

Waste Reduction in Industries using Lean Manufacturing

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Abstract- *Lean manufacturing refers to a manufacturing improvement process based on the fundamental goal of Toyota production system (TPS) in order to minimize or eliminate waste while maximizing production flow. Many manufacturing organizations realize the importance of practicing lean techniques. However, few organizations apply lean techniques with the necessary knowledge and proven tools to achieve it. A value stream includes all the operations and processes to transform raw materials into finished goods or services, including non-value adding activities. Value stream management is a management tool for planning a production process involving lean initiatives through systematic data capture and analysis. It is a proven process for planning the improvements that will allow companies to develop lean practices. The purpose of this study is to develop a value stream map for a manufacturing company in Minnesota. This particular tool allows the company to document current lead time, inventory. Levels and cycle times to determine the ratio of value added to total lead time of the product line being analysed. The first step will be to create a current state map to make a picture of the production flow and understand the company's current cycle times, process communications, and machine equipment capacity. This provides the information needed to produce a future state map by creating a vision of an ideal value flow, although that will not be done in this study.*

Keywords- *Lean manufacturing, planning, Value stream management*

I INTRODUCTION

Nowadays organizations are worried about getting better and better results with fewer resources, in order to survive and overcome the high competition, globalized markets, economic downturns and cost effects that obligate them to follow this policy. In this sense, there are many proposed solutions to face those challenges (methods, strategies and techniques) available on internet portals, consulting sectors, books and many other sources. One of these is the well-known strategy "Lean Manufacturing", a popular Japanese production method that was mainly developed in Toyota as the Toyota Production System. Many companies have tried to implement it as a whole system or have adopted a portion of the strategy, in order to improve their internal processes. Lean Manufacturing is a way of production that achieves the challenge of getting more with less through the elimination of waste or activities that do not add value to the production process. It also increases customer satisfaction, improves the organizational performance and results in general. The Lean thinking specifies value, line up that value with the creation of actions in the best structure, conduct these activities without interruption, and perform them in a more efficient manner. Manufacturing operations are continually striving to increase productivity and output of their operations. Their goal is to satisfy the customer with the exact product, quality, quantity, and price in the shortest amount of time. Lean manufacturing is more than a cost reduction program or a problem solving approach (Tapping, 2002). The main idea is that an efficient production can be achieved by a comprehensive approach to minimize wastes. This means eliminating excess production and inventory, redundant movement of material, waiting and delays, over processing, excess worker motion, and the need for rework and corrections. Part of lean manufacturing is reviewing operations for those components, processes or products that add cost rather than value (Tapping, 2002). Each step of the manufacturing process is monitored to determine if it adds value to the product. If it does not add value, the process could be delegated to a subcontractor or outsourcing company in order to focus the staff on value-added operations of its core business. A value stream is the set of processes required to transform raw materials into finished goods that customers value (Womack & Jones, 1996). In this study, a value stream map will be developed for a manufacturing company in Minnesota. Creating a value stream map will allow the company to document current production lead time, inventory levels, and cycle times in order to determine the ratio of value-added to total lead time of the product family being analyzed, creating a vision of an ideal value flow. The goal is to identify and eliminate the wastes in the production process. The company will use these results in order to map the future state and implement lean manufacturing. Womack, Jones, et al.[1] and Roos (1990), the term "lean" represents a system that utilizes fewer inputs in order to create the same outputs than those created by a traditional mass production system, while increasing the range of different finished goods for the end customer. The term lean manufacturing is synonymous with different names, such as agile manufacturing, just-in-time manufacturing, synchronous manufacturing, world class manufacturing, and continuous flow. Ohno et al [2], Imitating America is not always bad. We have learned a lot from the U. S. automobile empire. America has generated wonderful production management techniques, business management techniques such as quality control (QC) total quality control (TQC) and industrial engineering (IE) methods. Lean manufacturing is in direct opposition with traditional manufacturing approaches characterized by use of economic order quantities, high capacity utilization, and high inventory (Feld, 2000). In changing from a traditional environment to one of lean production, cultural issues will emerge quickly, as well as resistance to change. Implementing lean manufacturing techniques will change the organizational culture because everyone needs to be more involved. and accountable and people may be laid off. A fast managing change program is needed to accompany the effort. A slow approach generally does not work or achieve significant results. Lean manufacturing is not a magical solution (Feld, 2000). It involves a change in leadership that requires considerable communication, coordination, and organization which results in a change in the company's culture. Just implementing one lean technique such as a Kanban system will not result in lean implementation. Positive employee reaction to lean manufacturing is essential to success, but does not always occur since becoming lean improves productivity and can reduce the number of workers needed. Laying people off and asking the remaining employees to become more involved may not work. Feld stated that in order to create a lean manufacturing environment, the organization needs to be aware of where it is at that point. They must know why they need to change and why change is important. It is necessary to provide the answers to these questions to employees so they become more engaged in the process. "Motivation, tenacity, leadership, and direction all play roles in the successful deployment of a lean program" (p. 7). Feld also stated

