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INCREASING EMPLOYEE SATISFACTION WITH THE BASIC PRINCIPLES OF LEAN MANUFACTURE A Research Conducted in California Pacific Medical Center, Radiology Department

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Submitted by

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ABSTRACT

Healthcare across the United States is feeling the impact of the economic recession. The challenge is to do more, with fewer resources. In response, many healthcare organizations are moving to redesign their processes and practices in an effort to survive. The purpose of this thesis is to document the Lean implementation and its impact in employee satisfaction at California Pacific Medical Center (CPMC). "The lean approach is a production strategy in which all parts of the production system are focused to eliminate waste and defect while continuously increasing the percentage of value-added work." (Liker, 2004, p. 4) This research will show that by placing employees at the center of the solution, it will increase employee's satisfaction.

CHAPTER 1 - INTRODUCTION

The challenges currently facing the United States healthcare system includes escalating gaps between the demand and supply due to the impact of the economic recession. As the demand for healthcare services are increasing as the population ages, chronic diseases become more common, and the medical use of technology increases. Yet, the allocation of staff is decreasing with the challenges are to do more, with fewer resources. (Black et al, 2008). In other words, in order for healthcare organizations to survive, many of them are switching to Lean Manufacture.

The Lean Manufacture concept was born from the success of Toyota Motor Corporation with the focus to reduce waste while continuously increasing the percentage of value added work." (Womack et al., 1990, p. 67). It is argued that healthcare organizations could benefit by successfully implementing the Lean Manufacture. Furthermore, the implementation of the Lean Manufacture not only has a positive impact in the organization's culture but also on the employee's satisfaction. The Lean principle has the potential to transform the culture and the employee's behavior while maintaining the employee's long term satisfaction.

This thesis will focus in particularly with the healthcare system within California Pacific Medical Center's radiology department. The objective of this thesis is to explore the impact that the Lean Manufacture program will have and its effects on employee satisfaction within the radiology department.

The Lean production is not a new concept that has been successfully used in various manufacturing companies for decades and now it's making dramatic improvements in the healthcare system. So the question to ask is: "What does the production of cars have to with the healthcare system?" Simple, both industries focus on delivering high quality with error free

results. However, despite the growing awareness for the need to implement the Lean Manufacture in the healthcare, few studies have examined its effectiveness in increasing employee satisfaction. To fill this gap, this research study aims to explore and understand the implementation of the Lean Manufacture and its impact in employee satisfaction. This study will use eight front line employees to critically examine the CPMC Radiology's workflow, provide input and make direct changes to the current process.

This thesis is based on key points below:

Problem Statement: Hospitals across the United States are feeling the impact of the economic recession. The challenge is to do more with fewer resources.

The main research question examined in this study was: Could employee satisfaction, efficiency and quality at CPMC Radiology be increased by adapting the basic principles of the Lean Manufacture?

The hypothesis used in this study was: If the Radiology department at the employee level adapted a program on the basic principles of Lean Manufacture it will improve efficiency, quality, and increase employee satisfaction.

Independent variable: If the Radiology department implemented a program on the basic principles of Lean Manufacture:

- Dependent variable 1: It will improve efficiency
- Dependent Variable 2: It will improve quality
- Dependent variable 3: It will increase employee satisfaction

The research will be divided into two Phases. Phase I will involve completing a survey by the eight front line employees of the radiology department, which advise the current state of the employee's satisfaction prior to Lean Manufacture implementation. The data and results of Phase I of the survey will be used to set a baseline for each employee's satisfaction prior to Lean Manufacture implementation.

Phase II will consist of the implementation of the Lean program by completing the same survey the same eight front line employees. The results will alert the level of employee's satisfaction after the implementation of the Lean program. The degree of the changes for implementing the Lean principles will result with a positive impact on the company's culture and increase of the employee satisfaction (Hook et.al, 2008).

1.1HISTORY OF CALIFORNIA PACIFIC MEDICAL CENTER (CMPC)

California Pacific Medical Center consists of the four oldest hospitals in San Francisco: Davies Medical Center, Presbyterian Medical Center, St. Luke's Medical Center and Children's Medical Center. The Davies Medical Center was founded in 1852 to help San Francisco's German-speaking immigrants find food, shelter, work, and healthcare. The Presbyterian Medical Center was the first medical school in San Francisco founded in 1857. St. Luke's Medical was founded in 1871 by the Episcopalian church and was committed to providing high quality of healthcare regardless of a patient's ability to pay. Lastly in 1875, its Children's Medical Center was founded as the pacific dispensary for women and children. CPMC mission was to serve the communities by providing high quality, cost-effective healthcare services in a compassionate and

respectful environment, which was supported and stimulated through education and research. (Sutterhealth.org. 2011).

With today's economy, the CPMC as a healthcare organization is struggling to overcome the economic recession and remain competitive. In order to survive, CPMC is embracing techniques such as the Lean Manufacture to cope with the changing trends of the economy and remain competitive. For this study, the Radiology department at CPMC's St. Luke's Medical Center was selected.

1.2 BACKGROUND AND HISTORY OF LEAN MANUFACTURE

The Lean Manufacture, which was based on the Toyota System, is a term applied to the production methods pioneered in Japan after World Wall II by Kichiro Toyoda. Mr. Toyoda was highly influenced by Henry Ford's theory on the mass production strategy. Mr. Toyoda could not adapt the mass production strategies from the Ford Company due to the economic situation in Japan after the World War II. The demands for mass produced vehicles were real low during that time. This ordeal led to the development of Lean Manufacture approach in which all parts of the production system were focused to eliminate waste while continuously increasing the percentage of the value added work. This theory helped Toyota to minimize cost, maintain the quality and provide several models to satisfy different customer requirements. (Dale et al., 2007).

