MAKING ASSEMBLY MORE LEAN: A CASE STUDY IN MALAYSIA

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Abstrak (Malay)

Penyelidikan ini adalah untuk meneroka sebahagian daripada pelaksanaan *Lean Manufacturing* (penyingkiran pembaziran melalui pembaikan berterusan) di sebuah syarikat elektronik di Malaysia. Di dalam mengambil langkah untuk mencapai pelaksanaan *Lean* yang menyeluruh, penyelidikan ini telah mengenalpasti beberapa aspek ketidakcekapan di dalam keseluruhan proses dan telah mencadangkan beberapa kaedah untuk melaksanakan *Lean*. Namun, penyelesaian yang dihasilkan mendapati Syarikat A agak ketinggalan di dalam aspek *Lean* yang seperti tiada berkesudahan.

Penyelidikan ini juga telah mendedahkan beberapa peluang untuk pembaikan antaranya ialah melaksanakan sistem penarikan, pengurangan buangan melalui kaedah pengisian semula 2-kotak dan kaedah perutinan, kaedah penyeragaman, kaedah penjadualan, penggunaan teknologi maklumat, pembentangan maklumat luaran dan kaedah penyimpanan setempat. Data-data penyelidikan ini diperolehi melalui pemerhatian dan temuduga serta pembentangan kes-kes kajian.

Abstract

This research explores the partial implementation of Lean Manufacturing at an electronics company in Malaysia. To take steps toward a more complete implementation of Lean, the research identified several non-lean aspects of the assembly process and proposed solutions based on Lean tools. These solutions progress Company A further down the never-ending Lean journey.

The researcher uncovered several opportunities for improvement including implementing a pull system, waste reduction through two-bin materials replenishment and milkruns, standardization, schedule fixing, information technology, cellular layouts, and localized storage. The researcher obtained data through observation and interviews and presents these findings as a case study.

EXECUTIVE SUMMARY

In the highly competitive world of manufacturing, the thorough application of many tools available to management is necessary to remain competitive. One such set of tools, Lean Manufacturing (LM), has the potential to increase profits, decrease lead time, reduce waste, and increase the competitiveness of an organization. However, research has shown that few companies have been able to implement this method of process improvement completely (Sohal and Egglestone, 1994; Sheridan, 2000).

An important organization with which to analyze the implementation of Lean Manufacturing is Company A's Technical Center located in globally competitive Malaysia. (The company's name and people's names in this project have been masked). Company A is a Fortune 500 electronics company. This facility is Company A's first regionally-integrated manufacturing, research and development (R&D), and distribution center in the Asia-Pacific region. This advanced facility has internal assembly processes that have inefficiencies and quality problems. The researcher used Lean Manufacturing to develop solutions to these problems.

This research describes the assembly area in this plant. Next, it shows waste and problems related to non-leanness in the assembly area. Then it proposes the further implementation of LM tools, specifically in standardization, pull-system, two-bin stocking, use of information technology, scheduling, and training to increase the efficiency and effectiveness of this company. The insights gained from this case study are expected to be applicable to other situations as well.

CHAPTER 1

1. INTRODUCTION

1.1 Introduction

The assembly section is usually the highest concentration of labor in an electronics assembly plant, and therefore holds much potential for undetected waste. Assembly, along with its enabler materials handling, can be carried out with speed, efficiency, quality, and effectiveness. On the other hand, this section of a facility can drive up costs by encouraging waste, creating confusion, and causing quality problems. What do you do when assembly has some of the components in this latter list? One philosophy by which management can solve such problems is Lean Manufacturing.

This research looks at the assembly portion of a manufacturing facility and shows how Lean Manufacturing can be applied to improve these processes. Although this facility has partially implemented Lean, this research proposes solutions to current process problems as an example of how one plant can more completely implement this manufacturing theory.

1.2 Background of Research

Company A is a globally-successful electronics company that produces handheld electronic devices (HEC) in its Malaysia facility. The assembly section of this facility, with its high number of processes and employees, is the area needing the most improvement. In this section are waste, error, and confusion. Assembly runs with large and uneven inventories, has a lack of standardization, and is unorganized. Materials are moved haphazardly without a procedure or control resulting in over-staffing and wasted movement and time. Given the financial pressure in the current world economic situation, this company will greatly benefit from finding solutions to these problems so they increase their profits.

