LEAN MANUFACTURING SYSTEM IMPLEMENTATION : A CASE STUDY IN FOOD PROCESSING COMPANY

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Thank you Allah for making this happened. Thank you for giving me the strength. Alhamdulillah.

Thank you to my beloved husband and lovely daughter. Special thanks also dedicated to my parents and my parents in-law.They bore me, raised me, supported me, taught me, and loved me. To them, I dedicate this thesis.

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As a case study, I have took world-wide topic from my previous subject taken in Semester 2 which is Lean Manufacturing. The case study company has been known as PPNJ Poultry & Meat Sdn. Bhd. which is the one of the local largest Broiler Integrator company in Malaysia. In order to gather all the information and record, my special thanks went to En. Baharduddin Haji Azmi, Puan Hadija, Cik Baizura and the key people, En. Abdul Wahid for their assistance in data collection used in this research.

ABSTRACT

This research identified the critical major Non Value Added activity (MUDA); Motion, Defects/Errors and Waiting waste that exist in the case study company. The case study will be conduct at one of the local biggest Broiler Integrator Food Processing Company namely PPNJ Poultry & Meat Sdn. Bhd. located in Machap, Johor. This case study will used some approaching way such as observation on day to day working task during GEMBA, interviewing a personnel face to face and some documentation and record review from respective department. The critical major Non-Value Added activity will be analyzed based on the outcome from Waste Walk assessment than will be conducted during GEMBA at processing floor. The analysis will follow through after all the methodology implemented. Cause and Effect diagram will be used in order to identify potential root cause contribute to the major waste. An effective problem solving tools; P-D-C-A tools will be used to plan for the improvement as well as giving the beneficial solution for the company. All the potential solutions that suggested can be beneficial to the company in terms of money and time savings. This idea will directly help the company to increase their productivity, producing good quality products as well as providing good environment to their employees. The new workstation design will help the company eliminates all major critical waste and create smooth and efficient production. Output from this real study will be used for establishments and development of Lean Manufacturing System in food processing industry. These guidelines can be used for implement effectiveness Lean Manufacturing System in all organizations.

ABSTRAK

Kajian ini adalah bertujuan untuk mengesan aktiviti yang tidak mempunyai nilai (MUDA) seperti pergerakan yang tidak diperlukan, kerosakan atau kecacatan, dan pembaziran masa menunggu yang wujud dalam kajian kes syarikat. Kajian kes ini akan dilakukan di salah sebuah syarikat pemprosesan ayam daging iaitu PPNJ Poultry & Meat Sdn. Bhd. yang terletak di daerah Machap, Johor. Kajian kes ini akan menggunakan beberapa pendekatan seperti pemerhatian terhadap kerja-kerja seharian sewaktu melakukan GEMBA, menemubual individu secara bersemuka dan menyemak dokumen serta rekod daripada pelbagai jabatan yang terlibat dengan aktiviti pemprosesan ayam daging ini. Aktiviti yang tidak mempunyai nilai ini kemudian akan di analisa berdasarkan hasil keputusan daripada audit untuk mengesan pembaziran yang dijalankan semasa melakukan GEMBA di kawasan pemprosesan. Analisa akan dilakukan selepas semua kaedah untuk mengumpul data dilaksanakan. Gambarajah sebab dan akibat akan digunakan untuk mengesan punca sebenar yang menyumbang kepada pembaziran utama. Kaedah penyelesaian yang efecktif iaitu PDCA akan digunakan untuk merancang penambahbaikkan dan juga memberi cadangan yang bermanfaat kepada syarikat dalam bentuk duit dan penjimatan masa. Cadangan ini akan terus membantu syarikat untuk meningkatkan kadar produktiviti syarikat, menghasilkan produk yang berkualiti serta menyediakan persekitaran yang baik untuk pekerja mereka. Cadangan tempat kerja yang baru akan membantu syarikat menghapuskan semua pembaziran yang kritikal dan membentuk produksi yang lancar serta efisien. Hasil kajian akan di gunakan untuk membangunkan dan mengukuhkan ‘Lean Manufacturing System’ dalam industri pemprosesan makanan. Panduan ini boleh digunakan untuk mempraktikan ‘Lean Manufacturing System’ yang efektif terhadap semua organisasi.