Due to negative treads in healthcare system, various companies want to be able to remain competitive therefore, are embracing various techniques, like Lean Manufacture. This will enable the healthcare systems the ability to cope with the changing trends of the economy to remain competitive. The history Lean Manufacture in healthcare is a philosophy that seeks to

eliminate waste or non-value-added activities by adding value to the patient experience (Dickson et al, 2009, p. 54). Specifically, the Lean Manufacture in healthcare has been described as: "…the relentless elimination of waste in every area of operations with the aim of reducing inventory, cycle times, and costs, so that delivering higher-quality patient services can be provided in the most efficient, effective, and responsive manner possible, while maintaining the economic viability of the organization." (Steed, 2012, p. 19).

However, it was not until the late 1999s early 2000s that Lean Manufacture started to make dramatic improvements in healthcare companies. The Lean approach has proven to provide safe, cost effective, and hassle free services to any organization or business process. The core of the Lean Manufacture is to eliminate waste and defects by focusing on what does the customer wants, and how to increase their satisfaction. By eliminating waste and defects looking through the customer's eyes, organizations can observe a process and separate the value added steps from the non-value steps. Such processes can be applied to any organization and any business process at any time. Toyota has identified seven types of non-value adding waste, which are:

1. Overproduction: Producing more than the order at hand is overproducing, which can generate waste.
2. Waiting: Waiting for components from the previous process or supplies, parts, or tools.
3. Transport: Any transport of material, machines/equipment or people is non-value-adding.
4. Over processing: To process more than necessary.
5. Inventory: Excess of inventory of supplies.
6. Movement: Any waste motion employees have to perform during the course of their work.
7. Defect: Production of defective parts or correction. (Liker, 2004).

The culture of the Lean Manufacture is based on the fourteen principles of the Toyota Way. The Lean Manufacture principles were developed to be applied to any organization so that they can be diligently practiced to achieve high performance that continues to add value to customers, employees and society as a whole.

Principle 1 – "Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals."

Principle 2 – "Create a continuous process flow to bring problems to the surface."

Principle 3 – "Use 'pull' systems to avoid overproduction."

Principle 4 – "Level out the workload (work like the tortoise, not the hare)."

Principle 5 – "Build a culture of stopping to fix problems, to get quality right the first time."

Principle 6 – “Standardized tasks and processes are the foundation for continuous improvement and employee empowerment.”

Principle 7 – “Use visual controls so no problems are hidden.”

Principle 8 – “Use only reliable, thoroughly tested technology that serves your people and process.”

Principle 9 – “Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.”

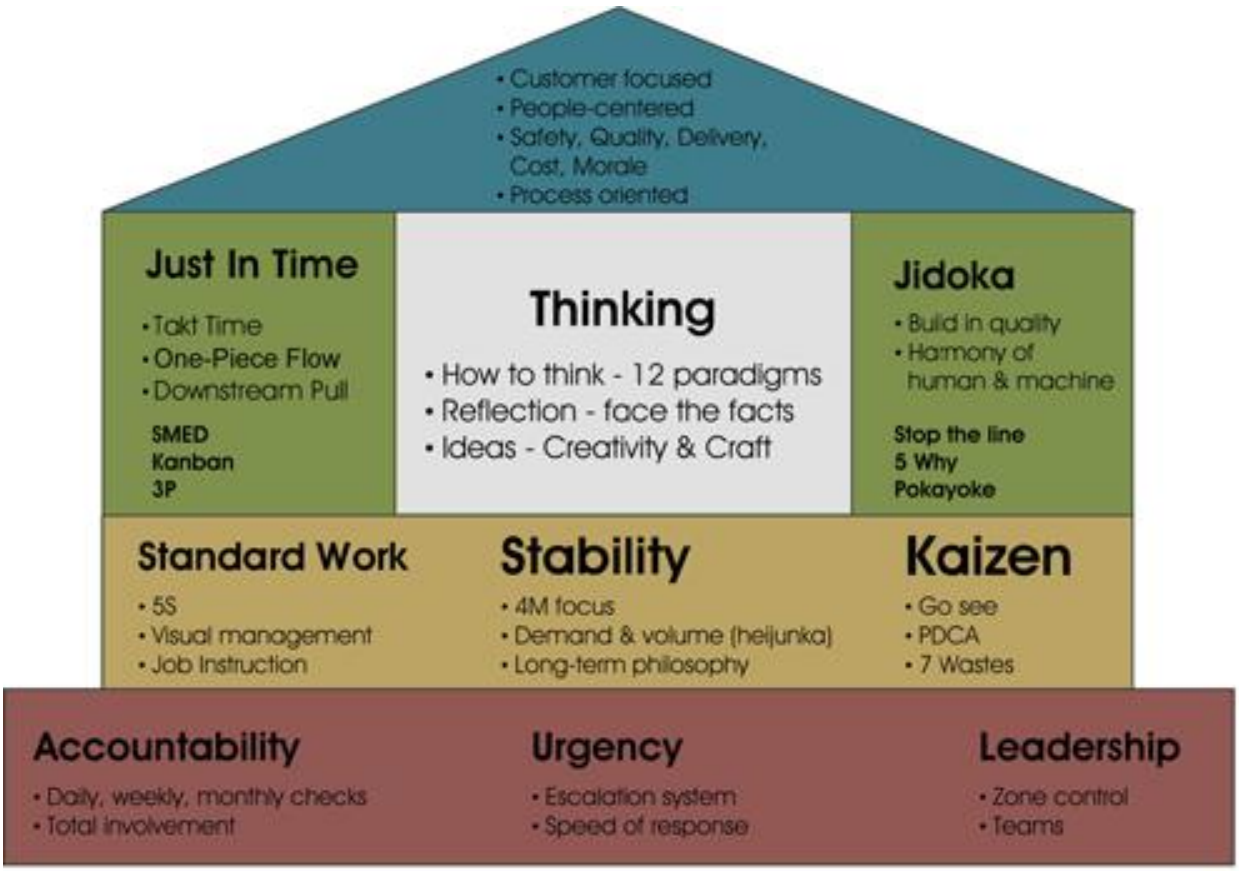
Principle 10 – “Develop exceptional people and teams who follow your company’s philosophy.”