Along with the global economic situation, the location of operations also requires attention to improve operations. Malaysia is a competitive and capable location for electronics manufacturing. Many companies, in addition to the company of study, have invested billions of dollars in Malaysia. These investments are backed by profitable agreements with the Malaysian government, not the least of which is dedication to moving Malaysia "up the value chain" with R&D and technological advancement. Increasing competitiveness from other Asian countries like China, India, Vietnam, etc. beckons plants in Malaysia to continue improvement in operations (*Malaysia*, n.d.).

How can this company systematically improve operations by finding solutions to these problems? Lean Manufacturing is a beneficial route because this popular and complex philosophy can increase competitiveness and profit and make material handling and assembly more efficient and effective. In the manufacturing industry, including the electronics sector, Lean has been researched and used much. Even with all the publicity and long history of this concept, though, very few companies have mastered it.

For these reasons, this research explores the more complete implementation of Lean Manufacturing principles as a means to offer solutions to current process problems in the assembly section of Company A- Malaysia. The research further explores the theory of lean implementation as a case study to discuss how lean improvement is practiced in a manufacturing environment.

1.3 Problem Statement

Johnson, Sun, and Johnson (2007) show in their random survey of manufacturers that Lean Manufacturing is usually not implemented completely. Companies often apply parts of Lean but stop before a complete transformation. This partial implementation can result in the lingering of quality, efficiency, and waste problems that decrease competitiveness in an increasingly competitive world. Further research needs to be done to practically show ways that LM can be more completely applied to address problems resulting from a lack of leanness.

One prime area on which to focus research for lean is th``````e assembly portion of a plant. This area can be a prime location of waste and unnecessary costs because of the number of man-hours incurred. Furthermore, the way this area is run dictates how the upstream production processes are carried out as well. An efficiently planned pull system in the assembly area can facilitate the same smooth flow in production.

In the assembly area of Company A, they experience waste and process problems. These problems are found in the fundamental processes, therefore are not limited to certain products. For example, they have quality problems with mixing components, the build-up of work in process (WIP), and a lack of standard procedure for material handling. Each of these problems, plus others revealed in the research, are waste in the processes that are not lean, and therefore decrease the company's competitiveness. While they have attempted Lean Manufacturing for years, they still have a way to go in all processes becoming completely Lean. They need to address problems resulting from only partially applying Lean because these non-lean aspects result in waste, whether that waste is in the form of quality problems, wasted time, or wasted space.

As a result, this study focuses on analyzing non-lean aspects in the assembly portion of Company A-Malaysia and offering solutions to these problems by a more complete application of Lean Manufacturing.

1.4 Research Objective

This research is a case study that examines the assembly area of an electronics company that has implemented Lean to some extent. It suggests ways to move the company down the road of becoming more Lean by applying Lean tools and Lean philosophy.

Since Lean implementation is based on a continuum, a company partially implements Lean when they practice some of the tools, or some of the processes are in line with the Lean philosophy. A company becomes more lean, and closer to a more complete implementation when they address some non-lean aspects of their processes to make them lean.

The focus of this research is to investigate how Company A can move from a partial implementation of Lean Manufacturing to a more complete implementation by using Lean to solve problems in the assembly area.

1.5 Research Questions

In order to accomplish the research objective, the researcher turned the research objective into research questions that guided the research. These questions focused the research to pinpoint ways to move Company A to a more complete implementation of Lean.

The researcher investigated the following research questions:

- What non-leanness occurs in the assembly section of this plant?

- How are these non-lean aspects really problems?
- What Lean tools can be applied to solve these problems and make the area more lean?

Non-leanness or non-lean aspects can be defined as processes that are not in line with Lean philosophy, meaning they have some sort of waste or time, movement, lack of standardization, etc. Applying Lean tools can reduce the waste and make these aspects lean.

1.6 Significance of the Study

This study furthers the research that states that LM has not been completely implemented in most companies, and in fact it is difficult to do well (Sohal & Egglestone, 1994; Sheridan, 2000). While much research is conducted on the theory of LM, not much is written how to further implement this philosophy after an initial partial implementation. This research helps fill this gap, and could be applicable to many of the companies who have tried to implement lean and only partially succeeded. It is a practical study of this previous research finding that can help increase the understanding of the implementation of Lean in real situations. It includes examples of partial implementation and the resulting problems, as well as potential solutions to these problems.

