "dynamic learning potential" (Holweg 2007: 422). From perspective based on Wernerfelt 1984, Lean can be interpreted as coherent management system and continuously expanding which provides organization with "capacity to integrate, build and reform internal and external efficiency to handle rapid environment change" (Teece et al. 1997). These have been an important implication for spread and Lean's adaptation thinking and enable expectation outside perspective refining delineated.

2.3.2 Strategic level: The conceptual building blocks of Lean thinking

The conceptual building block of lean thinking containing several principles as below:

Principle 1 – Define value from the customer perspective.

Lean aimed to increase value in the company that offers to get a larger market share. Therefore, it implied based on paradigm growth and need to be differentiated from cost reduction and easy attenuation (Bicheno 2008;. Hines et al 2008b). It is the customers which eventually choose. Their choice may be different and could not be dealt with "one size fit all approaches" (Womack & Jones 2003). Lean admits this diversity and stress variation product and adaptation.

Principle 2 – Place and identifying the value stream for each product.

Lean's thinking is normally based on process organization. Therefore, by deeming that value created through end to end process, it is challenging mentality silo and system bureaucrat (Dahlgard & Qstergaard 2000). Perception that Lean Enterprise" extends view based on this process with perspective supply chain and stress that end to the straight value flow end consisting of several organizations (Womack & Jones1994; Liker & Wu 2000). Finally, it is important to understand that concept value trends more than just different perception to process. Mapping value trend (Value Stream Mapping) not only determines the activities of the organization to deliver products or services. It also distinguishes between value added activities that directly contribute to fulfill customer's need and added value activity (Slack et al. 2010).

Principle 3 – Make the value stream flow.

While certain Non Value Added activities are indispensable to enable proceeding or subsequent Value Added, other Non Value Added can be removed to increase process efficiency. They are called “muda”, the waste in Japanese word (Liker 2004). Ohno (1988) defines the seven sources of muda as transportation, inventory, motion, waiting, over-processing, over-production and defects. Lean aims at removing all muda to enable a smooth flow of the remaining activities (Bicheno 2008). In a manufacturing environment this means turning away from traditional “batch and queue” techniques by reducing safety buffers and shortening set-up times to approach the ideal state of continuous one-piece flow (Slack et al. 2010).

Principle 4 – Introduce customer pull for value creation.

Once flow is achieved, pull is the next logical step to remove more muda and maximize value creation. “Meaning of pull in is that no one upstream should produce a good or service until the customer downstream asks for it” (Womack & Jones 2003: 67). This is realized by two concepts: First, Just in Time (JIT) means that all bodily processes of the value stream are transmitted out on demand, i.e. when they are needed and exactly in the required quality and quantity (Liker 2004). Second, synchronization and leveled capacity means that all steps of the value stream are conducted with the same cycle time, which is influenced by the demand for the ultimate product or service (Slack et al. 2010).

Principle 5 – Strive for perfection of the first four principles.

The initial implementation of the first four Lean principles usually requires radical change, “kaikaku” in Japanese, as they are a major departure from traditional operations principles. However, at its core, Lean stresses the notion of continuous incremental improvement, expressed by the Japanese word “kaizen” (Womack & Jones 2003; Liker 2004). Kaizen meaning that a state of perfect “leanness” is instead an ideal to follow than a concept to be implemented (Karlsson & Ashlstrom 1996). Finally, Kaizen inevitably triggers the pursuit for perfection as it suffers a self-reinforcing effect: “The four initial principles interact with each other in a pure circuit. The harder you pull, more impediments to flow are revealed so they can be removed” (Womack & Jones 2003: 25).

Today, these five Lean core principles have become widely accepted common knowledge of operations management and seem to be uncontroversial for new generations” scholars. However, at the time of their introduction they were seen as revolutionary and counter-intuitive as they challenged deeply enrooted traditional beliefs of operations theory and practice (Slack et al. 2010). Probably most important, the ideal of one-piece flow with its requirements to abolish inventories and shorten set-up times challenged traditional “batch and queue” thinking and the belief in capital-intensive fully automated production. Economies of scales were replaced by economies of flow. Inventory, usually seen as an asset, was redefined to be waste (Liker 2004). Lean favors human intelligence over advanced technology (Emiliani 2008). Even though this is more or less implicit in the five Lean core principles, this relationship should be explicated. Therefore, the definition of the Lean’s conceptual building blocks

should be complemented by the following two fundamental Lean methods (Dahlgaard & Qstergaard 2000).

Method 1 – Identify and solve a problem’s root cause. Root cause analysis means that every problem is examined with rational methods to identify its underlying causes and solve it immediately and once and for all, i.e. without workarounds (Spear & Bowen 1999). Root cause analysis was introduced which is often described as “learning to see” – as it enables for the first time to fully comprehend the sources of muda (Rother & Shook 2003). It is also closely related to the “go and see” concept, also expressed as “gemba” in Japanese (Bicheno & Holweg 2008): Managers should not only manage by numbers but also need to pay more attention to the real tangible processes and activities of their operations.

