UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Work Study At Lay Up Process In Preparation For An Aeraspace Company Value Stream Mapping And Kaizen Implementation

Report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka for the Bachelor of Manufacturing Engineering (Manufacturing Process)

By

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I hereby, declared this thesis entitled "Work Study At Lay Up Process In Preparation For An Aerospace Company Value Stream Mapping And Kaizen Implementation" is the results of my own research except as cited in references.

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APPROVAL

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ABSTRACT

Work study is the systematic examination of the methods of carrying out activities such as to improve the effective use of resources and to set up standards of performance for the activities carried out. Work study can be define into two tools which is work method and work measurement. In work method, it is explained about the method or technique that people using to make an analysis on their working process. To obtain data for the analysis, the used of work measurement is important in seeking the perfect data and result for the analysis. Choosing the correct method and technique is important in delivering and obtaining the data from the working environment. The data obtained was used to develop value stream mapping and apply kaizen implementation.

ABSTRAK

Analisis kerja adalah satu teknik di mana ia menguji keberkesanan sesuatu kerja dalam sesuatu proses. Ia juga merupakan salah satu aktiviti pembaikpulihan sesuatu cara kerja bagi menghasilkan produktiviti yang tinggi dan menetapkan satu standard yang akan diikuti oleh semua pekerja dalam tempat kerja tersebut. Dalam analisis kerja terdapat dua istilah yang perlu diambil kira iaitu teknik melakukan kerja dan pengukuran kerja. Dalam teknik melakukan kerja, terdapat beberapa jenis teknik yang sering diaplikasi oleh pengguna bagi memperoleeh satu teknik yang baru untuk menghasilkan product yaang baik dan meninggikan produktiviti kerja. Dalam menganalisis data, kecekapan dalam memperoleh data bergantung kepada pemilihan parameter datam pengukuran kerja. Penggunaan teknik-teknik kerja dan parameter dalam pengukuran kerja membantu sesuatu proses menjadi lebih baik dan lebih mudah. Hasil analisis data kemudiannya akan digunakan dalam pembentukan 'value stream mapping' dan penggunaan 'kaizen'.

DEDICATION

To my beloved parents and family. Also to my supervisor for the support and encouragement.

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APP	-	Altering Poisson Process
COWS	-	Continuous Observation Work Sampling
CTI	-	Cost Time Investment
CTP	-	Cost Time Profile
CTRM	-	Composites Technology Research Malaysia
FLEP	-	Fixed Leading Edge Lower Panels
IOFLE	-	Inboard Outer Fixed Leading Edge
OA	-	Orthogonal Array
PTS	-	Predetermined Time System
SNR	-	Signal to-noise ratio
SOWS	-	Snap Observation Work Sampling

CHAPTER 1
INTRODUCTION

1.1 Background Introduction

Consumer demands for a high degree of manufacturing responsiveness and reduced lead-times, unpredictability in the marketplace, resulting difficulties in forecasting, and pressures for reduced inventories are placing an increasing focus on the design efficiency of manufacturing systems and their supply chains (Matson and McFarlane, 1998). In traditional manufacturing operations, the supporting facility infrastructure, equipment, processes, and personnel are operating with less-than-optimal flow processes, facility constraints, and outdated equipment.

Traditional, or "Push", manufacturing methods of production are batch-and-queue, task-oriented, and functionally isolated (Sharma and Moody, 2001). Current systems are designed and arranged as separate system elements, which result in excessive inventory requirements and parts travel time and distance. Industrial processing equipment is aging and is at the point of needing refurbishment or replacement. Such systems are prone to excessive downtime due to long lead maintenance parts, out-of-business contractors, and obsolete parts. With over 60 percent of a total system's life cycle cost associated with operations and maintenance, and as systems age, there is great opportunity to optimize the industrial space (Blanchard and Fabrycky, 1998).

The traditional industrial space needs to be improved to function at increased levels of efficiency through modern business philosophies and production techniques, such as lean manufacturing (Lamming, 1993; Womack and Jones, 1996; Liker, 1997; Maskell and Baggaley, 2003). Lean manufacturing initiatives, based upon the famous Toyota Production System (Monden, 1983; Ohno, 1988; Shingo, 1989), have been proven to produce excellent results when properly implemented. Lean manufacturing facilitates increased capacity, higher quality, and higher productivity while simultaneously reducing inventory and order lead time (Kilpatrick, 1997). How does an enterprise know if it is lean? Benchmarking oneself against best internal operations, or against external direct competitors, or against external functional best operations, or against generic functions regardless of industry, can be one measure of the relative value of one's leanness (Mathaisel et al., 2004). Appropriately chosen metrics are used to assess whether or not an enterprise is lean. There are no true established measures of categorical leanness, but lean system introductions have been associated with time, space, quality, people, and cost savings. A recent Lean Aerospace Initiative study (MIT Lean Aerospace Initiative, 2005) found:

a) labor hours: 10-71 percent improvement;
b) costs: 11-50 percent improvement;
c) productivity: 27-100 percent improvement;
d) cycle time: 20-97 percent improvement;
e) factory floor space: 25-81 percent improvement;
f) travel distances (people or product): 42-95 percent improvement;
g) inventory or work in progress: 31-98 percent improvement;
h) scrap, rework, defects or inspection: 20-80 percent improvement;
i) set up time: 17-85 percent improvement; and
j) lead time: 16-50 percent improvement.