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LIST OF ABBREVIATIONS

PPNJPM	**-**	**PPNJ POULTRY&MEAT SDN. BHD.**
NAFAS	**-**	**National Farmers Organization**
TPM	**-**	**Total Productive Maintenance**
NVA	**-**	**Non Value Added activity**
VA	**-**	**Value Added Activity**
TPS	**-**	**Toyota Production System**
ROI	**-**	**Return on Investment**
KG	**-**	**Kilogram**
RM	**-**	**Ringgit Malaysia**
FAMA	**-**	**Federation of Malaysia Agriculture**
MOA	**-**	**Ministry of Agriculture**
MARDI	**-**	**Ministry Agriculture of Research and Development**
DVS	**-**	**Department of Veterinary Services**
GLC	**-**	**Government Link Company**
FOA	**-**	**Federation of Agriculture**
NAFAS	**-**	**National Farmers Organization**
CP	**-**	**Chaproen Pokhpand**
MFM	**-**	**Malaysia Flour Mills**
JAIJ	**-**	**Jabatan Agama Islam Johor**
DOE	**-**	**Department of Environment**
VHM	**-**	**Veterinary Health Mark**
GMP	**-**	**Good Manufacturing Practices**

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Broiler Chicken is one of the most widely accepted muscle foods in the world. Its high-quality protein, relatively low fat content, new products, and generally low selling price because of favourable feed conversion make chicken a high-demand food in the marketplace. Furthermore, the absence of cultural or religious taboos allows increased chicken production and consumption worldwide (A J Maurer, 1993).

Poultry industry, in particular of the broiler production, is an important food sector of Malaysia agriculture. Malaysians do not just love to eat chicken but it is one of the cheapest sources of protein in the country. As per capita incomes rises, the demand of chicken meat will increase, and currently, Malaysians are among the world's highest poultry consumers with an average consumption of 37 kg/person/year. Due to the changes in Malaysian lifestyles and the availability of variety ready-to-cook chicken products, there is no stopping demand for chicken meat, and it is expected to increase further in the years to come. Therefore, in order to meet the increasing demand for chicken meat for the domestic and export markets,

local poultry integrators like Pertubuhan Peladang Negeri Johor (PPNJ) are investing in modern poultry farming as well as to keep abreast with present technological changes. As a food processing company, PPNJ Poultry & Meat Sdn. Bhd. which is fully owned by PPNJ have to stay competitive in order to compete with the others biggest players such as Leong Hup Industries, Chaproen Pokhpand (CP) and Malaysian Flour Mills Sdn. Bhd. (MFM) refer Appendix X. From the Broiler marketing chart in Chapter 4, the processing activity contributes to the highest operation cost. This operational cost sometimes contains unnecessary value activity that shouldn't be paid by the processor. On top of that, there is a need to develop and establish a method to identify and eliminates Non- value added activity. For that purpose, Lean Manufacturing System is introduced in order to overcome the highlighted issues.

This research addresses the application of lean manufacturing concepts to the continuous production or process sector with a focus on the food processing industry. After World War II, Japanese manufacturers, particularly in the automotive industry, were faced with the dilemma of shortages of material, financial, and human resources. Eiji Toyoda and Taiichi Ohno at the Toyota Motor Company in Japan pioneered the concept of the Toyota Production System, or what is known today in the US as "Lean Manufacturing." The basic idea behind the system is eliminating waste.

Waste is defined as anything that does not add value to the end product from the customer's perspective. The primary objective of lean manufacturing is to assist manufacturers who have a desire to improve their company's operations and become more competitive through the implementation of different lean manufacturing tools and techniques. Quickly following the success of lean manufacturing in Japan, other companies and industries, particularly in the US, copied this remarkable system. The term "lean" as Womack and Jones (1994) define it denotes a system that utilizes less, in terms of all inputs, to create the same outputs as those created by a traditional mass production system, while contributing increased varieties for the end customer. Lean is to manufacture only what is needed by the customer, when it is needed and in

the quantities ordered. The manufacture of goods is done in a way that minimizes the time taken to deliver the finished goods, the amount of labour required, and the floor-space required, and it is done with the highest quality, and usually, at the lowest cost.