Secondly, this research sheds light onto how the more complete application of Lean Manufacturing could benefit organizations in the current economic situation. Lean is one tool for companies to increase competitiveness. This research provides examples of how Lean can solve process problems, which now more than ever is relevant to industry.

Third, it shows how to apply Lean Manufacturing to improve the assembly section which is one of the most labor-intensive sections in a manufacturing facility. This section is often the most critical of all in terms of labor cost and the large number of processes including assembly and material handling. The reader can learn by reading how operations in this portion of the plant were improved by practical application of this theory.

Finally, this case contributes to the learning and benefit of Company A. Since these solutions were made in conjunction with the lean engineers' input, whether in-line with their expressed desires or in response to a specific problem they expressed, the analysis and solutions are directly applicable. This company can implement these solutions to make the operations more Lean.

1.7 Organization of Remaining Chapters

The following chapter, chapter two, discusses current academic and industry literature relevant to this research and provides the foundation of the conceptual framework, method of analysis, and recommendations for solving problems of non-leanness. Chapter three details the methodology of the research and explains its logic. The case write-up in narrative form makes up chapter four. Chapter five is the case analysis that proposes steps for further implementation of Lean in terms of recommended solutions to problems listed in the preceding chapter. Finally, chapter six summarizes these recommendations, explains the research's contributions and its limitations, lists suggestions for further study, and concludes the research.

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

The following is an overview of Lean Manufacturing, also referred to as "LM", "Lean Production", "LP", or just "Lean", and a description of the major components, or tools, of this philosophy that are applicable to this project with Company A- Malaysia. Also in this chapter are how Lean relates to materials handling and challenges and considerations in Lean implementation.

A survey of current process improvement literature shows literally hundreds of tools in use, mostly originating from a few popular management approaches. Näslund (2008) proposes that every decade, a couple of new management philosophies gain popularity in a way similar to fads, and that many methods that are proclaimed as totally new approaches to replace failed previous methods are really not that different from what has come before. Examples of these methods include Business Process Re-engineering, Lean Manufacturing, Total Quality Management (TQM), Six-Sigma, and Agile manufacturing.

Despite these fad tendencies, methods both old and new contain principles that are useful to improve the performance of organizations. This is true especially if managers don't forget helpful principles in previous methods and if they view new methods not as an all-encompassing fix-all, but rather as one more tool to use alongside other tools.

Based on this understanding, one can use the principles of any of these modern management methods and benefit from them. Bhasin and Burcher (2006) highlight Lean by writing that Lean Production's principles are universal, and it is the core of business management. Lean is the central core on which other concepts should be added.

This review will discuss process improvement using one of the methods that is currently in high use: lean manufacturing. This philosophy will be used as a basis on which to analyze and improve the assembly area at Company A- Malaysia.

2.2 Lean Manufacturing Overview

The phrase "lean manufacturing" or "lean production" was popularized by Womack, Jones, and Ross' 1990 book *The Machine that Changed the World*. The book describes processes created by Toyota that, since the early 90's, have dramatically impacted organizations worldwide. However, Taiichi Ohno first developed this philosophy at Toyota Motor Company in the 1950's (Motwani, 2003).

The goals of lean manufacturing are to increase profit and competitiveness by increasing efficiency, decreasing costs by eliminating wastes, and reducing cycle times and lead times (Motwani, 2003). The main thrust of this method, as the name implies, is to reduce waste or anything that does not add value. According to the definition of waste in this system, which is called "muda" in Japanese, it can be divided into seven categories: defects, overproduction, inventory, processing, motion, waiting, and transportation (Taj, 2008). Krizner (2001) says that waste can account for between 55 and 95 percent of the manufacturing process, and therefore the main aim should be to eliminate that waste.

A process can be defined as "lean" when it does not have any waste or when it is in line with LM principles. "Non-lean" describes a process that has waste, is in contradiction with Lean principles, or is not using Lean methodologies.

