Arab American University

Faculty of Graduate Studies

"Assessing the Potential of Applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital"

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Thesis Approval

Thesis Title

"Assessing the Potential of Applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital"

This Thesis was defended successfully on 03/06/2023 and approved by:

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Declaration

I declare that all the work in this thesis titled “Assessing the Potential of Applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital” has been done to fulfill the requirements for the degree of Master’s in Quality Management and submitted to Arab American University Palestine. All work is original and it has been written by me. I have duly acknowledged all the sources of information that have been used in this thesis.

This thesis has also not been submitted to any other degree or university.

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Acknowledgment

Conducting this thesis has been a truly life-changing experience for me and it would not have been possible to do without the patience that has been given for me by “GOD”.

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The Researcher: Raghda Al-Ama

Abstract

This study mainly aims to assess the potential of applying lean Six Sigma tools for food waste reduction in Bethlehem Arab Rehabilitation Society Hospital. To this end, the study used descriptive and analytical approaches that are appropriate for the aim of the study. The quantitative method approach has been used to collect the needed and comprehensive data from the employee perspectives via a questionnaire. The study population consisted of all employees working at the Bethlehem Arab Society for Rehabilitation, which counts 150 employees including (Nurses, doctors, and administrative). A random sampling technique was adopted to gather the needed information from the employees at the hospital. In total, 94 employees participated in the questionnaire.

The analysis of the gathered data was conducted by SPSS. The results revealed that some of the lean management tools are applied in the hospital. More specifically, concerning DMAIC model components, definition, analysis, and improvement dimensions are applied very well, while the Measurement and Control elements of DMAIC came out in a moderate appliance. In addition, results revealed a high degree of customer satisfaction among the food services provided at the hospital, in which the communication dimension of customer satisfaction came out as a moderate degree. Also, the study found that customer satisfaction among food services provided at the hospital was affected positively by applying the lean six sigma management tools, and by the food waste reduction strategies.

The study recommends that the hospital's food services division must proactively promote and spread policies built on a resource-efficient supply chain that takes into account the entire production system. Moreover, food service providers need to place more emphasis on identifying suitable substitute uses for leftover raw materials as well as composting options, as well as decreasing raw material waste as much as is practically practicable. In addition,

food services staff and healthcare staff must develop their communication skills with patients and their relatives, to obtain higher customer satisfaction.

Keywords: Lean Six Sigma, DMAIC, Food Waste, Customer Satisfaction, Bethlehem Arab Society for Rehabilitation Hospital

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List of Abbreviations

C&E	**Cause and Effect investigation**
CSF	Critical success factors
CTQ	Critical to Quality
DMADV	Define, Measure, Analyze, Design, Verify
DMAIC	Definition, Measurement, Analysis, Improvement, and Control.
ERP	Enterprise Resource Planning frameworks
LSS	Lean Six Sigma
MRO	Maintenance, Repair, and Overhaul (MRO)
MRP	Material Requirements Planning
PDCA	Plan-Do-Check-Act
SS	Six Sigma
TPS	Toyota Production System
VSM	Value Stream Mapping

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Chapter One: Introduction

1.1 Overview

Malnutrition in hospitals is a widespread issue. Patients suffering from malnutrition have been recognized as a concern for over 40 years. An international consensus has been achieved that at least 30% to 50% of hospitalized patients are malnourished. This may get worse if it had gone untreated during the hospital stay (Simzari et al., 2017)

The majority of hospitalized patients (67-94%) rely on hospital meals to meet their nutritional needs. Patients who do not consume enough food are more vulnerable to the nutritional deficit, which is common in hospitalized patients and can develop or worsen malnutrition. According to studies, a significant proportion of hospitalized patients (40%) suffer from malnutrition worldwide, including both developed (20-46 %) and developing countries (50%) (Anari et al., 2021).

As a result, it is now widely understood that the serving of meals should be seen as an integral component of patient care rather than merely a hotel service. However, just preparing and supplying enough nutritious food is useless if it is not consumed, and giving greater quantities is not a viable technique for increasing calorie consumption. Food waste is connected with lower calorie and protein intakes, which has an influence on malnutrition-related problems (Williams & Walteon, 2011). Food waste can account for up to 50% of total trash generated in a medical ward, posing nutritional, financial, and environmental problems in addition to the nutritional consequences of this waste. Food waste can occur at any stage in the food service system, including storage, ingredient preparation, cooking, and serving, although the highest losses occur at the time of consumption. Measures of plate waste, or food provided but not consumed, have been used to provide input on meal acceptance, aid menu planning, and evaluate food intake adequacy (Williams & Walteon,

2011). Applying LSS is one of the important issues that affect the performance of the organizations in general, toward producing and providing the society with the highest quality of services and products. Based on that, this study aims to assess the potential of applying Lean Six Sigma tools for food waste reduction in Bethlehem Arab Rehabilitation Society Hospital.

1.2 Problem Statement

Food waste is a growing issue that has gained popularity in recent years. There is a direct link between the problems of food waste and the three dimensions of sustainability: environmental, economic, and social. Food waste is related to the waste of both natural resources and money and it raises societal concerns since wasting food has the potential to threaten food security (Eriksson et al., 2020). Hospital food services are a major source of food waste, accounting for up to 50% of overall waste in hospitals. Food waste reduction will preserve natural resources and lessen the economic load on the expenses of the healthcare sector. If patient satisfaction and food consumption could be increased, societal sustainability may be addressed through reduced malnutrition. Malnutrition is a well-known problem in hospitals across the world, and it has been related to higher morbidity and death, higher expenses, and longer hospital stays. As a result, there is a lot to be gained in terms of sustainability by minimizing hospital food waste (Eriksson et al., 2020).

Six Sigma (SS) is a quality improvement technique that consists of reducing waste to enhance the flow of people, information, or goods—in a hospital context, this would increase the flow of patients through the system by eliminating non-value-added activities. This activity might involve everything from waiting for an appointment through the actual treatment or diagnostic, as well as any interaction with a member of the hospital staff, both clinical and non-clinical. SS is a data-driven process improvement approach to increase process capabilities and service delivery through the implementation of improvement

projects concentrating on decreasing process variance (Teeling et al., 2019). Synergies were discovered between Lean and SS because they both use a process-oriented approach and align in their emphasis on variance, flow, and the customer. A combined Lean Six Sigma (LSS) method searches for 'root causes' of issues through real-time observational data collecting in the workplace, known as 'Gemba' in LSS terms. LSS projects in healthcare have described the potential application of LSS principles due to its zero tolerance for errors and possibilities for eliminating medical errors in the literature; however, there is a gap in the literature on the effect of Lean management, which is still being studied for its actual effect on staff and patient wellness (Teeling et al., 2019).

To this end, applying LSS management tools in the healthcare sector in Palestine is investigated in this study. More specifically, a case study on the Arab Rehabilitation Society hospital is measured in this study, to assess the implementation of LSS into the food department in the hospital. The outcome of this study would further strengthen the healthcare sector especially hospitals, by helping hospitals to think and act more strategically in food waste management, and to suggest methods for reducing the effect on social, financial, and environmental dimensions of sustainability. Based on that, the problem of this study is represented in the following main question:

"To what extent is there an implementation of Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital?"

1.3 Significance of the Study

The significance of this study arises from the importance of the industry it discusses. More specifically, given the distinct attributes of the Palestinian context, having efficient and effective systems in Healthcare in Palestine is critical, as the services fulfill and satisfy the needs of patients whilst also reducing the costs hospitals bear as a consequence of food waste and health complications caused by malnutrition. Eventually, having lean six sigma

processes applied in hospitals would enhance its service and patients' overall wellness and satisfaction this study is significant as well due to the best of our knowledge; it is the first of its type in Palestine to investigate the impact of using lean six sigma management practices in hospitals to eliminate food waste. The predicted findings of the research, as an action research, would be useful to the healthcare sector in Palestine in general, and Arab Rehabilitation Society hospital in particular. It may also be of interest to other researchers in developing countries who are interested in undertaking comparable studies in the healthcare sector in their circumstances.

1.4 Objectives of the Study

As mentioned previously, the main goal of this research is to assess the implementation of lean Six Sigma tools for food waste reduction in Bethlehem Arab Rehabilitation Society Hospital. Per this goal, the following objectives were derived:

1. To identify the LSS tools that are implemented in the BASR hospital related to food services in the Arab Rehabilitation Society hospital in Bethlehem.
2. To describe the DMAIC model phases applied toward food waste in the Arab Rehabilitation Society hospital in Bethlehem.
3. To assess the level of customer satisfaction with the food services implemented in Bethlehem Arab Rehabilitation Society Hospital.
4. To examine the differences among the implementation of LSS Tools for food waste reduction in Arab Rehabilitation Society Hospital in Bethlehem, due to the demographic information of respondents (Gender, Age, Education, Years of Experience, and Position at the Hospital).