1.2 Background of the Research

In Malaysia, industry is rewarding poultry producers and expectations are high in broiler sectors. The objective of poultry producers until 2010 under the National Agricultural Policy is to maximize income through the optimal utilization of available resources. Various steps are being taken, such as the establishment of designated production areas for poultry production and developing, exploring Malaysia's potential as an International Halal Food Hub and to ensure high productivity in order produces maximum capacity of broiler chicken for locally usage as well as meet the market demand.

There are a lot of things can improve with the existing local Broiler processing plant in Malaysia. Most of the local Broiler processing plants are running their production with the lower capacity of broiler yearly. Even, with the lower capacity, still they produced a large number of defects (for example chicken mortality, disease, Non-HALAL and etc.). Automatically defect will happen due to quality problem and some causes by non-value added activities within the process and will dissatisfy the customer expectations. This resulted lower productivity. The repeatability of this problem soon will create a shortage in supply of Broiler chicken in the local market. This major problem is the chronic disease in every processing company and need to be solved immediately in order to be competitive with the established company. Yet, many of the Broiler processing companies still run their production without systematic manufacturing or processing system. The best solution to apply systematic system is with the implementation of Lean manufacturing system. The implementation of Lean is a must in automotive and services industry.

However, in literature review and past research, the implementation of lean in food processing industry is very limited and marginal.

The processing of poultry results in additional waste materials, including the offal (feathers, entrails and organs of slaughtered birds), processing wastewater and bio solids.

1.3 Problem Statement / Research Problem

This research is driven by the fact that while researchers and practitioners have widely used lean tools in the manufacturing and service industry, no research has systematically investigated how to apply lean tools and techniques to a food processing environments. In order to compete in today's global competitive market the continuous process industry also needs to look in several ways in order to gain the competitive edge.

The selected Food Processing Company in this study having difficulty visualizing the overall process flow in their production line. Besides that, there is an unnecessary workload is performed in certain areas. The company hasn't got certified and implement any production system that will produce an efficient working environment. There is no method to trace which process and section that contributed to the problem such as bottleneck and high percentage of waste. This has happened due to no Industrial Engineer is hired in response to those problems. The company is also facing poor workstation design and layout that contribute to the hidden waste occurred in the process. Therefore, this study is focused to identify the method to recognize various types of waste utilizing the Lean Manufacturing Method of Waste Walk and Waste Assessment. There are problem identification and solving tools that used in order to give opportunity for improvement. All root causes than are then

identified and analyze in order to generate better final proposed solution and give a high return on investment to the company.

1.4 Justification of the Research

This section describes justification of the research. This research is important and necessary contributes in providing efficient processing and slaughtering process for broiler chicken meat in Malaysia. The conducted study will benefit consumers in terms of better quality of food, healthy food, consistency pricing and fulfills the local demands of broiler meats in the market. The company will raise more profit due to the elimination and identification of non-value added that occurred in their current operations with the application of the 5S (Quality Environment) concept into their plant and operations processes. In this method, current and future radar chart of waste and 5S assessment will determine in order to produce efficient operations. Besides that, the company productivity will be increased as well as employeeemployee's satisfaction thuemployeeing the employee's morale.

The aim of this research is to adapt lean manufacturing tools in the food processing environment and to evaluate their benefits at a specific industrial concern. The research hypothesizes that there are big opportunities for improvement in the process industries if lean tools are utilized. The objective is to systematically demonstrate how lean manufacturing tools when used appropriately can help the process industry to eliminate waste, have better inventory control, better product quality, and better overall financial and operational procedures. In this research the food processing industry will be used to represent the continuous process industry, and case study will be carried out at an actual broiler slaughtering facility, whose identity is restrictreferred and will be refered as PPNJ Poultry and Meat Sdn. Bhd.