LM has been described as a system, a management philosophy, and a culture. Hines and Taylor (2000) point out that Lean is a methodical attack on waste, and therefore is struggling against the factors that are behind poor quality and other management problems. It is foundational to the management process, and is an all-encompassing solution.

Lean Manufacturing consists of dozens of components as discussed in the next section.

2.3 Lean Manufacturing Components

Appendix A lists sixty consolidated LM elements as compiled by Anand and Kodali (2009b). Some of the major components of LM are described below.

2.3.1 Just-In-Time

Just-in-time (JIT) is one of the most important components in the lean philosophy. In fact, both LM and JIT are very similar in that they focus on adding value and eliminating waste in processes, and share such tools as process/value stream mapping, Five S's, kaizen, and kanban. Lean manufacturing is an improvement and addition of JIT according to Näslund (2008).

JIT is having only what you need at the right place at exactly the right time. The following are ten pillars of JIT: focused factory; reduced set-up times; group technology; total preventive maintenance; multifunctional employees; uniform plant loading; total *kanban*; quality control; quality circles; and JIT purchasing (Davy, White, Merritt, & Gritzmacher, 1992).

Production leveling is an important concept in JIT and Lean. Even in environments where demand fluctuates, the production schedule should be held as predictable as possible to reduce waste (Business Knowledge Source, 2009).

JIT, like Lean, is difficult to implement because it requires a change in the company culture. The interconnectedness of JIT with Lean Manufacturing is evident.

2.3.2 Standardization

Another of the foundational lean principles are the "Five S's," developed by Osada in the early 80's. When translated, these words literally mean organization, neatness, cleanliness, standardization and discipline.

Standardization is one of the main tenants of LM according to Niepce and Molleman (1996). Standardization simplifies job training and collaboration, reduces mistakes, and is the basis for continuous improvement. As an example of permeating standardization, Toyota only has two job classifications for the entire plant: assembly line worker and craft technician. An assembly line worker can work at any workstation with this high level of cross-training, performing any task in the assembly line (Vaghefi, Woods, & Huellmantel 2000). The craft technician performs all other support tasks.

One way that standardization can improve efficiency is by clarifying communication for what is required for a specific job. Holmstrom (1998) states that the main contributor to uncertainty in slow operations is distorted communication in the activity system. He shows in his empirical research that increasing the speed of operations can increase efficiency. Therefore, standardization is also foundational for increased speed with efficiency.

2.3.3 Pull System

Pull production means to produce only when a customer places an order, and has the benefits of lower storage costs, number of defects, and obsolescence. Ideally, WIP in a pull system should only be one piece between workstations and one piece in stock, although this is difficult to achieve in reality (Monden, 1998).

A pull system uses kanban, which means signal. This production flow tool refers to using cards to signal production needs, thereby pulling product through production rather than pushing it through based on output upstream. This method requires smaller lot sizes (Monden, 1998).

Lee-Mortimer (2008) reports how a UK Siemens PCB producer took steps to become more lean by implementing a kanban system among other Lean tools from 2005 to 2007. Even though the plant had won awards for continuous improvement, there was still a lot of improvement to be realized by the further application of Lean. Such improvement was difficult because it meant the company's culture must continue to change like it had changed to implement continuous improvement. kanban and a pull system were used to reduce lead times, inventory, WIP, and inefficiencies. These tools were an important part of their company's transformation.

2.3.4 Cellular Manufacturing

Cellular manufacturing has been described as work connected in time, space and information (Hyer & Brown, 1999). The production process is divided into self-contained, self-governed cells that manage and improve the process themselves. Cellular manufacturing is one example of work teams which form the heart of LM.

Krizner (2001) says arranging work in cells is perhaps the most important Lean methodology.

In cellular manufacturing, Bidanda, Ariyawongrat, Needy, Norman, and Tharmmaphornphilas (2005) found that communication is the most valued component. Horizontal communication can increase collaboration, teamwork, and continuous improvement. Thus, using communication for solving problems with the scientific method is an essential part of LP (Olivella, Cuatrecasas, & Gavilan, 2008).

A case study in *Modern Materials Handling* (Tompkins, 2005) describes why Tompkins and Associates improved a traditional assembly line by creating a cellular, U-shaped layout. The author explains that not only does this type of layout increase communication and collaboration, but it maximizes space, minimizes waste, and streamlines flow, and describes this as often being the case in their experience of using cell layouts.