that roles within the team and the way in which team members interact with one another are important. All members must understand their roles and why they were selected for their assignment.

II BRIEF HISTORY OF LEAN

To talk briefly about the history of Lean, we can start from the late 19th century, when the engineers Frederick Taylor, Frank and Lillian Gilbreth, Henry Ford, and other engineers contributed to some theories and worked to eliminate waste from the manufacturing process. These and some other developments later became part of the Lean Manufacturing techniques; works such as time study and standardized work, elimination of waste, the Ford assembly line, among others. Lean is a conception that has evolved from the craft production, mass production and Fordism. Following those contributions, Lean history is mostly based on the origins and development of the Toyota Production System (TPS) in Japan, the majority of the tools and techniques were developed in Toyota Motor Company. The TPS which is a philosophy that looks for the total elimination of waste, as was explained in the previous topics it impregnates all aspects of production in pursuit of the most efficient methods, tracing back its roots to the automatic loom of Sakichi Toyoda, founder of Toyota. This system has evolved through many years of trial and error to improve efficiency based on the “just in time” concept. To following figure presents a step by step evolution of this system

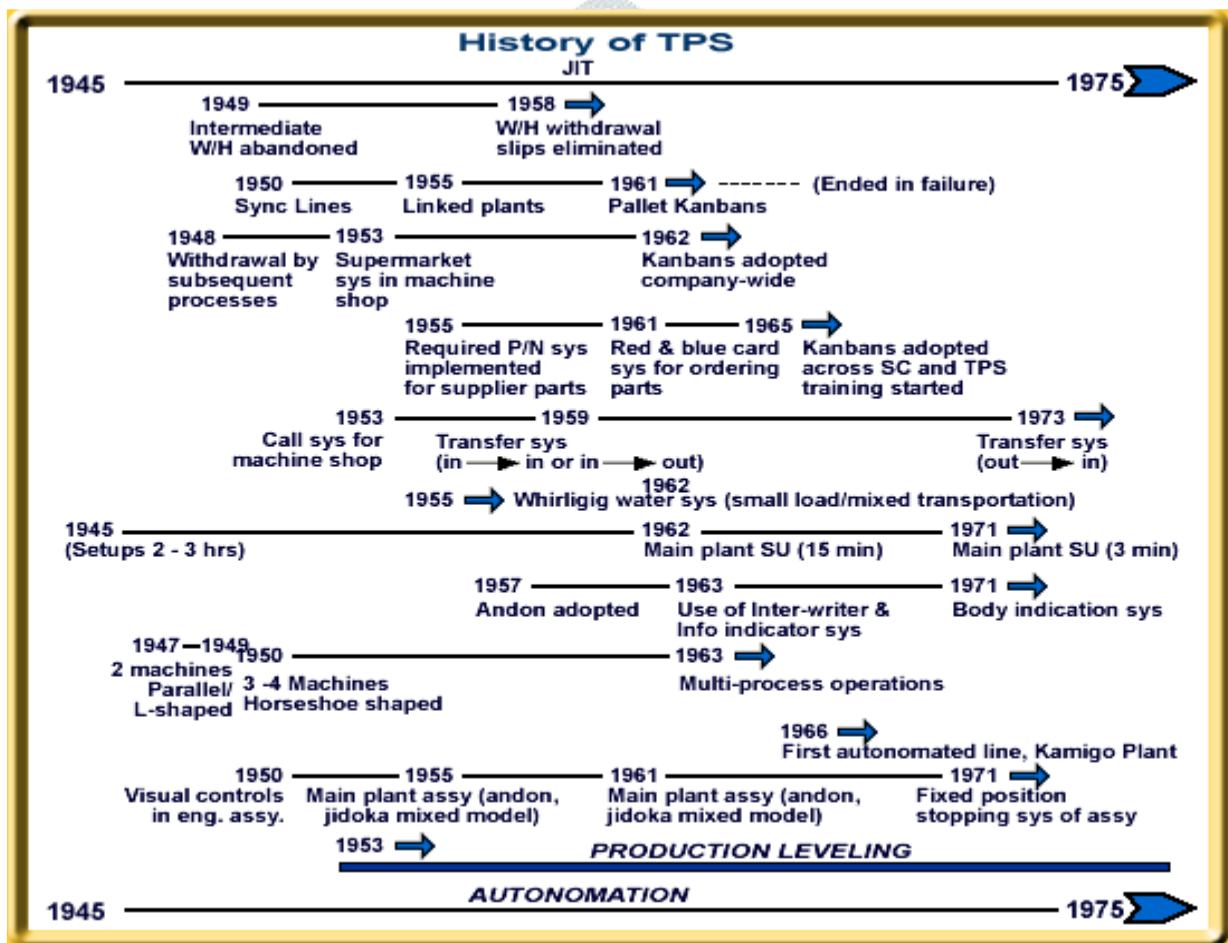


Figure.1

The contributions of the engineers Taichi Ohno and Shigeo Shingo from Toyota were very important to create many important changes in the productions system. They were able to transfer their contributions and ideas to literature, what later were used by James P. Womack, Daniel Roos, and Daniel T. Jones to recalled the concept “Lean Manufacturing” in their book “The Machine that change the World” and a subsequent work called “Lean Thinking”. There are some other contributions that affected the creation of the Lean concept, like the one from Professor Edward Deming with his production principles and cycle process that is used in Kaizen tool. In these brief words the most relevant events that support the development of this interesting production strategy has been collected. To visualize how all the Toyota Production System is structured, it is used temple of TPS, which is a well-known diagram that has become very important in modern manufacturing. It represents the whole system and its elements, the tools that contribute to achieve the success using this methodology. In the following figure, it can be appreciated the two pillars, Just in Time and Jidoka, sustaining and integrating the whole system, of course supporting it with strong bases to achieve the main goals placed on the roof. In the structure of the temple we had a glance of the foundation of TPS, now it is good to know how all

this configuration works in the real production process at Toyota. The following figure shows the real production process of Toyota Motor, how the system flows from one process to another, and what are the requirements to make that happens