1.5 Methodology

This chapter describes the methodology of the research that consist the justification for the methodology used to complete this research. The justification stage covers the explanation on why the studied are conducted at PPNJ Poultry & Meat Sdn. Bhd. Several instrumentations have been used in order to obtain collection of data. Every single step in collecting data is describedescribed in detail in Chapter 3. From the data collection, deep analysis will be conducted in order to develop a new solution to the problem identified. All proposed solution must be validated before it can be used. Therefore, there is a need for validation or comparative study between before and after improvements . The details about the methodology will be discussed in Chapter 3.

1.6 Objectives

In order to conduct this study which benefits to the industry and stakeholders , the following objectives need to be undertaken:

a) To identify, analyze and eliminates the non value added waste at PPNJ Poultry Meat Sdn. Bhd. Slaughtering process.
b) To identify the critical factors influencing the productivity of PPNJ Poultry& Meat Sdn. Bhd. Slaughtering process.
c) To propose solution to the major problem at the PPNJ Poultry & Meat Sdn. Bhd. Slaughtering process

1.7 Scope

The broiler slaughtering processing plant consists of four main departments. The major critical area need improvement is at low risk a; ea;slaughtering process. The scopes of this research activity are limited to :

a) This study is limited to the following processes:

- Receiving and Holding Area
- Stunning
- Slaughtering
- Scalding
- De-feathering
- Leg Cutting
- Head Pulling

b) The proposed method and solution is not necessary to be implemented

1.8 DEFINITION OF TERMS

There are several terms that use in this research as listed in Table 1.1.

Table 1.1 Definition of terms

Poultry	Domestic fowls, such as chickens, turkeys, ducks, or geese, raised for meat or eggs.
Broiler Chicken	Broilers are chickens raised specifically for meat production. Modern commercial broilers, for example, Cornish crosses or Cornish-Rocks, are specially bred for large scale, efficient meat production and grow much faster than egg laying

	hens or traditional dual purpose breeds.
5S	A process to ensure work areas are systematically kept clean and organized, ensuring employee safety and providing the foundation on which to build a Lean Office.
Waste	Anything that adds cost or time without adding value
Root cause	The origin or source of the problem
Kaizen	"Kai" means to "take apart" and "zen" means to "make good". Kaizen is synonymous with continuous improvement.
Slaughterhouse	a building area with special design and construction which meets certain techniques and hygiene requirements, is used as a chicken slaughterhouse for public consumption's purpose.
Carcass	is a part of chicken's body after slaughtering, plucking, and eviscerating, either with or without head-neck, and/or feet starting from tarsus and/or air sack and kidney
Chicken Meat	is the slaughtered part of chicken that is edible for human, including the skin.
Viscera	are the chicken's liver (after the gallstone is removed), heart, colon and other organs located in chest and stomach abdominal which are edible after passing the cleaning and washing procedure.
seven muda	Ohno's original seven types of waste found in production: Transportation, Inventory, Motion, Waiting, Over-Processing, Over-Production, and Defects5S – A process to ensure work areas are systematically kept clean and organized, ensuring employee safety and providing the foundation on which to build a Lean Office.

1.9 Research Contributions

At the end of the study, a framework of Lean manufacturing tools will be proposed in order to identify waste at the company. There are several familiar tools such as Waste Walk Assessment, 5S, Employee Suggestion Scheme (ESS) used to help the company identify hidden waste at the food processing company. The problem solving method such as P-D-C-A Cycle (Plan-Do-Check-Action) can be used to identify waste easily. The Lean Manufacturing framework will be the guidance in order to propose re-designs of the work station and job task at broiler slaughtering process area. The proposed design will help the company to eliminate or reduce the non-value added activities that appears in slaughtering process. This will directly give the company opportunities to reduce their operation cost. Hopefully, a similar operations company can benchmark this company as a first step to implement Lean Manufacturing System.

This qualitative case study will give good input to the case study Company as well as to the government bodies or private company in similar operations. The output of the study will encourage further research in the area of facility design, Lean production system, 5S and Kaizen. This qualitative case study is important to identify issues and challenges faced by the food processing company. The analysis conducted is importance to be highlighted and the proposed solution should be considered in order to achieve high productivity.