2.4 Materials handling

Materials handling is an important consideration in Lean Manufacturing because it encompasses material flow, people and parts, and it is related to quality and JIT. According to Lean philosophy, an operator should only perform tasks that add value to the assembly object. Materials handling falls on either a dedicated material handler or on a group leader.

In lean production, there is a goal of using small container sizes to minimize the hidden inventory cost and increase the adaptation to changes in demand. Also, phased-out components should be withdrawn and become scrap as they take up valuable space on the line (Wänström & Medbo, 2009).

Another Lean tool is localized storage. Storage of components near to point of use minimizes transportation time (Industrial Equipment News, 2009).

2.4.1 Two-Bin System

Wänström and Medbo (2009, p. 1) write, "Component racks that are portable and easy to rearrange, together with free space, greatly facilitate handling of new product introductions or modifications of products. The new and old component can be displayed and fed to the same workstation, and if there is a larger change a whole segment of a component rack can easily be replaced by a new one between work shifts."

One way to accomplish this facilitation is with a two-bin system, where one bin of current components and one new (or old) bin are stored on a rack at a workstation. This is part of standardization and visual control of materials handling.

Decisions about the type of materials handling system are influenced by the levels of stock at the line and the turnover rate of components. The risks associated with these indicators are parts on the line becoming obsolete in the production run and the need to quickly adapt to changes in demand (Wänström & Medbo, 2009).

2.4.2 Milk-run

One materials handling system that controls these risks is the milk-run. In this method, a continuous loop route is set for how often a material handler is to visit each workstation and the number and frequency of components to be stocked. Domingo, Alvarez, Peña, and Calvo (2007) describe the validity and criteria for establishing the details of milk-runs. Effective milk-runs utilize small lot sizes and a kanban system for material replenishment.

These authors go on to point out that in Japanese automotive plants, packaging types are designed in order to facilitate the assembly process, not based ease of transport. The containers are arranged so that operators can easily locate the components, and to minimize the operator's movement both in the distance they transfer the components to the workstation and by reducing the need for operators to bend or twist.

Horbal, Kagan, and Koch (2008), also wrote a case study of how milk-runs are used as an effective Lean tool in a high-product mix assembly environment. In their case, the milk-run reduced inventories on the shop floor to two hours and the space required for production was reduced in half.

2.5 Implementing Lean Manufacturing

Lean Manufacturing should be thoroughly implemented in an organization. As Bhasin and Burcher say, "Rather than embracing one or two isolated tools it is suggested that it is important that companies practice most, if not all" of the principles in Lean Manufacturing (2006, p. 56). Motwani agrees by stating, "LM is the umbrella over these concepts, and while many companies often grasp a couple of these concepts, the full potential of a company cannot be reached without implementing all of these initiatives [of LM]" (2003). Additionally, Sheridan (2000) writes that it takes three years to establish competency in some of the basic Lean tools and five years for employees to establish a firm belief in all of the tools. These sources explain the foundation of a continuing journey of implementing Lean.

Bhasin and Burcher (2006) conclude that the following factors are necessary for successful implementation of LM:

- Simultaneously apply at least five Lean tools

- View lean as a long term journey
- Instill continuous improvement
- Change the culture for empowerment and a thorough implementation.

2.5.1 Partial Implementation

In reality, the percentage of companies that successfully apply these above listed factors is minute. Sohal and Egglestone (1994), from their research of Australian companies, have reported that only 10 percent of companies have successfully implemented lean manufacturing practices in reality among those that have tried. A company that has tried some of the tools but has not implemented all of them to an extent that almost all of the waste in the processes is eliminated can be referred to as incompletely implementing Lean. These incomplete implementations can also be called “partial implementations” because they only apply some of the lean tools, or they only apply the tools partially when there is room to apply them more or better. When almost all of the waste in the system is eliminated by using all or most of the Lean tools, then the company can be referred to as completely implementing Lean.

What are the reasons for these partial applications? Baker (2002) lists several factors why the vast majority of UK companies have not fully implemented lean. The reasons are:

- Lean must be applied systematically through all aspects of the business
- Commitment from the top to the operator level is required
- Qualified trainers are in short supply

- Some process improvements might be prerequisite for beginning Lean implementation.