1.5 Questions of the Study

This study seeks to answer the main question *"To what extent is there a Potential of Applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital?"*.Accordingly, some sub-questions are as follows:

1. What are the lean six sigma tools that can applied in hospital meal service in Arab Rehabilitation Society hospital in Bethlehem?
2. What is the level of customer satisfaction with the food services applied in Bethlehem Arab Rehabilitation Society Hospital?
3. What is the impact of applying LSS tools on the patients' satisfaction in the Arab Rehabilitation Society hospital in Bethlehem?
4. What is the impact of food waste food reduction on the patients' satisfaction in the Arab Rehabilitation Society hospital in Bethlehem?
5. What are the differences among applying LSS tools for food waste reduction in the Arab Rehabilitation Society hospital in Bethlehem due to the demographic information of respondents?

1.6 Hypothesis of the Study

Based on the research questions and objectives, the following hypotheses are formulated:

H1: There is no potential for applying LSS tools for food waste reduction in the Arab Rehabilitation Society hospital in Bethlehem.

H2: There are no significant differences at the level ($\acute{\alpha} \leq 0.05$) in the potential of applying LSS tools for food waste reduction in the Arab Rehabilitation Society hospital in Bethlehem according to the gender of participants.

H3: There are no significant differences at the level ($\acute{\alpha} \leq 0.05$) in the potential of applying LSS tools for food waste reduction in Arab Rehabilitation Society hospital in Bethlehem according to the practical experience of participants.

H4: There are no significant differences at the level ($\acute{\alpha} \leq 0.05$) in the potential of applying LSS tools for food waste reduction in Arab Rehabilitation Society hospital in Bethlehem according to the educational level of participants.

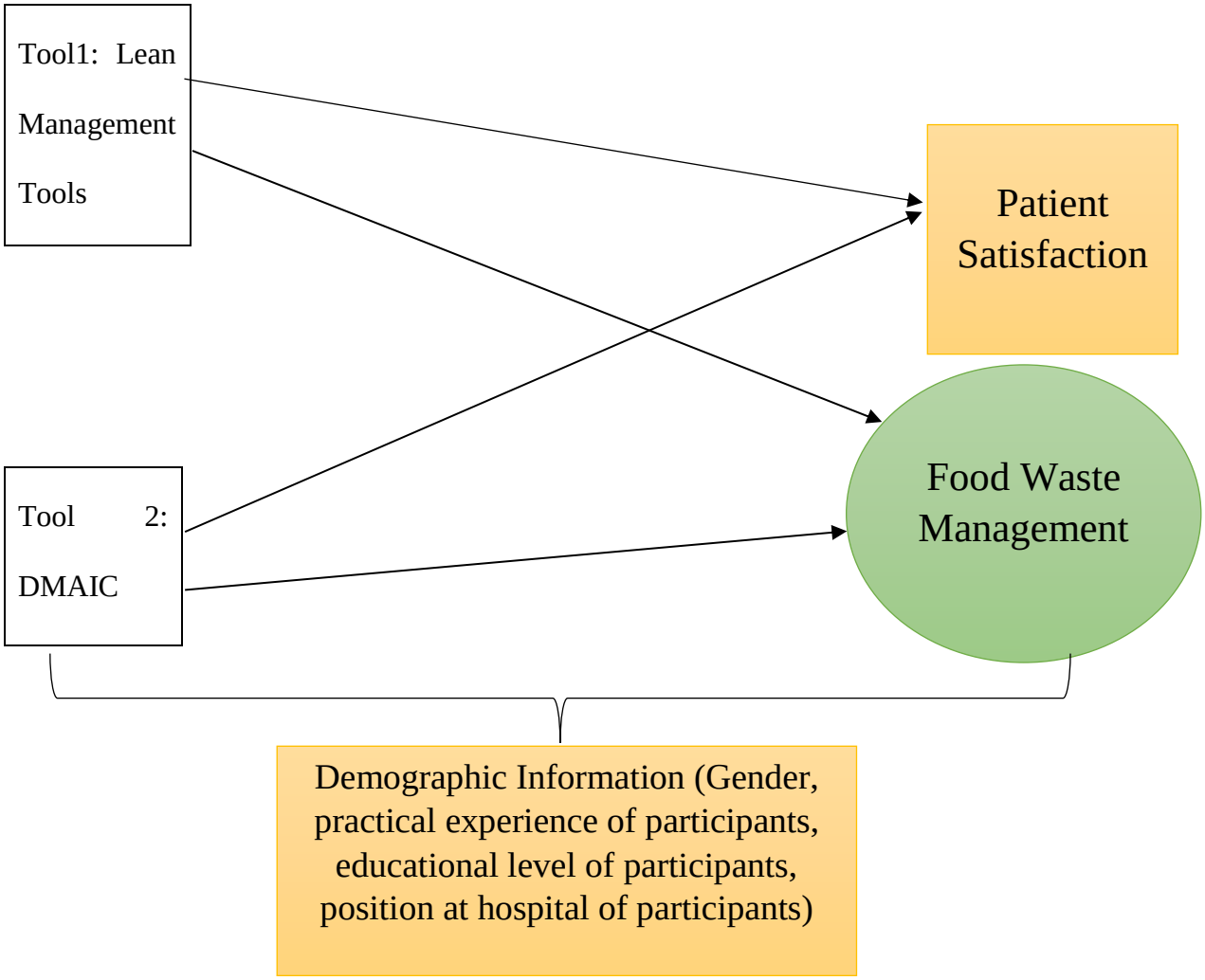
H5: There are no significant differences at the level ($\acute{\alpha} \leq 0.05$) in the potential of applying LSS tools for food waste reduction Arab Rehabilitation Society hospital in Bethlehem according to the position at the hospital of participants.

H6: There is no impact of applying LSS tools on patient satisfaction in the Arab Rehabilitation Society hospital in Bethlehem.

H7: There is no impact of food waste food reduction on patient satisfaction in the Arab Rehabilitation Society hospital in Bethlehem.

1.7 Conceptual Model:

The conceptual framework of this study represents the hypothesis, and relationships within variables studied in this study as follows:



1.8 Thesis Structure

This thesis consists of five main chapters as following:

Chapter One: Introduction (Problem Statement, Significance of the Study, Objectives, Questions, and Hypothesis of the Study).

Chapter Two: Literature Review related to the topic of the study.

Chapter Three: Methodology followed by the researcher toward answering the questions and achieving the objectives of the study.

Chapter Four: Presentation of the findings and answering the questions of the study.

Chapter Five: Conclusion and Recommendations.

Chapter Two: Literature Review

2.1. Overview

Lean Six Sigma (LSS) has emerged as the most well-known corporate methodology for communicating continuous improvement in service sectors as well as the public sphere (Laureani &Antony, 2011). Every organization on the earth strives for continuous improvement to help them achieve qualitative and functional greatness and enhance performance (Al Ahbabi et al., 2019). It has permanently altered every aspect of the firm, from the people and the equipment to the operations and the organization. When machines are not functional and in line with company goals, they are worthless; here is where the SS Methodology and the machine industry collaborate to enhance business (Bhaskar, 2020). There is a misunderstanding that the Lean and Lean Six Sigma ideas are relevant to supply chain, inventory, and service processes (Antony et al., 2012). Yet, all areas of a firm may make use of these devices (Lee &Chang, 2010). The ability to recognize waste, reject the waste, and vehemently work to eliminate all activities of any kind that do not add value or increase customer loyalty, both inside and outside the organization, is the fundamental foundation needed for Lean and Lean Six Sigma techniques to prevail in every area of an organization.

These methods are not an additional event. In actuality, the Lean technique has been a potent tool since the dawn of the modern era (Durakovic et al., 2018; Trakulsunti & Antony, 2018). Organizations have always aimed to increase performance, meet customer expectations, and expand reality while still having the ability to increase performance (Schwager &Meyer, 2007). The development of Lean and LSS hinges on knowing which techniques—or which approaches—should be used together to provide the best possible impact on the business.