1.10 Outline of the report

The structure of thesis is arranged as the followings. Chapter 1 discusses an overview of the research problem, objectives, scopes and research methodology. Chapter 2 accounts for the literature review on Lean production system in general,

seven wastes (MUDA), 5S and Kaizen. Chapter 3 discusses the methodology that specifically employ in the research. The methods of conducting this research are described in detail in Chapter 3. All gathered data collection from respective case study company are analyzed and compiled in chapter 4. The deep analysis will lead to proposed solution that describe in Chapter 5. Finally Chapter 6 concludes and discusses about the policy recommendations based on the empirical findings. The flow of the thesis is illustrated in Figure 1.1.

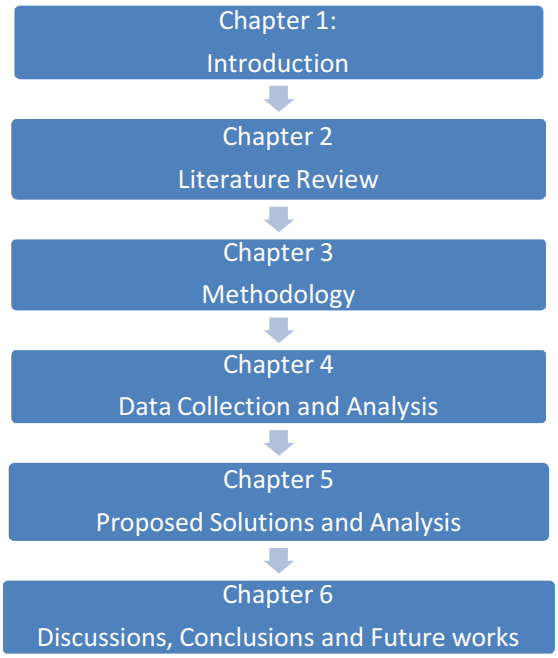

Figure 1.1 Flow of Report outline

1.11 Conclusion

This chapter describes introduction to the project which include background of the project. This study is problem solving oriented, whereby problem is identified, analyzed and potential solutions will be proposed. This chapter also presents the importance of Lean application in the food processing industry in order

to result high productivity. The Kaizen method is the best solution that helps the company to improve their workstation and working environment.

REFERENCE

1. Womack, J.; D. Jones; and D. Roos. 1990. The Machine that Changed the World – The History of Lean Production, Harper Perennial, New York.

2. Womack, J. and D. Jones. 1996. Lean Thinking – Banish Waste and Create Wealth in your Corporation, Simon & Schuster, New York.

3. Rother, M. and J. Shook. 1999. Learning to See: Value Stream Mapping to Add Value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA.

4. McDonald, T.; E. Van Aken; and R. Butler. 2000. "Integration of Simulation and Value Stream Mapping in Transformation to Lean Production", IIE Annual Conference.

5. Abbett, D., and V. Payne, "Gulfstream V Value Stream Tour," (Presentation at 1999 Lean Summit), 1999.

7. Billesbach, J.T., "Applying Lean Production Principles To A Process Facility," Production and Inventory Management Journal , Third Quarter, 1994, PP. 40-44..

8. Brunt, D., "From Current State to Future State: Mapping the Steel to Component Supply chain," International Journal of Logistics: Research and Applications , Vol. 3, No. 3, 2000, PP. 259-271.

9. Cleland, D.I., and B. Bidanda, The Automated Factory Handbook: Technology and Management, (Blue Ridge Summit, PA,1990).

10. Cox, A., " Radically Eliminating Waste," World Mining Equipment, January-February, 2002.

11. Dennis, Roger Daina, "Defining Production and Inventory Management Systems for Process Industries" (Ph.D. Dissertation, University of Cincinnati, 1993).

12. Detty, R.B., and J.C. Yingling, "Quantifying Benefits of Conversion to Lean Manufacturing with Discrete Event Simulation: a case study," International Journal ofProduction Research, Vol. 38, No. 2, 2000, PP. 429-445.

13. Dimancescu, D., P. Hines, and N. Rich, The Lean Enterprise, (American Management Association, 1997).

14. Fled, M.W., Lean Manufacturing: Tools, Techniques, and how to use them (Boca Raton,London: The St. Lucie Press, 2000).