Black (2000) makes another list of constraints to complete Lean Manufacturing. Of this list, two hurdles that are applicable to this case are:

- The top management person (or the real leader) does not totally buy into the conversion.
- Systems changes are inherently difficult to implement. Changing the entire manufacturing production system is a huge task.

Anand and Kodali (2009a) discuss the lack of literature connecting benchmarking and lean manufacturing as a way to assess the level of leanness an organization has acquired, or "Degree of Leanness (DOL)." They note that while some researchers have looked at the leanness of organizations, theirs is the first paper they know of that puts forth a standard benchmarking tool to measure DOL.

Considering that ninety percent of companies attempting Lean have only partially implemented it (Sohal and Egglestone, 1994), there is a need for more research to address the reasons behind this partial implementation, the Degree of Leanness of a company, and how a company with partial implementation can continue the journey of complete Lean implementation.

2.5.2 Role of Management

In order to work, the implementation of Lean needs to be driven from the top of an organization (Boyer & Sovilla, 2003). Worley and Doolen also show that implementing lean is complicated, and management support plays a strong role in successful implementation of lean manufacturing (2006).

Organization learning is rarely harnessed to its full potential. Cavaleri (2008, p. 485) says, “Executives will someday discover even greater value in organizational learning – when they learn of its potentially unrecognized critical role as – a missing link that can unite knowledge management with performance improvement and TQM.” This fact can be applied to any other management chain in addition to TQM.

Creating firm belief by management in Lean can take years. In fact, Lean Investments LLC finds it so hard to find top management who not only believe in Lean but have ample experience in implementation that it buys struggling companies in order to place its proven Lean executives in charge. These companies have seen dramatic turnarounds as a result of top-notch Lean management (Sheridan, 2000).

Each of these perspectives converge that upper management is a critical link to the successful implementation of a management philosophy such as Lean.

2.5.3 Information Technology

Putzger (1998) writes that the key component in the implementation of process improvement is the correct choice of information technology. Riis, Mikkelsen, and Andersend (2008) conclude from their research that software rollouts need to be smaller, more incremental improvements, rather than large roll-outs to coincide with continuous improvement and flexibility. In addition, Motwani (2003) states,

> "The role of IT in the business process change project could be either dominant or as an enabler. Evidence suggests that IT led projects often fail to capture the business and human dimensions of processes, and are likely to fail (Markus & Keil, 1994). A case is often made for the socio-technical design approach that suggests a mutual, bi-directional relationship between

IT and the organization (Hoplin, 1994; Mumford, 1994). Such an approach recommends synergy between the business, human and IT dimensions of an organization and could be promoted through cross-functional teams."

Dasgupta, Sarkis, and Talluri (1999) report that investment in IT increases the efficiency and effectiveness of a company.

Thus we can see, IT is an important component in Lean Manufacturing and the way that it is implemented can determine its effectiveness.

2.5.4 Company Culture

LM is about changing corporate culture in that it pushes decision-making to the lowest levels, fosters a culture and strategy of change, develops supplier relationships based on trust, nurtures a learning environment, focuses on the customer, tracks lean measures, increases scheduling, and creates a long-term commitment (Bhasin & Burcher, 2006). The right company culture needs to be created in order for Lean to be successful. Sheridan (2000) proposes that LM is such an extensive cultural change that it takes at least several years to fully make the change.

Research by Gogan, Zuboff, and Schuck (1994) on Motorola-Malaysia revealed cultural differences that contradicted Lean principles. The factory manager at the time was skeptical of Company A's initiative in other plants to promote greater employee participation in decision making because she thought that empowerment was inappropriate in this Asian context. Their paper implies that the culture of this company needs to be changed in order for Lean to be fully accepted at this plant.

The necessity of a complete implementation of Lean Manufacturing for the goals of a company is obvious. In search of this aim, this research presents a case analyzing Lean in one company and provides solutions for a more thorough implementation.