Lean training and management programs are built on the SS DMAIC (Define, Measure, Analyze, Improve, and Control) framework (Mustapha et al., 2019; Protzman et al., 2018). The objectives of Six Sigma are to advance service (Cherry, 2019). This kind of value control was primarily developed for large corporations. It was intended to make procedures better and get rid of any flaws that were discovered. The Lean approach is a way of thinking focused on eliminating waste and providing the best possible customer experience (Stefanelli et al., 2019). There are eight different types of waste, according to the Lean service-educated authority: shortages, overproduction, halting, non-used capability, transportation, stock, movement, and additional handling.

2.2. Lean and Six Sigma

The Toyota Production System (TPS), a manufacturing theory developed by Japanese architects Taiichi Ohno and Shigeo Shingo, can be linked to the concept of lean thinking (Inman, 1999; Womack and Jones, 1996). This production approach was developed immediately after World War II and was first used by the Toyota Motor Corporation (Pepper &Spedding, 2010). By providing an organizational-wide term that unites the five elements of "the item improvement process, the provider management cycle, the client management cycle, and the strategy centering process for the whole organization," lean service expands the scope of the Toyota production reasoning (Taj &Morosan, 2011; Pepper &Spedding, 2010; Durakovic et al., 2018).

As a "company improvement system that promises to enhance investors' value by focusing on quality, speed, consumer loyalty, and expenses: it achieves this by mixing methodologies and standards from both Lean and Six Sigma," LSS has been described (Assarlind &Aaboen, 2014). Driving manuals "fail to describe Lean Six Sigma as a unique strategy," according to Gershon and Rajashekharaiah(2011). Lean Six Sigma "utilizes instruments from both systems to gain the most from the two methodologies, speeding up while also increasing

exactness," according to Laureani and Antony (2012). An organization must focus on its products and clients to implement Lean and Six Sigma (Assarlind &Aaboen, 2014). The concepts of lean and SS, according to Stoiljkovi et al. (2011), are intertwined in that Lean speed enables Six Sigma quality and Six Sigma quality empowers Lean speed. Thus, Pepper & Spedding (2010) besides Ferng &Price (2005) acknowledged that Lean thinking may be used to identify areas of development and establish standards, whilst the Six Sigma approach could be used to concentrate on them and investigate departures from those norms. The single item and its value stream continue to receive attention as the lean vision is strengthened (recognizing value-added and non-value-added exercises), and the core goal of lean thinking is to eliminate all waste across all domains and capacities inside the framework (Womack &Jones, 1996; Pepper &Spedding, 2010; Mustapha et al., 2019). Lean Six Sigma combines two effective cycle improvement methods: It lowers the association's costs by:

• Getting rid of "Waste" from a cycle: Waste is any activity taken during an encounter that is not anticipated to produce something or provide a service that is dependent on predetermined instructions (Gouvea et al., 2013; Protzman et al., 2018).

• Addressing problems caused by a cycle: Issues are shortcomings in a product or service that cost the association money (Drohomeretski, 2013).

2.2.2. Integrating Lean and Six Sigma

The two most important continuous improvement (CI) strategies for achieving functional and service greatness in any association are Lean and Six Sigma (Sony, 2019; Walter &Paladini, 2019). LSS is a mix of two of the most amazing cycle greatness approaches (Alexander, et al., 2019). According to Sokovic and Pavletic (2008), Lean denotes swift action (reducing waiting times) while Six Sigma denotes identifying flaws and fixing them. Lean Six Sigma Engineering also denotes superior quality. To assist its customers, it adds

value to the manufacturing or service association and sets aside money without engaging in capital speculative activity (Sokovic &Pavletic, 2008).

Using a focused technique called Six Sigma, deformities, misunderstandings, or failures in business cycles or frameworks are identified and attempted to be remedied by focusing on those process performance aspects that are fundamentally important to clients' needs (Albliwi et al., 2015). It is a quantifiable statistical approach that aims to reduce variability in any cycle, lower costs for goods and services, make reserves more realistic, increase client loyalty, measure flaws, improve product quality, and reduce deformities to 3.4 parts per million (ppm) possibilities in an association (Albliwi et al., 2015). Several organizations find it difficult to implement Six Sigma because of the high cost of the training (Sinthavalai, 2006). Sending Lean administration in segregation cannot effectively handle the cycle and remove variation from the interaction, and sending Six Sigma in disconnection cannot remove a variety of waste from it (Albliwi et al., 2015).

In light of this, a few firms have opted to combine the two strategies to overcome the drawbacks of these two systems when used separately and create an even more amazing system for process enhancement and continuous improvement (Albliwi et al., 2015). LSS complement one another, and there is a clear relationship between the two ideologies, which makes collaboration between the two tactics possible. In this way, combining these two approaches increases the association's efficacy and effectivity and helps to complete major tasks more quickly than when each methodology is used separately (Albliwi et al., 2015).

According to Salah et al. (2010), combining Lean and Six Sigma is the best way to overcome both of their shortcomings since they are complementary to one another. This incorporation helps businesses deliver goods quickly and for a low cost while ensuring zero defects. The combination of these two, according to Bhuiyan & Baghel (2005), is the best strategy for

associations to increase their potential for progress. The following will be part of the integrated approach to process improvement (using Lean and Six Sigma):

- Use value stream planning to create a pipeline of projects that are conducive to using either Lean or Six Sigma tools (Sokovic &Pavletic, 2008; Purohit et al., 2015).
- Presenting the Six Sigma method later to address the more complex challenges after training Lean standards to increase thrust (Sokovic &Pavletic, 2008; Purohit et al., 2015).
- Modifying the content of the training to meet the needs of the specific association. While certain service areas might benefit from implementing the Lean standards for housekeeping, others will already have these necessities in place and will be ready for improved equipment (Sokovic & Pavletic, 2008; Purohit et al., 2015).

The book of Hill et al., (2018) explains how you combine Lean and Six Sigma to create a comprehensive guide. Assembling companies are thus looking for a technique that enables them to combine the two ideologies into a single framework or improvement manual.

Duarte (2011) has shown how numerous firms, including Ford, DuPont, 3 M, Dow Chemicals, Honeywell, and others, have adopted Lean Six Sigma as a widely accepted concept for process improvement. Nowadays, 35% of the Forbes top 500 companies have used the Lean Six Sigma process (Duarte, 2011). He describes as shown in Table 2.1, how the Six Sigma DMAIC cycle (Define, Measure, Analyze, Improve, and Control) may be used with Lean tools.

Table 2. 1: How Lean is fused with Six Sigma DMAIC (Duarte, 2011).

Lean BB DMAIC	Define	Measure	Analyze	Improve	Control
Purpose	·Define Business Metrics ·Identify projects for process improvement ·Select resources for project improvement	·Establish baseline performance ·Validate measurements for each project	·Set performance objectives ·Identify sources of variation	·Prioritize the vital few causes of variation ·Establish relationships between output and input variables	·Implement Solutions ·Ensure Solutions are sustained ·Document Case Studies
Primary Tools	1. Voice of the Customer 2. Business Metrics 3. Trend Charts 4. Process Mapping 5. Value Stream Map 6. Value Stream Measurements	1. Data Collection 2. Descriptive Statistics 3. Six Sigma Metrics 4. Measurement System Analysis Basic SPC 5. Process Capability Analysis 6. Process Analysis 7. Process Cycle Time	1. Data Collection Forms 2. Control Charts 3. Hypothesis Testing 4. Cause & Effect Diagrams 5. Affinity Diagrams 6. FMEA 7. Root Cause Verification 8. ANOVA	1. Design of Experiments 2. FMEA 3. Planning Tools 4. Process Capability Analysis 5. Measurement Capability Analysis 6. TPM 7. 5S 8. SMED 9. Kaizen 10. Solution Selection Matrix	1. Mistake Proofing 2. SPC Implementation 3. Control Plans 4. Process Standards 5. Evaluate Process improvement results 6. Visual Management 7. Standard Operating Procedures 8. Dashboard
Key Outputs	·Project team ·Project selection and measurement ·Program plan ·Management Commitment	·Product performance baseline ·Measures for evaluating performance of the Product or Process	·Defined list of potential sources of variation ·Cost Benefit Analysis	·Select appropriate solution ·Proposed process settings ·Impact of proposed solutions	·Process in Control ·Project Documentation ·Opportunities for transfer of learning

2.2.3. Basics of Lean Six Sigma

A few manufacturers are focusing on what ought to be an organization's primary success factor—beneficial development in their efforts to become closer to customers. For businesses to effectively achieve their growth and benefit goals in the current challenging service environment, it needs more than practical solutions, rethinking, and scaling back (Jha &Saini, 2011). Although making these choices would result in short-term financial relief, they would not be the greatest path to long-term growth and productivity. Hence, to advance and continuously disprove key concern assumptions, they must bring lean; and to bring lean, they must master eight foundations of Lean Six Sigma for assembly.