Principle 11 – “Respect your extended network of partners and suppliers by challenging them and helping them improve.”

Principle 12 – “Go and see for yourself to thoroughly understand the situation.”

Principle 13 – “Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.”

Principle 14 – “Become a learning organization through relentless reflection and continuous improvement.” (Liker, 2004, p. 37-41).



1.3 SCOPE AND LIMITATIONS OF THE STUDY

The study projected some limitations:

1. The study was focus in a healthcare settings.
2. The study was limited to the Radiology department at CPMC.
3. The data collected from the Lean Manufacture was based on small sample size (eight employees).
4. Impact of the Lean Manufacture implementation only measure employee satisfaction.
5. The data was limited to the transformation of one implementation to one area i.e. Department.

6. Since Lean Manufacture is a continued improvement process results are expected to be different for future implementation projects.
7. Funding.
8. Employee and higher management resistance to change.

CHAPTER 2-

LITERATURE REVIEW AND DEFINITIONS OF THE MAIN CONTEST

The research is based on the empirical data from California Pacific Medical Centers, specifically the radiology department. This study does not cover other departments within CPMC or other hospitals therefore, it is extremely important to provide a summary of the current literature review, and the definition of Lean Manufacturing to prove this thesis validity.

2.1 LITERATURE REVIEW

Similar to the thesis, the findings from Black et.al (2008) studies, who found a positive correlation between the Lean Manufacture and employee satisfaction. Black believed that the Toyota production system would lead the healthcare system to excellence by increasing efficiency, quality and staff morale. (Black et. al 2008). He stated that an organization such as healthcare can be successful if the Lean Manufacture aims "at gaining the greatest possible return from the skills and ideas of the people who do the work, the employees." (Black et al, 2008, p. 6).

Hines and Holwe et al (2004) believed that many companies only focused on the Lean implementations at management level but to be successful, the Lean should be implemented to the entire organization especially at employee level. Moreover, when implementing Lean in a healthcare setting, the focus usually is on the tangible aspects, overlooking the most important human aspects (Dibia & Onuh, 2010).

Naida Grunden and Charles Hagood in their book, "Lean-Led Hospital Design: Creating the Efficient Hospital of the Future," focus on ways in which Lean principles can improve the way healthcare facilities are designed. They stated that in an era of budget constraints, the healthcare is expected to do more with fewer resources. Hospitals must find new ways to provide consistently efficient and quality care. By implementing the Lean thinking, not only will it improve process which will lead to improved care and cost, it will also improve staff and patient satisfaction. (Grunden et. al, 2012).

In addition, Protzman et. al (2011) wrote that the Lean practice is a matter of survival and the ability to maintain employee satisfaction while still delivering high quality care through continuous improvements as a necessity. He suggested that employee's satisfaction within the organization improves as the employees are familiar with policies and procedures that can only be accomplish with Lean thinking. Protzman et. al point will help proof that by implementing lean manufacturing practices, organizations gain the potential to keep production and quality levels high, while minimizing waste, will be the key to remaining competitive as the economic climate improves. But most important is the key to employee satisfaction.

Sohal et al (1996) wrote that employees satisfaction are based on education and training and is crucial for successful Lean implementation. Other successful factors are management's commitment to changes (Sohal & Egglestone, 1994). and culture supported team work (Crute et al., 2003). In other words, a leadership dedicated to Lean principles. In a nut shell, becoming lean requires tremendous learning and a high level of commitment to the process (Chen et al., 2010).

In his book, Mark Graban explains the why and how the Lean hospitals can be used to improve safety, employee satisfaction, quality, and efficiency in a healthcare setting. Additionally, Graban emphasize the critical role of the front line staff in developing and implementing Lean. With similar context, Westwood et al (2007) highlighted that Lean is implemented in organizations from top management vision, but success comes with the involvement of front end employees.

Fullerton and Wempe et al (2008) confirmed in their study that successful adoption of Lean Manufacturing depends on the front end employee involvement. Only the front line workers can identify and fix small problems (Dennis, 2007). Their study also show that the Lean Manufacturing guarantees employee satisfaction.

Cotte et al. (2008) emphasize that Lean Manufacture is linked to making changes by breaking down processes to understand them easier, which will also motivate the employees and increase employee satisfaction. Also, Cotte et al. (2008) point out that without employees' ground level involvement, problems can only be solved at the surface level since these employees have more knowledge about the detail processes and daily workflows.

Lean in healthcare promotes resource optimization, reduction in variability of process, and defect free healthcare services leading to the improvement in performance, quality of work, and reduction in job dissatisfaction (Karwowski et.al, 2004).