2.6 Conclusion

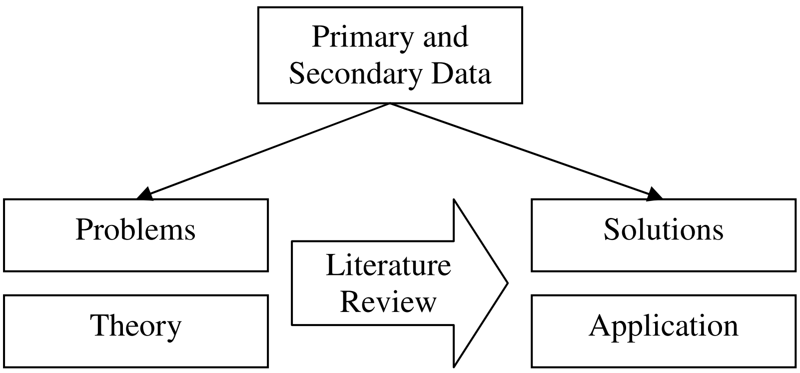
Lean Manufacturing consists of dozens of tools. Some of the major Lean tools that are applicable to this research are: JIT, the Five "S's", Pull System, and Cellular Manufacturing. A two-bin material replenishment system with milk-runs are part of a Lean materials handling system that reduce waste by standardization and waste reduction. LM should be implemented completely to see maximum benefit in increasing profit and competiveness. However, most companies only partially implement this philosophy. Management backing, clear communication, and information technology used properly are vital for successful implementation of Lean which constitutes a cultural change in an organization.

CHAPTER 3

3. METHODOLOGY

3.1 Introduction

This research is a problem-solving case study based on the company's needs. Primary and secondary data were obtained through research, plant visits, and interviews with plant personnel. By the literature research, a framework for analysis was developed as was an understanding of Lean developed that later led to solutions to the problems observed in the interviews and site visits. These solutions were explored in conjunction with plant visits, observation, conversations, and interviews. Finally, the research was written to describe and address the application of theory on the focus company, as displayed below:



3.2 Qualitative Research: Case Method

Qualitative research addresses the how and why of a particular situation by analyzing in a non-exact sense. One method of qualitative research is the case method. The case method was first used in modern times in 1905 by Harvard Business School. This method examines a situation in narrative form by providing background, details, and a problem or problems. Then, the case is analyzed and solutions are proposed as part of the learning process. It is a popular method of teaching in many business schools today.

Yin (1984) defines the case as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (p.23). He further explains how cases allow the combination of new empirical insights with theories to learn more than could be learned with only a theoretical approach.

While there are many types of cases, this research is project-based. Project-based research is when the researcher explores a situation based around a problem or a project. In this case, the project is the more complete implementation of Lean Manufacturing in Company A. Solutions are proposed as a final step of the presentation of research around this project.

This research is a tool for relaying understanding of a practical example and solutions based on the application of research. Such an example and interpretation of research can be helpful to students of the field of study, academicians, and practitioners seeking practical application for their situations.

The case portion of this research was written in such a way that it can be used for teaching. The dramatic narration of the case is meant to draw the reader into the case so that they feel a part of it. Once this occurs, the reader's perspective and problem-solving are more like a real situation which helps in the future translation of learning to the practical application in the real world.

This case includes all necessary information for students to analyze it themselves. It puts forth the opportunities for improvement of LM implementation in this plant, allowing the reader to analyze the situation and recommend solutions.

The final chapter in this research provides the researcher's solutions to the problems detailed in the next chapter.

3.3 Conceptual Framework

Bhasin and Burcher (2006) and Motwani (2003) write that a company needs to use most if not all of Lean tools in order to reap the benefits of this philosophy. In addition, Sheridan (2000) writes that it takes several years for a company to begin to use these tools well. Research by Sohal and Egglestone (1994) confirm this idea in that they see only 10% of companies who use Lean to use most of the tools well.

Lean is a never-ending journey (Bhasin & Burcher, 2006; Karlson & Ahlstrom, 1996). A company practically never arrives at total leanness, but is always in the transformation process of moving from partial implementation to more complete implementation of the Lean philosophy and tools.

One major reason a company is never 100 percent lean is because of the continuous improvement principle. This principle by definition is continuous, and it never ends because there is always room for improvement. Secondly, a company is always changing with new products, new quantities, new requirements, and new problems. As the company is changing, so must the implementation of Lean continue. Lastly, waste can never be completely removed. As long as the world is imperfect, processes will be imperfect, randomness will occur, and the methodical attack on waste will continue.