2.3. Software as the Solution

A virtual information base replaces the real data set in a modern, cloud-based environment. Information is sent across cloud computing (Hashem, et al., 2015). Organizations were led to believe that electronic frameworks would solve every problem relating to growth and profit. Organizations were promised by masters of the Material Requirements Planning (MRP) and Enterprise Resource Planning (ERP) frameworks that if they executed their electronic programs at the forefront of their priorities, everything would work out. In a typical business, converting the quarterly financial hypothesis into reality still takes additional time, increased inner/external speed, last-minute "on-the-spot" item modifications, and, shockingly, a little "planned deception" now and again (Hashem, et al., 2015). Consequences include shipping challenges that don't exactly inspire sufficient customer loyalty as well as scrap, modify, and guarantee charges that adversely affect productivity and quality (Hashem, et al., 2015). Companies have spent a lot of money on MRP and ERP only to see development and benefits suffer as a result of uncontrolled operating expenses that led to noncompetitive pricing (Bhuiyan et al., 2006; Corbett, 2011). Electronic programming initiatives can thus be a solution to these problems and do away with the major motivators of inadequate frameworks and cycles.

Preparation waste (debris generated during meal preparation and cooking), tray waste (unserved prepared food), and plate waste can account for up to 50% of the total waste produced in a medical ward environment (Food delivered to patients that were brought back uneaten) (Antasouras et al., 2022).

Many observational and interventional research on hospital food waste has mostly focused on the consequences of plate waste, which can be up to two or three times more than in other food service sectors. The causes of food waste in hospital food services are numerous and complicated. There are several reasons for this, including clinical problems, menu, and food-related problems, service problems, and environmental problems. Figure 1 illustrates the causes of plate waste in this regard. (Antasouras et al., 2022).

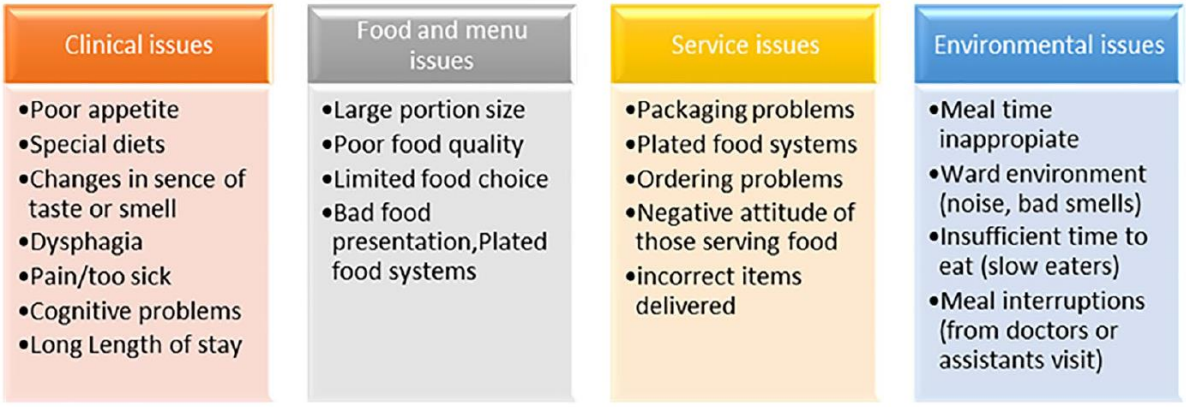


Figure 2. 1: Reasons for plate waste in hospital institutions (Antasouras et al., 2022)

Therefore, the existence of software applications used by all parties involved in the food services at the hospital will support and serve the decreasing of food waste. In which, the software application is programmed to solve all external and internal issues in a disciplinary way. Making each order digital, and prompt response by the food services department, which leads to control and monitor the food waste.

2.4. How to Get to Root Causes

By thoroughly understanding the Six Sigma foundations and then putting the eight tenets of Lean Six Sigma into practice, producers may identify the main causes. The domination of the Lean service fundamentals has to be the focus of service groups. These necessities want proactive planning and unwavering execution, which call for management above and beyond performing daily obligations. Some leaders are unable to see the benefits of controlling the

production of necessities. Some are virtually unable to pass up the chance. Organizations won't achieve their maximum development and benefit potential without a solid application of the fundamentals of Lean Six Sigma (Hashem, et al., 2015).

Following are the eight Lean Six Sigma fundamentals that every manager should understand and practice (Hashem et al., 2015):

- **Information integrity**: When time goals and guaranteed payouts are not met, it is common for front office management to become discouraged by automated and computerized frameworks' performance. The inability of frameworks to produce outcomes that are acceptable when they are based on erroneous information and faulty, uncontrolled documentation.
- **Performance management:** Frameworks for measuring performance can persuade or not. The 1980s' sole objective setting is a real-world example of an unpersuasive estimate since it pitted one person or group against another and showed little dedication to the overall growth and profit of the business. Nowadays, company winners make their decisions based on the fair scorecard.
- **Successive Sequential production:** Service firms need more than complicated frameworks to manage production plant operations. Organizations need to replace the inflexible old shop booking strategy with the straightforwardness of successive and sequential manufacturing to achieve on-time shipments at sound overall revenues (Jha and Saini, 2011). Service innovators have replaced the "send off and help" process used for shop requests with continuous production lines supported by real-time, visible material stockpiling chains, or sequential manufacturing. The claim that subsequent production only functions under high production, device service circumstances is a fallacy.

- **Place of-utilization operations:** Taking care of and storing material are two of the service's expensive, non-value-added activities. All manufacturers should prioritize getting rid of their stock rooms. Revisiting the fundamentals and significantly reducing costs by moving manufacturing components and ingredients from the stockroom to the production point of usage.
- **Process duration management:** High process times are a sign of poor service execution, significant non-value added expenses, and regrettable, subpar service performance (Kouki, et al., 2008). The ongoing shortening of all process durations is something that producers need to focus on. Creating progress calls for a specific management approach that emphasizes core causes, dynamic critical thinking, and problem-solving rather than "putting out fires".
- **Production linearity:** If a company produces more than 25% of its monthly shipping plan in the last week of the month or more than 33% of its quarterly shipment plan in the final month of the quarter, it will never reach its full profit potential. To what extent does a production office adhere directly and linearly to the organization's specific plan? One strategy for achieving increases in speed, quality, and costs as businesses fight to remain competitive is to organize employee groups to pursue and complete direct and linear manufacturing.
- **Resource planning:** The proper measurement of work is one of the major challenges facing the industry today. By delaying raising the immediate workforce's skill level, market windows may be missed and clients may be lost, which might result in a decline in overall revenues. These operations demand practical, challenging judgments that call for precision, extensive planning, and reliable asset data (Hashem, et al., 2015).

- **Consumer satisfaction:** The main factor influencing steadfastness and client loyalty is customer satisfaction. It affects an organization's financial presentation and how customers perceive it (Hill, et al., 2007). Insights are what a company has to address to increase customer loyalty. The finest products and perks are useless if the client perceives the quality and level of service to be subpar. Companies must develop and implement proactive strategies to remove the communication barriers that undermine customer happiness (Hashem, et al., 2015; Deshmukh & Lakhe, 2008; Sommerville, 2008).

2.5. Key Lean Six Sigma Standards

Even though their suitable implementation has a variety of consequences as indicated by a variety of organizational structures, Lean Six Sigma standards refer to handling improvements (Halwachs-Baumann, 2010). Lean and Six Sigma standards are being integrated into all business activities, including item planning and development, integrated production networks, marketing and sales, client assistance, foundation, administration, and method distribution, by administrators at all levels (Fornari &Maszle, 2004). According to Lucid Content Team, consider the accompanying Lean Six Sigma principles for your organization to create an interaction stream that yields the greatest results:

1. **The center of attention is the client:** Lay down the level of value or requirements that the company has promised its clients before it starts making any unusual or even tiny alterations.
2. **Sort out your value stream**: Before you move forward and implement upgrades, you need to assess the current state of your organization. Lean Six Sigma standards are so powerful because they acknowledge the value stream verifiably. A value stream map shows every step of the process, from purchasing the components to

collecting them (and verifying their quality) to dispensing the finished product. Determine which stages are valuable additions and which are not.