Even Aherne et al (2007) agrees that in healthcare the main challenge in implementing Lean is empowering and providing the relevant training to the staff. However, if you are able to empower and provide adequate training not only will that increase employee satisfaction but will increasing efficiency and quality as well. Avoid 1-2 sentence paragraphs.

The influence of employee satisfaction during a Lean implementation is a result of education, training, and participation of employees contributing towards organizational learning (Wiklund et.al, 2002). The Lean Manufacture promotes employee empowerment and group activity, which has a positive influence on job satisfaction and employees' loyalty (Jun et.al, 2006).

According to Conte et.al (2002). Ann important prerequisite for using the Lean principals in healthcare is the harmony between healthcare employees and management. To support it, Miller et.al 2002 found that employee satisfaction increases as a result of the harmony among employees and management. Avoid 1-2 sentence paragraphs. Hook et.al (2008) studies showed the successful implementation of Lean, which requires an organizational culture change, leads to increased employee satisfaction, motivation and responsibility flow, quality and continuous improvement, through leadership.

From the employees perspective, the Lean principals benefits them in terms of the working culture or environment, freedom and ease in work, and enhances initiatives and innovation for work (PDTP, 2002). In other words, the Lean principals have proven to be effective as an organizational improvement mechanism which supports employee development and improves the work environment (Farris et.al, 2009). Lean Manufacturing in a non-healthcare organization is based on producing products in mass, often using an assembly line (Slack et al., 2004). In a healthcare organization, service delivery depends highly on the patients' needs. Service cannot be produced to stock of course; the production process can only start when the patient is present (Slack et al., 1998; Daft, 2000). The transformation process depends largely on what the patient's need and employee satisfaction.

According to Berwick (1994) Glouberman and Mintzberg, et al (2001) the differences between the production systems of Toyota and a hospital have major consequences for possible ways in which hospitals can organize Lean healthcare delivery. They provide an overview of arrangements reported in empirical healthcare studies.

Although healthcare differs in many ways from manufacturing, there are also surprising similarities. Whether building a car or providing health care for a patient, workers must rely on multiple, complex processes to accomplish their tasks and provide value to the customer or patient. But what links manufacture and healthcare, is that Lean increases employee satisfaction. (IHI, 2005).

It's often said, without much reflection, that people hate change. In 1989 Dr. Donald M. Berwick shared/prove in his book that people actually love change when they are fully engaged in the process, get to make improvements that improve patient care and make their day less frustrating. When they don't fear being laid off as a result of their improvements, not only it will increase patient satisfaction but it will increase productivity.

Unleashing the energy and creativity of every employee to solve problems every day, should be the sole focus of every healthcare leader. Lean Manufacture provides examples of front line staff coming up with solutions to problems on their own and implementing them. Healthcare leaders need to understand that their management role must radically change to one of supporting daily Lean processes if quality safety and cost are to improve in healthcare and increase employee satisfaction.

John Toussaint, MD et al (2008)

CHAPTER 3-

RESEARCH METHODS

The purpose of this research was to explore the usability of the Lean Manufacture approach and its impact in employee satisfaction in a healthcare environment. The aim of the study is to increase employee's satisfaction by 10% or greater diversion rate compared to prior Lean practices at CPMC. The diversion rates for this analysis will be compiled in two phases. Phase I will be aimed to compiled data from surveys as a baseline of the current employee's satisfaction at CPMC, radiology department without the Lean practices. Phase II will be aimed to compiled data from surveys after implementing the Lean practices at CPMC, radiology department.

3.1THE OBJECTIVE OF THE STUDY

Academic research on the Lean Manufacture is focused mainly in production and its impact on company's performance and process improvement. However, minimum attention has been given to Lean's implementation and its impact on employee's satisfaction especially in the healthcare sector. Therefore, the following problem statement and research questions have been formulated:

Problem Statement: Hospitals across the United States are feeling the impact of the economic recession. The challenge is to do more, with fewer resources.

The main research question examined in this study was: could employee satisfaction, efficiency and quality at CPMC Radiology be increased by adapting the basic principles of the Lean Manufacture?

Through literature review, we have a better understanding of the Lean tools and techniques, as well as the challenges and benefits of the Lean implementation in the healthcare services. This thesis draw from the hypothesis data that will be collected from the radiology department at CPMC to understand the process and improvements that can be made through Lean and its impact on employee's satisfaction.

The hypothesis used in this study was: if the Radiology department at the employee level adapted a program on the basic principles of Lean Manufacture it will improve efficiency, quality, and increase employee satisfaction.

More specifically the research has the following objectives:

- To understand Lean's tools and techniques applicable in healthcare.
- To measure employee's satisfaction before and after the Lean Manufacture.
- To analyze the impact in quality and efficiency before and after the Lean Manufacture implementation.

The scope of this research will identify the following variables:

Independent variable: If the Radiology department implemented a program on the basic principles of Lean Manufacture:

- Dependent variable 1: It will improve efficiency
- Dependent Variable 2: It will improve quality
- Dependent variable 3: It will increase employee satisfaction

3.2 RESEARCH DESIGN

Saunders et al. (2009, p. 141). highlighted the importance of having the right research strategy selection. Researchers followed this principle by first providing the theoretical background to understand research strategies, which led to the selection of the right research method. For the purpose of this thesis, qualitative research fits the best.

3.3 QUALITATIVE RESEARCH

This method strategy emphasizes more on analysis based on words rather than numerical data. Its focus is on inductive approach to generate a theory, as well as the research philosophy of interpretivism (Bryman & Bell, 2007, p. 28). Due to the qualitative research flexibility to adapt based on the findings of observation or circumstances, this thesis will focus in finding an answer and meaning of the Lean Manufacture and the impact in employee's satisfaction. Furthermore, Leedy et al. (2013, p. 134). Suggested, that there are several methods that can be followed in qualitative research. However, a case study research is the best approach for this thesis.