Therefore, initial attempts at Lean implementation start a cycle of discovering more problems and non-leanness, followed by a more complete application of the tools. Sheridan (2000) writes that the initial period of all employees gaining complete trust in these tools is usually around five years. Then the process of implementing the tools more and more completely lasts indefinitely.

The following is a graphical representation of this framework:

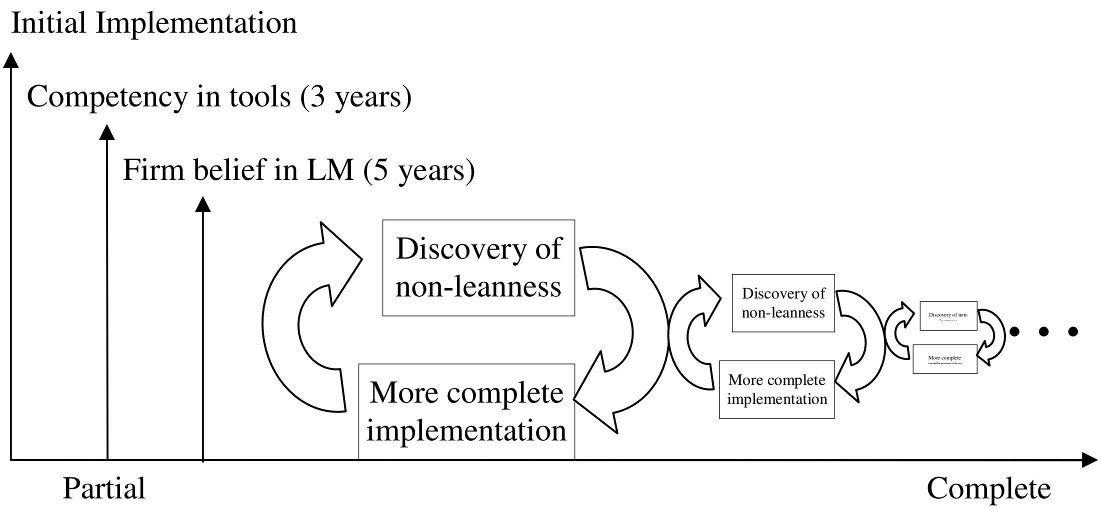


Figure 3.1. Journey of Lean Implementation
Source: Author's creation

In this research, LM will be used to propose solutions to problems observed in the assembly portion of Company A- Malaysia as a means to take this company a few steps further down the journey of Lean implementation.

3.4 Method of Analysis

In the application of this research framework, the researcher first read literature on Lean tools and solutions. The literature on the need for continued implementation of Lean as a moving from partial towards complete implementation shaped the conceptual framework. It also provided an understanding of Lean practice in theory and practice that enabled the researcher to know non-lean aspects when encountered in Company A.

In addition, the background of the researcher as an industrial engineer in a manufacturing and assembly plant acted as a reference and shaper of a Lean perspective in industry. Armed with this view, experience, and information, the researcher entered the assembly section of Company A.

Through observations, conversations, and interviews, key staff of Company A presented the operations in the assembly area. These key staff presented some problems and non-leanness in the assembly area as well. Additionally, the researcher determined other problems and non-leanness through the lens of past experience and knowledge of literature of theoretical and practical examples of leanness and non-leanness.

Once the researcher determined the non-leanness in the assembly area, the researcher analyzed these problems using literature, key staff, and past experience. The problems associated with this non-leanness were then analyzed and understood, as was the need to change these non-lean aspects of the plant.

Next, the researcher developed solutions to these problems using the same three resources- literature, Company A staff, and past experience. Literature was scanned for theoretical backing of solutions as well as practical examples of similar issues and solutions. Company staff offered some solutions themselves and gave feedback on other solutions that the researcher presented to them. The researcher developed and analyzed the solutions through past work experience.

Most of the solutions were developed by the researcher, but always with the collaboration of Company A key staff. In the solution about the pull system, for example, the researcher originally suggested the group leader pull up the BOM for an upcoming run in the stockroom, fill the cart with the necessary components, then enter the order complete in the oracle system. Only then would the water spider