3. **Get rid of defects:** Eliminate any workouts or opportunities for shortcomings that don't bring value. Avoid highlighting places on the value stream map that are operating efficiently. You may use a few alternative approaches to handle probable root causes of the issue if your value stream map is unable to pinpoint the exact location of the problem. Examples include cause-and-effect summaries.
4. **Keep the ball rolling:** Employees will continue to execute (or not complete) the same tasks until management makes a different decision. It is the responsibility of the business to successfully communicate the new rules and practices. Make certain that each employee receives instruction and input. Nevertheless, why would you anticipate the problem changing? Hence, nothing will change unless it is approved to change.
5. **Make a culture of progress and adaptability:** Lean Six Sigma necessitates a lot of change (Hardy, 2018). You want to welcome change and encourage your staff to do the same. Your firm should always look for new ways to improve communication and reduce waste as part of this cultural transformation. Keep an eye out for information, consider your main issue, and adjust your cycles as necessary. In "Lean thinking-expel Waste and make riches in your business," Womack and Jones (1997) summarized the five Lean Six Sigma Principles:

1) **Determining value:** Value is only meaningful when expressed as an explicit good or service that satisfies the customer wants at a certain price at a specific time.
2) **Distinguish and make value streams:** A value stream is defined as "any activity anticipated to move an item from unprocessed components (raw materials) into the client's hands.

3) **Making value stream:** Things shouldn't be wrapped in stock or delayed; they should go through a lean organization at the rate the customer requires.
4) **Pull production not push:** Just continue as necessary. Pull the value in the direction that the client desires.
5) **Making progress toward flawlessness:** Flawlessness or perfection does not automatically imply excellence. It entails providing the client with exactly what they need, when they need it, for a fair price, and with the least amount of waste possible.

The five Lean service standards were defined by Womack et al. in their book "The Machine That Changed the World" published in 1990. The five standards, which include defining value, designing the value stream, producing stream, using a pull framework, and pursuing flawlessness and perfection, are seen as a formula for enhancing workplace efficiency (Hashem, et al., 2015).

The guidelines encourage streamlining work procedures and promoting a culture of continual improvement. An organization may maintain seriousness, increase the value delivered to clients, decrease the cost of continuing to work, and increase productivity by practicing each of these five principles. To reduce waste, you may apply these Lean principles to each contact (Figure 1).

Figure 1. The five Lean principles (Womack et al., 1990).

2.6. Lean Six Sigma Systems and Procedures

According to Ben Ruben et al. (2017), Lean Six Sigma is an effective information-driven strategic method of thinking that is centered on eliminating waste, reducing process variation, and providing the best possible customer experience (Hill, et al., 2018). There are eight different types of waste, according to the Lean methodology: shortages, excess output, halting, non-used capacity, transportation, stock, movement, and extra handling. Lean Six Sigma is a methodical approach to resolving problems (De Koning, et al., 2006). The Lean Six Sigma structure seeks to address integrating Lean and Six Sigma in an effective manner (Page, 2010). It makes use of the Six Sigma-like DMAIC steps (Shahada &Alsyouf, 2012). Previous works affirmed that The DMAIC system is employed in lean Six Sigma to solve critical problems. It has been put into practice and verified at one design business in the UAE (Shahada &Alsyouf, 2012). The results demonstrate that the "Make-to-order (MTO) projects" cycle has a lengthy uptime (Shahada &Alsyouf, 2012). The organization's processes, clients, and subcontractors are the main contributors to the lengthy lead times (Shahada &Alsyouf, 2012). Using the approach, it was possible to identify the primary reason for the lengthy lead time, look into the underlying cause(s), provide three important options, and choose the one that was most preferred (Shahada &Alsyouf, 2012). Lean production, Six Sigma, modified scorecard, reenactment, and money-saving advantage inquiry tools were applied in this philosophy structure implementation.

As a result, the user will have a specific method for ongoing improvement when using the structural strategy. This technology also enables the user to identify the interaction problem(s) and properly address them (Shahada and Alsyouf, 2012). This system consists of five steps. Define, Measure, Analyze, Improve, and Control are their names. In order to take the execution of Maintenance, Repair, and Overhaul (MRO) to the next level, Hill et al. (2018) used a progression of continuous advances and promoted an underlying reasonable

Lean Six Sigma Framework (LSSF). According to Hill et al. (2018), an integrated LSS structure and diagrams were cleverly used to identify the factors that affect supply chain performance in an aircraft Maintenance Repair and Overhaul (MRO) office. It demonstrates how each Six Sigma DMAIC step is purposefully applied to each Lean stage. The first step of the execution stage was stage (0) of the LSSF. The stages follow these guidelines:

LSS Phase 1-Specify value by characterizing the Critical to Quality (CTQ) issue.

LSS Phase 2-Align the inward activities by estimating the degree of the Issue.

LSS Phase 3-Create flow by distinguishing limitations in the framework.

LSS Phase 4-Create flow through process enhancement.

LSS Phase 5-Continuous improvement and control of future cycles.

2.7. Tools and Procedures

Both Lean and Six Sigma have their collections of tools and techniques that may advance an organization's goals for value and benefit enhancement (Alexander, et al., 2019). Many tools and techniques for continuous improvement are included in lean six sigma, including the Kanban framework, 5S, Cause-and-Effect investigation (C&E), Value Stream Mapping (VSM), and many others (Albliwi &Antony, 2015; Drohomereski, et al., 2013). The six tools that are most frequently used in LSS applications, according to literature, are "Control Charts," "Value Stream Mapping," "DMAIC," "Kaizen," "Ishikawa Diagram," and "Histogram;" Control graph is the highest-level tool (Walter &Paladini, 2019). DMAIC is a five-stage process for advancing current cycle difficulties with hazy causes. DMAIC describes and assesses the problems; identifies the causes of the problems; and carries out, confirms, and maintains the problems. All Six Sigma and Lean tools are located in the DMAIC or Define, Measure, Analyze, Design, Verify (DMADV) tool compartment (Mustapha et al., 2019). The achievement variables of Lean Six Sigma are their ability to include the tool compartment in a precise and constrained manner.

2.8. Critical Success Factors (CSF)

The majority of critical success factor (CSF) studies have identified senior administration involvement and accountability as a CSF in the implementation of lean six sigma initiatives (Mustapha, et al., 2019). Senior backing has been identified by Carleysmith et al. (2009) and Mustapha et al. (2019) as a crucial factor that facilitates LSS implementation. According to Mustapha et al. (2019), senior administration support is one of the most important institutional aspects that facilitate the LSS system's operation. According to Delgado et al. (2010), management's responsibility is to influence training and steer corporate culture so that the association may provide ideas for development.

According to Sharma (2003) and Mustapha et al. (2019), senior administration participation ensures the program's benefit to the organization by cooperating with trust and communication. Senior management encourages staff to participate in methodologies and strategies for greater quality by showing gratitude for them. They also ensure recognition, which encourages effective and quick adjustment toward more significant improvement (Mustapha, et al., 2019). Both Mustapha et al. (2019) and Zu et al. (2008) considered the organizational basis and management decisions as crucial success elements for lean.

In order to ensure people's advantage in the lean task, Kumar et al. (2006) and Mustapha et al. (2019) emphasized that stressing overall program success and instantaneous victories is important in the foundational phases of LSS. In addition to these LSS initiatives, there is a need for champions or patrons who can direct the execution team, locate resources, and organize the project (Mustapha, et al., 2019). To execute lean, the organization's standing is also crucial (Mustapha, et al., 2019; Naslund, 2008; Jones, et al., 2005).

Different instruction and training are also essential requirements for the efficient execution of advancement exertion (Sharma, 2003; Kumar et al., 2006; Naslund, 2008). The questions of why a change in the framework is necessary, how it should change, and what the benefits

will be to the framework are addressed in instruction on associations from a framework and process viewpoint (Naslund,2008). This training can also create the associations and conditions for transformation (Naslund, 2008).

Consumer loyalty is the primary goal of LSS, along with cultural change and a shift in employee perspectives (Mustapha et al., 2019; Kumar et al., 2006), productive collaboration (Thawani, 2004), LSS working gatherings (Kumar et al., 2006), team member responsibilities and obligations (Kumar et al., 2006), integration of LSS with the performance management cycle (Kumar et al., 2006). Therefore, these components would offer LSS's efficient execution in an association when they were combined with other LSS components.