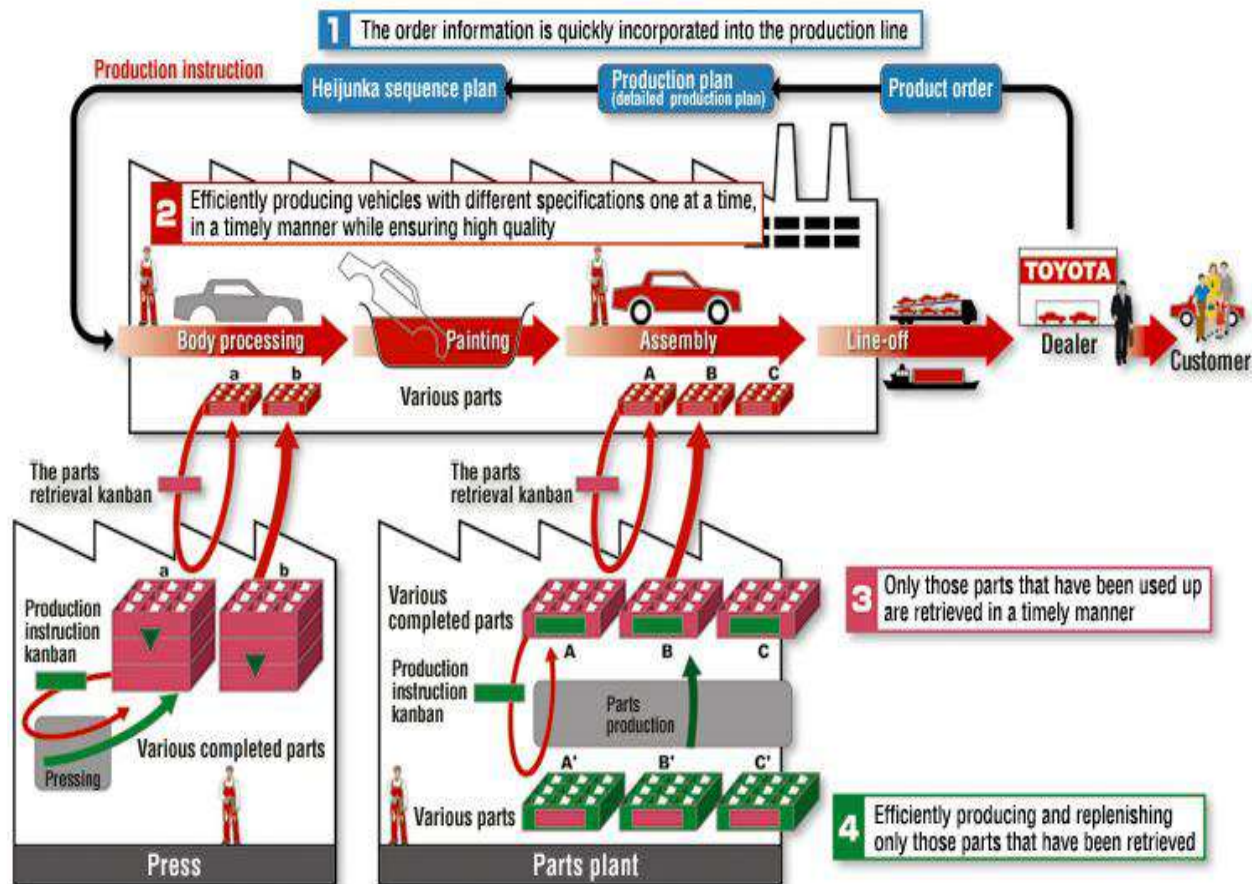


Figure 2

III. ASSUMPTIONS

It is assumed that by designing a map of the present state of the value stream selected with the necessary technical information and references to develop a future state map, XYZ manufacturing company in Minnesota will have the capacity to develop a future map in an effective way to implement lean manufacturing, in order to increase the productivity and output, as well as to reduce costs, inventory, and time. It is also assumed that all of the work centres involved in the study were working only with the selected value stream

IV RESEARCH METHODOLOGY

The main objective of this research project was to eliminate non-value-added activities and increase company's profitability while increasing production and reducing costs at the same time. The purpose of this study was to determine how the consultant of Stout Advanced Manufacturing Assistance is implementing Lean Manufacturing process based on the company actually located in Minneapolis. The participant in this study was a full-time senior consultant within the Stout Advanced Manufacturing Assistance at University of Wisconsin-Stout. Following a review of the related literature, an interview session was used due to gather data from full-time senior Lean Manufacturing consultant

The research addresses following questions:-

1. What are the benefits to implementing Lean Manufacturing?
2. Would it be suitable to implement Lean Manufacturing technology into a small shop with small number of production and employees?
3. How senior business consultants measure the effectiveness of Lean Manufacturing implementation?
4. How the senior business consultants deal with resistance when employees are against organizational changes?

The research objectives of the study were:

1. Identify the benefits of learning how manufacturing industry should learn more about Lean Manufacturing process not to be concerned with the size of a company.
2. Identify approaches to redirect non-value added activity into value added activity in order to improve efficiency of production.
3. Provide a solutions to production processes that reduce cost, free up working capital, and reduce customer lead time.