15. Galbraith, J., C.R. Standridge, " Analysis in Manufacturing Systems Simulation: A case study," Simulation, Vol. 63, 1994, PP. 368-375.

16. Groover, M.P., Automation, Production Systems, and Computer-Aided Manufacturing (Prentice-Hall, INC., Englewood Cliffs, New Jersey, 1980).

17. Gunasekaran, A., "Just-In-Time Purchasing: An Investigation For Research and Applications," International Journal of Production Economics , Vol.59, 1999, PP. 77-84.

18. Hays, R.H., and K.B. Clark, "Why some factories are more productive than others," Harvard Business Review , September-October 1986, PP. 66-73.

19. Hines, P., N. Rich, and A. Esain, "Creating a Lean Supplier Network: a distribution case," European Journal of Purchasing & Supply Management , Vol. 4, 1998, PP.235246.

20. Hines, P., and D. Taylor, Going Lean, Lean Enterprise research center, Cardiff Business School, 2000.

21. Imai, G., Gemba Kaizen (McGraw-Hill, New York, NY, 1997).

22. Karlsson, C., and A. Par, "Assessing changes towards lean production," International Journal of Operation & Production Management, Vol. 16, No.2,

1996, PP. 24-41.

24. Lankford, Jr., W.T, N.L. Samways, R.F. Craven, and H.F McGannon, The Making, Shaping and Treating of Steel (10th edition; Herbick& Held, Pittsburgh, PA, 1985).

25. Law, A.M, and W.D. Kelton, Simulation Modeling & Analysis (2nd edition;McGRAWHill, Inc.,1991).

27. Levy, D.L., "Lean Production in an International Supply Chain," Sloan Management Review, winter 1997, PP. 94-102.

28. Maintenance-TV, 5S, (ABB company, December 2000), unpublished. [Available http://Maintenance-TV.com].

32. Monden, Y., Toyota Production System-An Integrated Approach to Just-in-time (3rd edition; Norcross, Georgia: Engineering & Management Press, 1998).

33. Monden, Y., Toyota Production System, (Norcross, Georgia: Industrial Engineering and Management Press, 1993).

34.Moore, R., "Combining TPM and Reliability-Focused Maintenance," Plant Engineering, June 1997.

35. Nahmias, S., Production and Operations Analysis (Third Edition, 1997).

36. Nakajima, S., TPM Development Program: Implementing Total Productive Maintenance (Productivity Press, Cambridge, MA, 1989).

38.Ohno, T., Toyota Production System: Beyond large-scale production 1997.

39.Panizzolo, R., "Applying the lessons learned from 27 lean manufacturers-The relevance of relationships management," International Journal of Production Economics , Vol.55, 1998, PP. 223-240.

40. Quinn, J.B., and F.G. Hilmer, "Strategic Outsourcing," Sloan Management Review, summer 1994, PP. 43-55.

43. Emiliani, Bob; Stec, David; Grasso, Lawrence; Stodder, James (2007). *Better thinking, better results: case study and analysis of an enterprise-wide lean transformation* (2nd ed.). Kensington, Conn: Center for Lean Business Management.

45. Toyota Production System, Ohno, Taiichi, 1988, Productivity Press

46. Liker (2004) - The Toyota Way (p.28)

47.A study of the Toyota Production System, Shigeo Shingo, Productivity Press, 1989,

48. HMS Manual System, DRB Hicom 2008 Food Act 1983 and Food Regulations 1985, Malaysia.

49. Malaysian Standard MS 1480:1999. Food Safety According to Hazard Analysis and Critical Control Point (HACCP) System. Department of Standards Malaysia. (1999)

50. Codex Basic Food Hygiene Texts/Annex to CAC/RCP 1-1969, Rev.3. Codex Alimentarius. (1997).

51 Guidance on Regulatory Assessment of HACCP Report of a Joint FAO/WHO Consultation on the Role of Government Agencies in Assessing HACCP, Geneva (1998).

52. PPNJ Poultry & Meat Sdn. Bhd. Standard Operating Procedure, latest version 2012