2.9. Lean Six Sigma System

Lean Six Sigma combines the Lean and Six Sigma systems (Salah, et al., 2010). It has swiftly established a solid base for itself as the main business process improvement system that certain firms prefer (Hill, et al., 2018). Typically, the approach has been to align Lean Six Sigma arrangements with the association's strategy (Duarte, 2011). Often, the plan includes a measure geared toward the association's overall goals (Duarte, 2011). Thereafter, routine measures at the functional level are divided into key goals. The "Great Y" is divided into "little Y's" example Six Sigma terminology, and plans are established to target each "little Y" at the functional level. The majority of businesses employ this process to create a Six Sigma portfolio that aids in achieving the association's primary goals (Duarte, 2011). Organizations use Lean and Six Sigma, two important business process methodologies, to improve the quality of their services (Thomas, et al., 2008). Several businesses employ a hierarchical LSS-sending strategy that is supported by effective management (Duarte, 2011). Take General Electric, for instance. This strategy calls for a strong sense of leadership accountability and broad acceptance of the change (Duarte, 2011). Poor financial

performance, declining customer loyalty, increased competition, or the existence of a consumer pain point are common reasons for delivering LSS (Duarte, 2011). There isn't a single approach that perfectly suits standard Lean Six Sigma configurations. The firm uses a variety of arrangement models regularly nowadays.

The technique includes a pilot phase or proof-of-concept stage before concluding with a company-wide LSS implementation. At the pilot stage, specific concerns are addressed to show how the philosophy works and to accept more significant assumptions about the background, instruction, and training of yellow belts, green belts, black belts, and expert black belts (Duarte, 2011). Associations should be aware of the resources they have available to them and the advancements they anticipate making. Several organizations teach the idea of limitations and light-footed methodologies to their Black Belts to maintain their toolkit up to date and prepare them to include various service designing philosophies. The agreement should be in line with the strategy and focus on the appropriate areas of the business for genuinely successful LSS (Duarte, 2011).

2.10. Lean and Six Sigma in Hospitals

Lean is a quality-improvement idea and a collection of strategies that originated with Toyota and have been quickly adopted by the healthcare sector to encourage both system-wide and localized or focused clinical process improvements. During the past five years, lean, one of the most well-liked performance improvement techniques in the US, has witnessed a dramatic rise in use in healthcare settings (Walshe, 2009). The concept is built upon three core tenets: (1) foster a culture of continuous improvement; (2) include those who carry out the job on the front lines (respect for people); and (3) prioritize value and process from the perspective of the customer.

Several strategies offer the tools necessary to put these concepts into effect. For instance, an A3 provides both a broad approach to problem-solving and a structure for putting small

improvement cycles (Plan-Do-Check-Act, or PDCA) into practice to address root causes and develop workable solutions. A kaizen event, a guided problem-solving workshop that brings together relevant stakeholders to create and test solutions, can enhance PDCA cycles. Project progress is immediately accessible and visible thanks to results boards, which are routinely assessed and discussed by leadership on visits to the place where value is produced. Lean is applied as a QI strategy to address elements of the organizational context that are essential for success, such as stakeholder and frontline staff engagement and involvement (through Kaizen events), leadership commitment and awareness (through Gemba walks), and use of QI techniques like process mapping (Kaplan et al., 2014).

The interaction of contextual variables and lean interventions promotes change by building shared process understanding, encouraging cooperation to address problems, and improving error detection and process dependability (Mazzocato et al. 2010).

The historical focus of the Six Sigma approach for boosting quality has been on reducing mistakes and raising standards (Sperl, Ptacek& Trewn 2013). Six Sigma programs use many of the same methods as lean, including process mapping, to analyze process performance. Moreover, experiment design and other statistical techniques are used.

Programs for organizational Six Sigma usually involve infrastructure that promotes the endurance of the QI endeavor. Several firms combine the Lean Six Sigma emphasis on defects with the Six Sigma emphasis on waste to support efforts in quality improvement. Several departments have adopted quality-improvement strategies like Lean Six Sigma and hospital process optimization, including ambulatory clinics (Casey, Brinton, and Gonzalez 2009), pharmacies (Chiarini 2012), emergency departments (King, Ben-Tovim, &Bassham 2006; Taner &Sezen 2009), and surgery (Mason, Nicolay& Darzi 2015). Lean and Six Sigma integration have decreased waste and wait times while taking patients' demands into

account, minimized mistakes and expenses, improved treatment quality, increased staff participation, and continuously improved patient happiness.

2.11. Food Flow Process at the Hospital

The hospital’s food flow cycle begins when the kitchen staff including the head chef and the Clinical dietitian check the stock and demand orders of food and kitchen supplies from approved suppliers. Food orders are handled by the head chef. A clinical dietician is in charge of creating a menu for the entire week, which includes 3 meals (breakfast, lunch, and dinner) while taking into account all of the patient's medical conditions. There will be food waste while the kitchen staff prepares meals by the menu. Patients will be given food to eat, yet there will be food leftovers and food that remains uneaten, which is also classified as food waste. No software system in existence could help in requesting a patient's food plan. (McCray et al., 2018)

Food orders for patients are placed on paper forms, which are then handed off to the kitchen. Given the volume of transportation, the system is ineffective and falls below the standards. creating more paperwork, which is costly and wasteful. Figure #2.2 shows the flow of food process at the hospital:

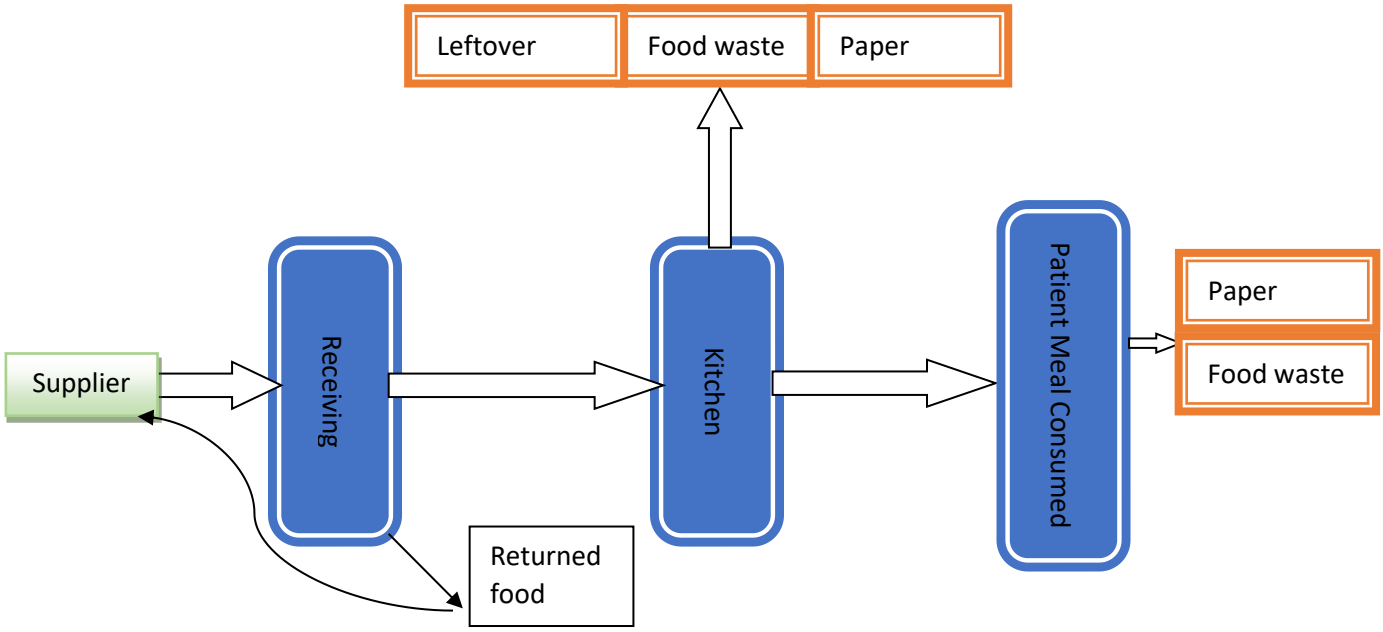


Figure 2. 2: Food Flow Process at the Case Study Hospital, conducted by the Researcher.