3.4 CASE STUDY RESEARCH

Is also known as idiographic research, involves a detail analysis of a particular individual, program or event studied in depth for a defined period of time. "A case study may be especially suitable for learning more about a little known or poorly understood situation. It can also be

appropriate for investigating how an individual or program changes over time, perhaps as the result of certain conditions or interventions. In either circumstance, it is useful for generating or providing preliminary support for hypotheses. Its major weakness is that, especially when only a single case is involved, we cannot be sure that the findings are generalizable to other situation." (Leedy and Ormrod, 2013, p. 141).

3.5 CASE STUDY METHOD

There are two types of case study methods:

1. Type I is a case study with a limited number of cases all with a general conclusion.
2. Type II is a case study focusing on a single case, deriving specific conclusions. (Gummesson, 2000, p. 84).

This thesis will be based on Type II which enables researchers to answer the "Why, What and How." There are five factors that are important for case study which are:

1. Organization of details about the case.
2. Categorization of data.
3. Interpretation of single instance.
4. Identification of the patterns.
5. Synthesis and generalizations.

With understanding of the theoretical principles, this thesis will follow the qualitative research strategy with a single case study research in CPMC, radiology department. A detailed

analysis has been conducted to investigate the implementation of the Lean Manufacture and its impact in employee's satisfaction.

3.6 RESEARCH VALIDITY

Validity invades every aspect and detail of the evaluative process, especially the selection, definition, and application of criteria. (Roper, 2013). However, selection bias can become an area of concern; for example, several data will be reviewed to understand the critical success factors and challenges for implementing the Lean Manufacture approach. Especially, when the research relies on using eighth front line employees to critically examine workflow processes, provide input and make direct changes to these processes. If certain employee's attend all training sessions, take careful notes, and asks engaging questions, while other employees misses several sessions, and pay no attention to the training. Such employees could not be counted in the same way. In addition, the research project will utilize surveys response which will contain bias and non-bias responses which become important areas to address. To try to eliminate both biases from this research, the key will be on removing as much identifiable information as possible when collecting data.

This thesis has some validity limitations since this was done with small sample size. However, this does provide the researcher valuable insight from the internal staff perspective on how the organization is doing with employee's satisfaction. Implementing and documenting the Lean Manufacture will have a positive effect that proves validity.

3.7 DATA COLLECTION METHODS

To understand the Lean Manufacture implementation in a hospital setting, this thesis will use primary data. A questionnaire/survey was created and utilized to collect the data. The survey used for this thesis will be a modified version of the questionnaire developed by CPMC which is conducted yearly. CPMC survey reveals the state of the organization in efficiency, the quality and employee's satisfaction. Therefore, the researcher chose this method because it will prove the hypotheses of this thesis.

The data timeline will be collected in five weeks. During the first week the employees will be asked to participate in the pre-survey, a session conducted to point out current issues and explore possible areas for improvement. In the second and third week, the improvements suggested will be implemented using the Toyota Seven Waste Process Phase I). During week four, employees will be asked to participate on a post-survey after implementation so that this data can be collected for finding results different from week one through three (Phase II). On the final fifth week, conclusions and recommendations will be drawn.

3.8 DATA COLLECTION FOR PHASE I AND PHASE II AND IMPLEMENTATION

The pre and post survey was distributed among the eight front line radiology employees to determine their state of satisfaction as well as the department's efficiency and quality of CPMC. The meeting with the eight employees was organized by this researcher in association with the radiology manager's approval.

The survey used in Phase I and II has three sections:

1) Employee's satisfaction,

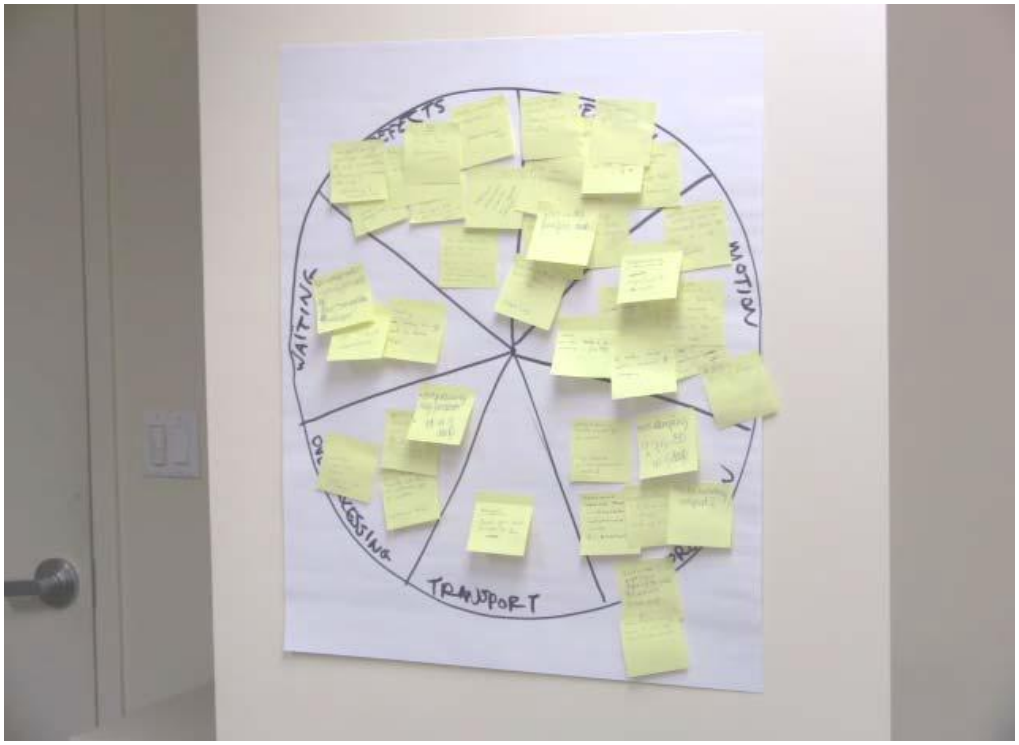
2) Resources,

3) Structure and Processes.