Method 2 – Empower staff to take ownership for their work. The logical consequence of “learning to see” is “see and do”, i.e. eliminate problems as they occur. Employee empowerment promotes and supports every employee to use up over ownership for the quality of his oeuvre and the entire production system. This includes training as well as team-based problem solving in quality circles (Liker 2004). Womack and Jones (2003:268) conclude that Lean thinking is “extraordinarily anti-hierarchical and pro-democratic. Hence, each and every worker inspects his or her own work, becomes multi-skilled, participating in periodic job redesign through *kaizen* activities. Layers of management are permanently stripped away. Transparency obviously makes all business aspects open for everyone”.

2.3.3 Operational level: How is Lean implemented?

Over time, several tools were developed to support framework implementation of the more fundamental Lean principles and methods at the functional stage (see e.g. Bicheno & Holweg 2008; Feld 2001; George et al. 2005). For example, different tools of VSM plump for the principle of flow, and Kanban cards, level scheduling and talk time are applied to implement customer pull. Depending on the author, this lean toolbox comprises also techniques that originate from other related improvement approaches such as Total Quality Management or six sigma. The distinction between these approaches is not always clear, though it has been argued that lean focuses more on process flow while the emphasis of Six sigma and TQM is more on reducing variation (Andersson et al. 2006; Antony 2011), e.g. by applying techniques of Statistical Process Control (Nolan & Provost 1990).

2.4 Need: Lean Service

Many argue whether or not manufacturing operation and service can be dealt with based on the same concept (Fitzsimmons & Fitzsimmons 2008). Although some stress the importance of service features that are special like the involvement of customer and intensity labour (Schlesinger & Heskett 1991; Gronroos 1990). Levitt (1972) thinks that this should not become excuse to prevent manufacturing concept as one way to increase operational efficiency service.

Many evidence shows that Lean's thinking can be used for service companies. Case study consisting of airline, fast food restaurant, insurance and hospital (Bowen & Youngdahl 1998; Swank 2003; Ahlstrom 2004) besides of that, cost saving report of

15% to 25% and reduction of time (Goland et al 1998). For example, Bowen and Youngdahl 1998 stressed that Southwest Airlines and Hospital Shouldice - both famous through Harvard Business School case study - maintain Lean's operation. Even though it probably true that a few their operation principles is close similar to Lean's thinking, second both organizations had announced that it pursues Lean's implementation. Third, although service companies purposely start Lean's journey, their application principles and Lean's method is frequent still shallow and scattered. Fourth and same, in all cases reported, Lean's implementation is stays restricted to odds and ends of the organization worth chain. Therefore, in any case it is by all accounts early days for Lean administrations and there stays some hypothetical foundation to be carried out. There is an expanding number of calculated works and handy rules that attempt to apply Lean intuition to the earth (see e.g. Bicheno 2008, Seddon 2005, Seddon & O'donovan 2010a, 2010b). As indicated by these records, a setting of Lean usage needs to address a few exceptional peculiarities of administration operations:

In the first place, esteem creation depends generally on the customer's view of his connections with the Service Delivery System (SDS) – the alleged "snippets of truth" (Normann 2000). This has suggestions for the qualification in the middle of VA and NVA, as quality is influenced by destination administration results as well as by subjective observations (Zeithaml & Bitner 2003). Certain exercises that may not appear quality adding concerning administration execution may be critical for the knowledge of in any event a few clients (Ashlstrom 2004), e.g. vis-à-vis benefit as contrasted with phone or online administration.

Second, because of client contribution and the elusive character of their offerings, numerous administration operations face higher multifaceted nature and variety of client interest. While producers offer a predefined set of items, administration suppliers frequently need to manage surprising solicitations (Seddon 2005). Bicheno (2008) proposes to methodically investigate interest examples and presents the refinement between "runners", "repeaters" and "outsiders" focused around the recurrence of an administration demand. While "outsiders" ought to be managed on a specially appointed premise, the association can introduce devoted methodology for "runners" and "repeaters".

Third, Lean needs to comprehend the diverse wellsprings of variability in administration forms. Common institutionalization methodologies may help to handle inward process variability that is instigated by the SDS or staff. In any case, because of the concurrence of generation and utilization all administration courses of action are likewise presented to client acquainted variability that is troublesome with control (Bicheno 2008), e.g. distinctive fitness levels or diverse desires and request. Thus, Lean in administration operations ought to concentrate on making the procedure versatile and skilled, as opposed to seeking after a perfect state of impeccable client consistence (Ashlstrom 2004; Seddon 2005).

Fourth, worker strengthening is the way to enhancing procedure ability and versatility. Staff must be empowered to react spontaneously and enough while cooperating with the client (Ashlstrom 2004). Therefore, there ought to be imperatives to the utilization of standard work in Lean administrations. While administration outlines and rules may be an extraordinary backing for staff, particularly when managing "runners" and