For the past 15 years, the private acute care sector has adopted the room service (RS) food service model to increase patient satisfaction and decrease food waste. Patient-centered food service models that encourage participation and personalized care can raise overall patient satisfaction. In an acute care setting, it can be challenging to meet patients' nutritional needs due to several extenuating circumstances, such as patients' appetites and clinical symptoms, food accessibility and availability, menu quality, food choices, and specific patient preferences. RS is designed to enable patients to order the food they want, when they want, in the hopes that they would consume a bigger portion of what they want as long as it fits their diet therapy, waste less food, and be delighted with the hospital foodservice experience. In comparison to the traditional food service Model (TM), McCray et al. (2018) study found statistically significant increases in energy and protein intake. At RS, customers get a higher quality menu with the option to choose the meal of their choice, are not disturbed while eating, and may order food whenever they want with delivery occurring at their convenience. Patients who prefer to eat less and more often will frequently be provided a snack. Increased

patient satisfaction has been cited in the literature as a major benefit of RS in the private setting. (McCray et al., 2018)

The ability for patients to order what, when, and in whatever amounts and combinations they feel like may have contributed to the increase in patient satisfaction with RS compared to TM. This flexibility allows for greater control over meal choices as well as more interaction and engagement during the meal ordering process. One of the main advantages of the RS model has been said to be a decrease in food expenses. (McCray et al., 2018)

2.12. Food Waste in Hospitals

Researchers in developed countries (the USA and Europe) started to become interested in the avoidance of food waste in the food services business in the 1910s, 1920s, and 1940s. Sadly, throughout World Wars I and II, problems with the army's capacity to sustain itself overshadowed the enthusiasm and made it fleeting. The primary focus of the early scientific literature on food waste—aside from the few recognized publications on prevention and management—is garbage disposal (Gadysz et al., 2020). They said that the need to avoid and minimize food waste was once again recognized in the early 1980s.

Every step of the food supply chain, including farms, plantations, and fisheries, as well as processing, packaging, logistics, shipping, distribution, and storage, retail establishments, residences, and restaurants, sees food waste (Dreyer et al., 2019). A significant amount of food waste is produced by the food services industry, which includes fast food chains, restaurants, bars, bistros, and caterers. For instance, according to a report by the Natural Resources Defense Council (NRDC), the amount of food waste produced by restaurants in the United States alone in 2015 was estimated to be between 22 and 33 billion pounds, and the amount of waste produced by hotels, hospitals, and schools was estimated to be between 7 and 11 billion pounds (Gunders & Bloom, 2017). According to reports, US restaurants squander over 7% of the food they provide their clients.

The numbers from other countries are not much better, for instance, in 2012, food services were responsible for 12% of food waste in the European Union (Stenmarck et al., 2017). Food waste is brought on by large amounts, strict chain shop management, a diversified menu, and inefficient or hurried meal service (Dreyer et al., 2019). In the United States, 17% of meals are frequently left incomplete, whereas 55% of edible leftovers are left at restaurants, according to Bloom (2010).

Food waste management is a topic that is often discussed and is recognized as a serious issue in many economies. Many pieces have been released in a variety of situations (Dhir et al., 2020). The food waste hierarchy proposed by Papargyropoulou et al. (2014) gives the following options for handling food waste in order of desirability:

1. Transfer of food excess to populations dependent on food insecurity
2. Prevention, and management of food surplus and unnecessary food waste
3. Using food scraps as animal feed.

2.13. Food Management at Bethlehem Arab Society for Rehabilitation

After asking the food services department at the hospital to provide information about the raw material and food sources, they stated that they do not contact specific sources of food, they purchase their food materials from several sources and suppliers. Moreover, their consumption of food materials is as follows:

- Daily request of 20 bundles of bread.
- Weekly request of Hummus, Labaneh, and White Cheese. 10 boxes from each category weekly requested, in which the box weight is 5 kilos. In addition, to a weekly request of 250 Yogurt cups.
- Vegetables and fruits are requested two times a week, according to the season of the fruits.

- Regarding the main ingredients of the meals such as Rice, Lentils, Freekeh, Bulgur, and Pasta, the food services department daily requests 10-15 kilos from each category.
- 40 kilos of sugar consumed weekly.

It is worth mentioning that the food services department at the hospital does not apply specific ways or strategies to get rid of the extra food.

2.14. Customer Satisfaction

Generally, studies evaluate pediatric service satisfaction using many parameters. The most often utilized standards are friendliness, civility, respect, competence, attention to detail, and communication skills, notably the staff's ability to provide information regarding the patient's health state, the follow-up process, medications, and examinations. It's interesting to note that the writers frequently analyze employee satisfaction without separating respondents by professional type (e.g., doctors, nurses). We reject that strategy, nevertheless, as segregation is necessary for good management procedures. (Ferreira et al., 2021).

According to one definition, customer satisfaction is "the degree of a person's felt state as a result of comparing a product's perceived performance." Customer satisfaction with the dental digital application was the topic of the current study, which defined it as "the levels of quality of service performances that meet the consumer expectation." (Hult et al., 2019)

Based on that, the study selected three dimensions of customer satisfaction on the food services provided at Bethlehem Arab Society Hospital, which are: quality, trust, and communication. Those dimensions are the most important to be measured to assess the level of customer satisfaction, regarding the quality of the food services, the trust of the food services provided in the hospital rather than other hospitals, in addition to communication that allows patients to complaint, and managers obtain feedback from patients about their satisfaction among food services. This is because customer satisfaction is affected by those

three dimensions of satisfaction among services or products, which lead the customer to feel involved in the processes of the hospital, and comfortable by communicating with the hospital staff.

2.15. Chapter Summary

Lean Six Sigma is a combination of Lean and Six Sigma, two effective cycle improvement methodologies. Removing "Squander" from a cycle and addressing the problems caused by an interaction, reduces association costs. Lean Six Sigma (LSS) is a rapidly developing, highly powerful technology that is used to identify and eliminate waste, improve performance, efficacy, and customer loyalty, and support in competitive manufacturing and nonmanufacturing environments.

The well-known lean six sigma methodologies, approaches, structures, success and failure variables, and gadgets may be used as a guide in the manufacturing sector. Another noteworthy aspect of the LSS is that it has been used all over the globe and in various manufacturing organizations to achieve greatness. Their LSS objectives have been successfully met. Nevertheless, some other challenges and barriers have been identified in the LSS deployment. The most important things that any professional should be aware of are evaluations of Lean Six Sigma preparation and execution processes. By having a thorough understanding of the fundamentals of Six Sigma, the foundations of Lean Six Sigma are reviewed to identify the main causes. Each director needs to be knowledgeable and practice the eight fundamentals of Lean Six Sigma for manufacturing to introduce Lean into the associations. By providing more great service in less time, improving relevant business procedures, eliminating inefficiencies, and focusing on how the task went through the cycle, they should be able to fulfill or captivate clients.

Chapter Three: Methodology

3.1. Overview

This chapter presents the methodology followed by the researcher to achieve the study's objectives and answer its questions. In addition to the presentation of procedures followed toward gathering the needed field data.

3.2. Research Approach

Mainly, the study aimed to assess the potential of applying Lean Six Sigma tools for food waste reduction in Bethlehem Arab Rehabilitation Society Hospital.

The method chosen by the researcher to gather, examine, and interpret data is known as a research methodology. There are three types of research methods: mixed, qualitative, and quantitative. In quantitative research, numerical data are gathered and analyzed to characterize, explain, forecast, or control relevant occurrences. Numerical data processing is a challenging task that requires a systematic approach. Deductive reasoning is used in quantitative research. The goal of qualitative research is to better understand a particular phenomenon of interest by gathering, analyzing, and interpreting extensive narrative and visual evidence. Qualitative research aims to understand phenomena as they naturally occur by simultaneously examining a variety of their facets. Using inductive reasoning, this strategy (Williams, 2007). As opposed to this, mixed methods research integrates quantitative and qualitative techniques by using both types of data in a single study. The link and strength between quantitative and qualitative research methodologies may be strengthened through the use of mixed methods research by the researcher. This makes it possible to comprehend the topic under study better. (Sekaran & Bougie, 2016).

According to the main objective of the study, the quantitative method approach has been used to collect the needed and comprehensive data from the employee perspectives. Throughout using a structured questionnaire that consists of primary data variables (e.g.

Lean management tools “Organizing Workplace, Waste Elimination, Process Efficiency, Quality of Product/Service”, and DMAIC model “Definition, Measure, Analyze, Improvement, Control”. In addition to Customer satisfaction “quality, trust, communication”).

Moreover, the study used the descriptive and analytical approaches that are appropriate for the aim of the study, in which the descriptive approach is used to describe the perspectives of hospital’s employees toward lean management tools, food waste reduction tools, and customer satisfaction on the services provided by the Bethlehem Arab Society for Rehabilitation. Whereas the analytical approach was used to measure the relationships between variables of the study. Those approaches have been followed throughout the tools of data gathering used in the study, and the procedures followed toward accomplishing the study.

3.3. Population of the Study

In contrast to the sample of the study, the population of any study is the overall group of individuals, events, or other items of interest to the researcher, according to Sekaran and Bougie (2016).