Section one has a total of 4 questions assessing employee's satisfaction. Section two has a total of 3 questions assessing resources. Finally, section three has a total of 3 questions assessing structure and processes.

The eight front line employees were asked take the pre-survey and to rank each question on a four point scale, with the most positive (strongly agree) scoring 4 and the most negative (strongly disagree) scoring 1 for the questions. Therefore, a score of 4 meant that the radiology employees were not satisfied and believe there is a problem in efficiency and quality in the department. (Image 1.5).

In addition to the introductory meeting, employees were also asked to participate in the implementation of the Lean Manufacture at the radiology department process and propose action plans using the Toyota Seven Types of Non-Value Added Waste, which will determine if a difference can be made. (Image 1.5).



3.9 DATA ANALYSIS

In Phase I, the pre-data analysis of the CPMC radiology is broken in two parts:

Part 1 basic statistics of the survey and how it will be calculated. In order to measure the current level of employee satisfaction, department efficiency and quality for each question, the survey responses will be calculated without the Lean practices. The scores were acquired by calculating the overall mean of each section per employee. For example, calculate the overall average for each section.

Equation: Question 1 + Q2 +……Q + 4 agree or disagrees divided by eighth people = Overall mean per section.

The results and data compiled set the baseline to pre-Lean Manufacture principles.

Part 2 focus on the pre-implementation of the lean approach and the employees proposed action which they see as the deficiency of the department. In addition, to agree and document on one current issues and explore possible areas of improvement.

3.10 SAMPLE OF THE SURVEY

Section 1: Employee Satisfaction	Questions- please circle your answer	Strongly Disagree	Disagree	Agree	Strongly Agree
1.	I feel satisfied with my job	1	2	3	4
2.	I feel motivated to go beyond my formal job responsibilities	1	2	3	4
3.	my job makes good use of my skill and abilities	1	2	3	4
4.	I would	1	2	3	4

	recommend this organization as great place to work				
Section 2: Resources	Questions- please circle your answer	Strongly Disagree	Disagree	Agree	Strongly Agree
1.	I receive the resources I need to do my job	1	2	3	4
2.	I have the information I need to do my job well	1	2	3	4
3.	This organization is expecting me to do more with less resources	1	2	3	4
Section 3: Structure and	Questions- please circle	Strongly Disagree	Disagree	Agree	Strongly Agree

process	your answer				
1.	the radiology department at CPMC has efficient work processes and procedures	1	2	3	4
2.	my job provides me with a chance to fix structure and process	1	2	3	4
3.	This Organization is doing a good job on monitoring and improving structure and process	1	2	3	4

3.11 OPERATIONAL TERMS AND DEFINITIONS

It is significant to mention definitions of various concepts which are used in this study. Therefore, below are described the main concepts of the hypothesis: If the Radiology department at CPMC adapted a program on the basic principles of Lean Manufacture at the employee level, it will improve efficiency, quality, and increase employee satisfaction.

- Radiology department: is a medical specialty that employs the use of imaging to diagnose and treat disease.
- Basic principle of Lean Manufacture: is a strategy in which all parts of the production system are focus to eliminate waste while continuously increase the percentage of value added work. (Liker, 2007).
- Improve efficiency: performing or functioning in the best possible manner with the least waste of time and effort; having and using requisite knowledge, skill, and industry; competent; capable: a reliable, efficient assistant.
- Improve quality: a measure of excellence or a state of being free from defects, deficiencies and significant variations.
- Increase employee satisfaction: Lean Manufacture positively impact job satisfaction and employee loyalty.

CHAPTER 4-

RESULTS AND FINDINGS

This chapter covers the analysis of the empirical data gathered from the survey and the Lean Manufacture implementation. The researcher analyzed the data and the results of these findings. Based on the review, discussion was provided for the implementation of Lean tools and techniques in CPMC radiology to fulfill the objectives for this thesis.

For the purpose of this study, one of the four campuses of CPMC named Saint Luke's Hospital was selected. The radiology department consists of inpatient and outpatient services, CT services, MRIs, Nuclear medicine, Ultrasounds and the Breast center with a total of 42 employees. On April 2014, eight front line employees came together to critically examine the CPMC Radiology's workflow, provide input and make direct changes to the current process. The case study based in CPMC radiology department demonstrated the value of the Lean Manufacture and its impact on employee satisfaction.

Most of the front line staff was excited about the changes due to Lean's implementation. On the other hand, the idea of changing their workflow created some reservations and resistance. The staff quickly realized that by implementing the Lean Manufacture techniques, not only did it provide the highest quality of care for the patients but it also increased the efficiency and employee satisfaction.