Also very useful to the transformation of an industrial enterprise is a cellular design (Sekine, 1992; Levasseur et al., 1995; Singh and Rajamaani, 1996; Mungwattana, 2000). The combination of people, machines, and simplified control and manufacturing processes that bind them together within cells reduces costs, material scrap, manpower requirements, lead times, rework, flow times, and optimizes the use of floor space.

In this thesis, the work study is focus on producing the standard time for the preparation of lean implementation in value stream mapping and kaizen approach. Based on the tools and technique of lean, an aerospace company is chosen to implement the lean approach because there is lots of opportunity to do improvement based on standard time.

1.1.1 Definition

Before describing the Work Study analysis and connect the standard time to lean implementation, some definition is needed to understand the workflows of this thesis:

a) Lean: The generic term lean manufacturing was popularised by its major proponents, international motor vehicle programme (IMVP) researchers of the Massachusetts Institute of Technology. Their project focused on the significant performance gap between Western and Japanese automotive industries of 52 assembly plants in 14 countries over a five-year period. The hypothesis of the subsequent research evolves from Liker's (Liker, 1996) perception of lean manufacturing; that it is: "a philosophy that when implemented reduces the time from customer order to delivery by eliminating sources of waste in the production flow".

b) Value Stream Mapping: Is a map of activities between the buyer and the supplier in order to identify the opportunities of improvement of the supplier integration (Hines et al, 1997).

c) Kaizen: Is a *Japanese* word indicates of continuous improvement in small increments that makes the process more efficient, effective, under control and adaptable (Besterfield et al., 1999).
d) Work Study: An analysis that frequently determines the proportion of time for specific task in which an operator or machine or process is engaged (Ho, 2001).
e) Work Method: is an analysis of ways of doing work.
f) Work Measurement: involves assessing the time a job should take to do.

1.1.2 Lean

In the New Lean context the word lean is an unfortunate one. Unfortunate because it has connotations of both manufacturing (which it is by no means confined to) and mean-ness or cutting back (which may apply to waste, but Lean should mean fit for new activities not skinny or anorexic). Lean can be defining as much definition as it could be base on manufacturing application and understanding (Bicheno, 2004).

1.1.2.1 Lean is Waste Prevention

One frequently hears that Lean is about waste where it is more about waste prevention than waste elimination. Johnson and Broms believe that the focus on elimination of waste is misleading, and argue that it is the subtle avoidance of waste whilst creating balanced flow that is the key. This is just like the total quality concept of trading the cost of prevention against the costs of inspection and internal and external failure. Spend more on prevention but far less on failure and inspection (Bicheno, 2004).

1.1.2.2 Lean is Value

Lean practitioners do go after waste. This is appropriate given the high levels of waste in most value stream. Although there will always be another layer of waste to address, the more experienced need to return to Value – to the first and second Lean principles of customer and value stream. Like the Quality concept of quality of design and quality of conformance, waste elimination or prevention is but one half of the total picture. Rethinking the value side is at least as important (Bicheno, 2004).

1.1.2.3 Lean is system

Lean is system – more than the sum of its components. Systems are in constant interplay with their environment – where the boundary is, is not obvious (what should be outsourced, the extent to which customers and suppliers are involved). Systems adapt continuously but at a faster rate when threatened, like ant colonies (true kaizen culture). System evolve – like bugs combating insecticides, So lean must learn to recognize and kill of inappropriate tools whilst developing new and stronger ones. Here is an analogy about lean system which is human body. Layout, supermarkets and buffers provide skeleton, kanban and material are the circulation system. Eyes and brain give vision and strategy, control, deployment and measurement come from the nervous system, quality and improvement from the muscular system, energy and getting rid of waste come from the digestive system. The body needs them all for fast, flexible flowing human action (Bicheno, 2004).

1.1.2.4 Lean is Waste

Waste prevention and value adding are certainly applicable in service. But adaptation is necessary. A new service lean toolbox is emerging, with contribution from six sigma, business process reengineering, service quality, service operation and

marketing. It contains adaptations on mapping, demand, service waste and customers flow. TPM and OEE applied to the person and the machine itself (Bicheno, 2004).

1.1.3 Value Stream Mapping

Value Stream Mapping is the map that shows the process flow in diagram. It is also a visualization tool oriented to the Toyota version of Lean Manufacturing (Toyota Production System). It helps to understand and streamline work processes by using the tools and techniques of Lean Manufacturing. The goal of VSM is to identify, to demonstrate and to decrease waste in the process. Waste is defined as any activity that does not add value to the final product. The word is often used to demonstrate and decrease the amount of "waste" in a manufacturing system. VSM can thus serve as a starting point to help management, engineers, production associates, schedulers, suppliers, and customers to recognize waste and identify its causes. As a result, Value Stream Mapping is primarily a communication tool, but it can also be used as a strategic planning tool. Here VSM can determine the standard work time in time study with data collection method and also use to gather the information flow and material handling that involve in the factory process.

1.1.4 Kaizen (Continuous Improvement)

In lean house, Kaizen or improvement program is includes in base of the house itself. Kaizen means simply continuous improvement. In Japanese kai refers "to take part' while zen refers "to make good". Lean production is founded on the idea of kaizen, which refers to the small, gradual, incremental changes applied over a long period that add up to a major impact on business result. Kaizen fundamental is basically about process oriented thinking and people oriented thinking. In process oriented thinking, kaizen generates the idea on how to improve the process to obtain a good result later. In people oriented thinking, kaizen depends on people's effort on how they manage to make the improvement in the process itself (Bicheno, 2004).