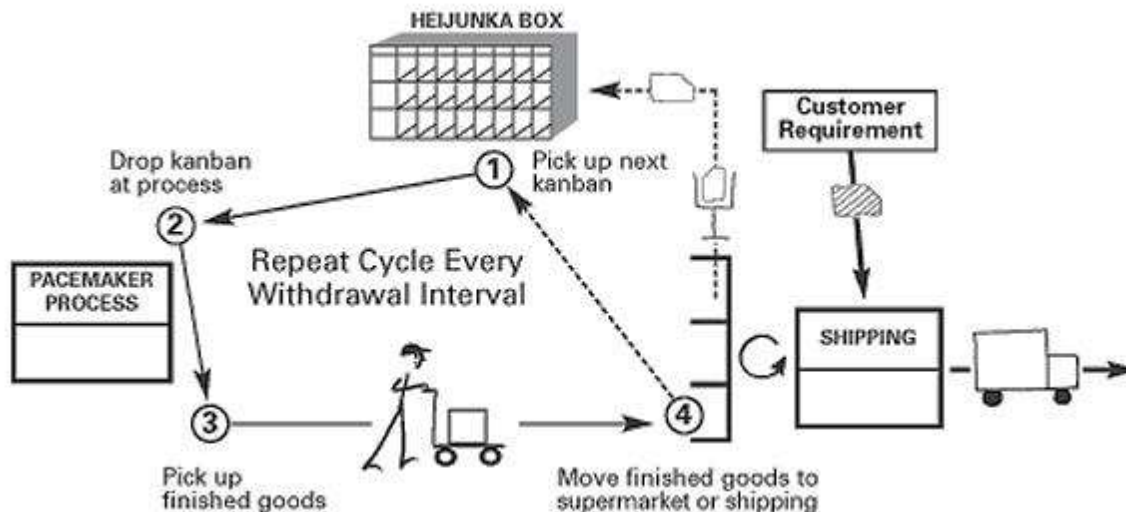


Figure 3

V RESEARCH PROCEDURE

The interview was conducted on August 21, 2003 at the office of the SAMA consultant. During the interviewing session the interviewee was given directions and questionnaires. The interviewee was only asked the questions which the researcher had prepared in advance. Prior to the date of interview session, the interviewee was informed that the participation in the study was voluntary, and there were no consequences for choosing not to participate. Their answers were recorded by digital recorder for quotation and analysis purposes. The fundamental background of Lean Manufacturing process and consultant's work execution procedure will be learned by information gathering from academic books, the Internet, and various academic journals. Fig. 1 Schematic diagram of helical Spring

VI DATA ANALYSIS

The data collected during the interview session was analyzed to determine the scale that raising potential profit through increased production size or reduced operational costs at the same time. Data analysis for this study consisted of compiling responses to open-ended questions. All open-ended responses were listed by the researcher and summarized into appropriate headings. The data is clearly displayed through appropriate headings that could potentially be improved. Qualitative data was analyzed by identifying and organizing the qualitative responses that introduced distinctive concepts. The data from the interview will be compiled to determine what characteristics are. It will then be decided if consultant should be utilized for lean manufacturing implementation, or having no trainers would succeed in lean training environment. The following chapter displays a complete review of the data gathered by interview session

VI CONCLUSION

Through this thesis work we have proposed the integration of Lean Manufacturing with Knowledge and Change Management, the last two concepts complement the implementation of the first one and vice versa. We find that Lean strategy creates knowledge and makes transformations in the production process and in the organizational culture in general, but there are some important aspects that can be fully strengthened by the knowledge and Change Management process, that is why the integration of these concepts has a relevant sense. While implementing Lean Tools, Knowledge and Change Management Tools and strategies can be deployed to maximize the Lean objectives. The three models shared enough common points, what can be considered a strength that facilitates the integration. In the other hand, this process needs more efforts from the team involved in implementation what can result as weakness compared to the single implementation of Lean. When Toyota Motor Company was implementing what is now called the Lean Production, it was created a lot of knowledge and provoked many changes in the traditional system at that time; main actors involved make resistance to the transformations and the new knowledge they had to acquire, but on the way to Toyota Production System they overcome and made a successful system. This can be taken as precedent of the combination of the models, but for a future integration taking the best practices of this experience and adding some special tools from the complementary models as it is shown in this work. Many organizations have applied Lean in their production processes, some other at least have tried to implement its tools and there are advanced one that are talking about Lean Change or Lean Knowledge, but there are a few of them that are integrating Lean, knowledge and Change Management. The benefits of the integration are under the synergy concept. The integration will generates more positive results than Lean as single model. The reason of that is the high complementing level that the three models have. Lean creates knowledge and

provokes changes, while knowledge management helps to handle the knowledge around and look for new one and change management creates the transition of the current and future scenarios. Observing the tools integration it can be realized that the biggest efforts need to be done when the value is mapped through value Stream Mapping and when the whole structure is subject to continuous improvement through KAIZEN, because the first one is the basis of Lean and second one is the update of the elimination of waste. The future challenges of Lean are linked to evolution of the production processes and the information technology. In the future production will evolved to the Industry 4.0 and things will be manage with virtual interactions, what will change the lean procedures, the way of knowledge management and transformation will be faster. To tackle this, the model integration has to be up to date with the new developments in production field.

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