The result and finding will be divided as following:

1. Phase I: CPMC empirical study of the employee's satisfaction prior to the practice of the Lean Manufacture.

2. Phase II: the impact of the employee's satisfaction after Lean Manufacture implementation.

4.1 PHASE I RESULTS AND FINDINGS

The results and findings of phase I characterize the current level of employee satisfaction. According to the pre-survey, the results are as follow:

Sections	Agrees/Strongly agree	Disagree/ strongly disagree	Overall Mean Agree	Overall Mean Disagree
Employees Satisfactions	11	20	1.375	2.5
Resources	16	15	2	1.875
Structure/ Process	7	16	0.875	2

To be more precise, the current state of the radiology department's pre-lean is towards disagreement and dissatisfied on employees satisfaction, structures and processes. But they were in agreement and satisfied with resources. These results set the baseline for employee's satisfaction, efficiency and quality factors prior to the Lean Manufacture.

4.2 RESULTS AND FINDINGS OF THE LEAN MANUFACTURE IMPLEMENTATION

The results and finding of the Lean Manufacture implementation reveal that change was difficult for staff. In other words, the staff resistance came down to fear for change. Every

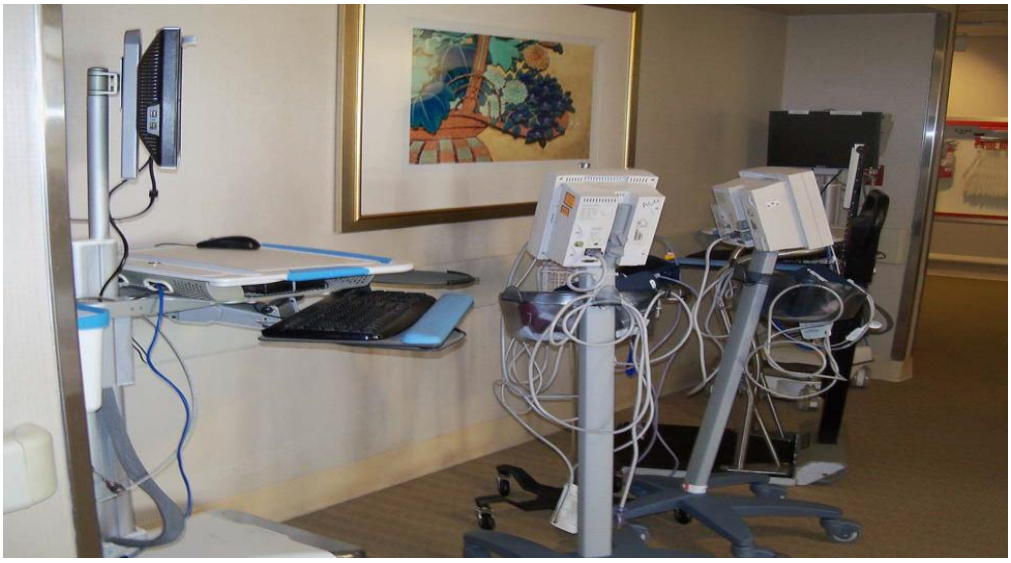
employee showed concerns that a change will make things worse or that their work was being examined. They also fear that the moral of the department would get worse before it got better. The main problem that employees were facing is to do more with fewer resources.

The Lean implementation revealed a detail analysis and the documentation of the current workflow process. In addition, results of the non-value added activities versus value added activities showed delays that had a major impact in patient care and most of all in employee's satisfaction. The result reveals issues that prevented them from meeting goals and becoming a successful department. The non-value added activities involved activities using the Toyota Seven Types of Non-Value Added Waste format. The non-value added activities involved activities like:

1. Overproduction: processing piles of documents that sit in binders and are never use.

2. Waiting: for patients to be registered (Action to de-clutter the front desk to reduce the registration process).

3. Transport: moving equipment into and out of an x-ray room.



4. Over processing: producing a paper copy when a computer file is sufficient.

5. Inventory: Over-stocking of supplies

6. Movement: Staff looking for items that should be labeled.

7. Defect: making mistakes due to incorrectly filing documents.

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The Toyota Seven Waste method illustrated the following:

Activities	Pre Lean Manufacture	Post Lean Manufacture	Improvements
Value added	41%	57%	16%
Non Value added	59%	43%	-16%

The table above shows the improvement of implementation through Lean Manufacture, improved the value added activities by sixteen percent. For example:

- The staffs work day inefficiency was reduced from forty one percent to sixteen percent. This increased the department efficiency.
- Decreased the radiology staff in house transit movement.
- Decreased of excess inventory supplies.
- Decrease in medical errors.
- Increase the number of procedures performed per day.
- Created a balance to utilize staff and space at the optimum level.
- Management is expecting to have $35,000 saving a year (estimate).
- Standardize workflow process.

4.3 PHASE II RESULTS AND FINDINGS

The results and finding of phase II characterize the current level of employee satisfaction. According to the post survey results are as follow:

Sections	Agrees/Strongly agree	Disagree/ strongly disagree	Overall Mean Agree	Overall Mean Disagree
Employees satisfactions	25	18	3.125	2.25
Resources	19	12	2.375	1.5
Structure/Process	14	10	1.75	1.25

The overall mean and improvement for employee's satisfaction, structure/process and resources shows a positive improvement which had an amazing impact in the attitude of the staff, the department's efficiency and quality. Based on the literature review, the Lean Manufacture had the potential to change the department's culture leading to a positive effect on employee's satisfaction. This is exactly what CPMC needed to survive in today's completive market. Provide a final section on

4.4 SIGNIFICANT/ KEY FINDINGS

This thesis provided data for the Lean Manufacture implementation at CPMC. The research main objective was to analyze the type of impact that Lean Manufacture techniques has on employee's satisfaction in the medical field. To fulfill this objective, a thorough implementation of the Lean manufacture was done in the radiology department at St. Luke's Hospital. The framework for the research was derived specifically to answer the following question: How to increase employee's satisfaction and improve efficiency and quality at CPMC Radiology by adapting the basic principles of the Lean Manufacture?

The research was broken down on two phases.

Phase I set a baseline level of employee's satisfaction, efficiency and quality of work before Lean Manufacture techniques were applied. According to the answers given by employees to question regarding their job satisfaction, it was determined that the staff was dissatisfied before applying Lean Manufacture techniques.

Phase II was the implementation of Lead manufacture techniques. Implementing these techniques not only improved employee's satisfaction but it also yields a 16% increase on x-ray exams, employee's efficiency and quality of work. The result of the post-survey shows a direct correlation between Lead manufacture techniques and the following:

• Job satisfaction due to well defined workflow, freedom in performing tasks, and increase in the quality of their work.

• Work efficiency due to a decrease in job stress, and work overload

Based on the literature review and the points stated on this thesis, the Lean Manufacture techniques can significantly improve the quality and the satisfaction of front-line employees. These improvements have the added benefits of reducing the waiting time of patients, reducing employee stress and increasing patient satisfaction. All this leading to a higher income for the organization. This is exactly what CPMC needs to survive in today's competitive healthcare market. In the area of patient care, happy front-line employees are extremely important because they represent the organization to the public. With that in mind CPMC should develop strategies that strengthen the work environment and increase the employee morale at that level. This affirms that the Lead Manufacture principals would be better applied at the front-line level of a healthcare organization than at the higher management level.

CHAPTER 5-

CONCLUSION AND RECOMMENDATION

This thesis provided data for the Lean Manufacture implementation at CPMC. The research main objective was to analyze the type of impact that Lean Manufacture techniques has on employee's satisfaction in the medical field. To fulfill this objective, a thorough implementation of the Lean manufacture was done in the radiology department at St. Luke's Hospital. The framework for the research was derived specifically to answer the following question: How to increase employee's satisfaction and improve efficiency and quality at CPMC Radiology by adapting the basic principles of the Lean Manufacture?

This thesis affirmed that CPMC must choose Lean Manufacture tools and techniques to survive today's economy and to have a competitive edge in today's market. The implementation of Lean Manufacture at CPMC transformed the hospital into a more efficient, patient oriented organization. Among other gains, Lean Manufacture reduced the Radiology department annual inventory cost by more than $35,000 a year. It was established that the implementation of Lean Manufacture at CPMC improved patient outcomes, reduce medical errors, increase responsiveness, efficiency, quality, financial performance, and employee satisfaction. However, the biggest impact was employee satisfaction. Such improvement frees up the staff and allows them to spend more time with patients.

The Radiology staff reported that the implementation of Lean Manufacture at assure them that their efforts contributed to the operational performance of CPMC. It also helps them address their concerns and fears in a straightforward manner. This research showed that by placing

Radiology employees at the center of the solution it created high levels of commitment leaning to an increase in employee satisfaction.

5.1 Recommendations

Recommendation 1: By September 1, 2015, CPMC management should appoint an action steering committee to review this study and activate specific recommendations provided to enhance operations in the radiology department. The review should be completed by October 1, 2015 and provided to CPMC management.

Recommendation 2: Over the next twelve month incorporate a culture of necessity. CPMC top management should influence the behaviors and attitudes of Radiology staff by developing a sense of necessity for Lean implementation. This could be achieved by sharing and stating clearly the problems in process, as well as highlighting the benefits of this process by focusing on value added activities and elimination of wastes. This should be completed by December 1, 2015.

Recommendation 3: By June 30, 2015, CPMC management should organize a workshop for the Radiology staff to introduce Lean Manufacture tools and techniques, which would help to create future Lean Manufacture strategy at CPMC. The workshop should be completed by October 1, 2015.

Recommendation 4: By June 30, CPMC senior management should conduct training for front end managers on the impact of change. This training will improve CPMC leadership ability to coach employee on change. The training should be completed by July 30, 2015.

Recommendation 5: By August 1, 2015, CPMC leadership should conduct a monthly training about patient comes first motto. CPMC should provide higher quality health care services and give greater attention to patients by focusing always on their needs. To do this, staff should also be well committed. In this way, hospitals can create the culture of the patient comes first motto. All training should be completed by September 1, 2015.

Recommendation 6: By October 1, 2015, standardize and streamline workflow processes Create a quarterly meeting to implement and incorporate Lean Manufacture techniques for Saint Luke's' Radiology management and staff.

5.2 Limitations of the Study

These are some of the limitations that were identified during the research:
This research was based in the hospital settings CPMC, Radiology which was difficult for the researcher, to understand some terms and processes, which were relevant particularly to healthcare.

Initial plan of this research was to implement and contrast the findings of Lean Manufacture at CPMC and what impact it has in employee satisfaction, but due to the time limitation of the study, researcher was only able to focus on implementation in the radiology department.

The limitations that have been raised above will create opportunities for future research. One of the future research areas could be on conducting comparative studies in other parts of the hospital to understand the transferability of Lean Manufacture in healthcare and its impact in employee satisfaction. All Lean tools and techniques may not be applied the same way and some may be adjust However, the Lean manufacture has proven to have a positive impact not only in improving the department process but creating a culture of employee satisfaction. Employees are the heart to any organization so why not spend the time and resources to implement the Lean Manufacture!

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