Based on the aim of this study, the population consisted of all employees working at the Bethlehem Arab Society for Rehabilitation, which counts 150 employees including (Nurses, doctors, and administrative), according to the human resources department at Bethlehem Arab Society (2023).

3.4. Sample of the Study

The author used the random sampling technique to gather the needed information from the employees at the hospital. Thus, 94 employees at the Bethlehem Arab Society for Rehabilitation participated in the questionnaire. The sample size has been calculated based on the following equation (Thompson, 2012):

$$n = \frac{N \times p(1-p)}{([N-1 \times (d^2 \div z^2)] + p(1-p))}$$

Where:

n: Sample size.

N: Population size (150).

z: Confidence level at 95% (1.96).

d: Error proportion (5%).

p: Probability of picking a choice (50%).

Accordingly, throughout applying the above equation, it is obvious that the size of the representative sample is 108 employees, who are needed to participate in the study. Based on that, the researcher distributed 108 questionnaires to 108 employees, and 94 questionnaires were valid to be statistically analyzed. This means that the response rate of 87%.

Therefore, the sample characteristics are as Table 3.1 shows:

Table 3. 1: Sample Characteristics

Variable	Frequency	Percent
Gender		
Male	41	43.6%
Female	53	56.4%
Total	**94**	**100%**
Age		
from 20-29	73	77.7
from 30-39	16	17.0
from 40-49	2	2.1
50 years and more	3	3.2
Total	**94**	**100%**
Years of Experience		
from 1-5	69	74.2
from 6-10	17	18.3
from 11-15	3	3.2
from 16 and more	4	4.3
Total	**94**	**100%**
Qualification		
Diploma	11	12.0
Bachelor	78	84.8
Graduate Studies	3	3.3
Total	**94**	**100%**
Position in the Hospital		
Nurse	63	67.7
Doctor	2	2.2
Administrative	4	4.3
Other	24	25.8
Total	**94**	**100%**

Table 3.1 shows that the sample has been distributed among 43.6% males, and 56.4% females according to gender. However, the age of the sample individuals fluctuated between 77.7% of respondents aged between 20 and 29 years, 17% for respondents aged between 30 and 39, in addition to 2.1% for sample individuals aged between 40 and 49, and 3.2 % aged 50 years and more. According to years of experience, the sample has been diversified between 74.2 % who have experienced between 1-5 years, 18.3% years of experience

between 6-10 years, while individuals years of experience between 11-15 3.2 %, and 16 years or more the rate was 4.3%.

According to the qualification variable of the respondents, the study indicates that most of the sample holds a Bachelor's degree within a rate of 84.8 %, and Diploma of 12%, and only 3.3 % holding graduate studies qualifications. Moreover, the study indicates that the majority of respondents were nurses 67.7% of the total respondents, and 25.8 % for others who are other employees, 4.3 % administrative, and 2.2 % doctors.

3.5. Data Collection

After developing the study's hypotheses, data must be gathered for each variable included in the hypotheses. In general, surveys, interviews, and observations can be used to gather primary data. There are three primary categories of questionnaires: (1) those given out in person; (2) those sent by mail; and (3) those given online (Sekaran and Bougie, 2016).

In this study, the researcher collected the needed data personally, by distributing the questionnaire among the employees at Bethlehem Arab Society Hospital, in which a total of 108 questionnaires were distributed, while 94 questionnaires were valid to be analyzed. Moreover, the time duration of collecting the data was 4 weeks from 15/1/2023 to 11/2/2023. This process reflects a response rate of 87% of the total sample size.

3.6. Instrument of the Study

The study depended mainly on the questionnaire as the main tool of data gathering, which has been designed according to the main objective of the study, since the main objective is to present the perspectives of employees at Bethlehem Arab Society for Rehabilitation, on the lean management tools used by the hospital management toward reducing the waste of food. The questionnaire has been developed based on the questionnaires used in the studies of (Gładysz et al., 2020; and Rosas-Hernandez et al., 2019). The questionnaire consists of four sections, in which:

The first section: consists of demographic information that includes 5 variables:

- Gender: (Two Categories).
- Age: (Four Categories).
- Years of experience: (Five Categories).
- Qualification: (Five Categories).
- Position at the hospital: (Four Categories).

Then, the second section is the lean management tools applied by the hospital, as this section consisted of 35 items distributed among 4 dimensions as follows:

- Organizing Workplace: (22 Items).
- Waste Elimination: (4 Items).
- Process Efficiency: (5 Items).
- Quality of Services / Products: (4 Items).

In addition, the third section was intended to measure the appliance of the DMAIC model at the hospital, which consisted of 25 items, divided into 5 dimensions of DMAIC as follows:

- Definition: (5 Items).
- Measurement: (5 Items).
- Analysis: (5 Items).
- Improvement: (5 Items).
- Control: (5 Items).

The fourth section: is the last section that measured customer satisfaction from the perspectives of employees at the hospital, which consists of 15 items distributed among 3 dimensions as follows:

- Quality: (4 Items).
- Trust: (3 Items).
- Communication: (5 Items).

3.7. Validity & Reliability of the Questionnaire

The validity can be defined as “the extent to which the scale can describe or evaluate what is designed to measure” Taherdoost (2016). The high validity reflects the nonexistence of statistical errors, which means that the researcher can proceed with distributing the rest of the questionnaires for the overall sample. While reliability means the degree which indicates the consistency of the instrument that means other researchers can use the same instrument in similar topics, and generalize the results of the study.

3.7.1. Content validity

The process of evaluating the research tool's validity starts with its content. It is an assessment of how certain metric components fit into the main body of the content of the structure that we are attempting to measure. The appropriateness of the tool's contents for the study topic under consideration and their form are referred to as the validity of the content. The initial round of the instrument's content validation involved a group of referees and expert arbitrators, who offered their feedback on the instrument's items (Appendix B). This allowed the researcher to arrive at a content validation of the instrument (Appendix A). Internal coherence correlations have been measured among the degree of each item in the instrument, and correlations with the total degree of the instrument to statistically confirm the validity. The validity of the questionnaire has been verified in two ways, The first one is that the questionnaire has been designed according to previous studies conducted in different areas, but has the same features. Statistically, the validity of the questionnaire has been calculated by using the Pearson Correlation test at the SPSS after collecting the data. The correlation results of the items and overall degree indicate that the instrument is valid and consistent, due to that results of the correlation coefficient fluctuated for all items between 0.518 and 0.831, as shown in Table 3.2:

Table 3. 2: Pearson Correlation Results of Questionnaire Items

Items	Pearson Correlation	P-value	Items	Pearson Correlation	P-value
SO1	0.567**	0.000	D2	0.682**	0.000
SO2	0.518**	0.000	D3	0.632**	0.000
SO3	0.587**	0.000	D4	0.725**	0.000
SO4	0.753**	0.000	D5	0.765**	0.000
SIO1	0.569**	0.000	M1	0.633**	0.000
SIO2	0.705**	0.000	M2	0.729**	0.000
SIO3	0.669**	0.000	M3	0.704**	0.000
SIO4	0.620**	0.000	M4	0.731**	0.000
SIO5	0.655**	0.000	M5	0.581**	0.000
C1	0.619**	0.000	A1	0.681**	0.000
C2	0.614**	0.000	A2	0.611**	0.000
C3	0.676**	0.000	A3	0.705**	0.000
C4	0.642**	0.000	A4	0.701**	0.000
ST1	0.662**	0.000	A5	0.622**	0.000
ST2	0.701**	0.000	I1	0.752**	0.000
ST3	0.603**	0.000	I2	0.699**	0.000
ST4	0.603**	0.000	I3	0.689**	0.000
SU1	0.627**	0.000	I4	0.657**	0.000
SU2	0.611**	0.000	I5	0.635**	0.000
SU3	0.529**	0.000	S1	0.576**	0.000
SU4	0.679**	0.000	S2	0.651**	0.000
SU5	0.583**	0.000	S3	0.689**	0.000
WE1	0.654**	0.000	S4	0.603**	0.000
WE2	0.703**	0.000	S5	0.573**	0.000
WE3	0.732**	0.000	QU1	0.596**	0.000
WE4	0.621**	0.000	QU2	0.584**	0.000
PE1	0.673**	0.000	QU3	0.672**	0.000
PE2	0.595**	0.000	QU4	0.745**	0.000
PE3	0.685**	0.000	TR1	0.683**	0.000
PE4	0.703**	0.000	TR2	0.831**	0.000
PE5	0.625**	0.000	TR3	0.744**	0.000
QP1	0.669**	0.000	COM1	0.609**	0.000
QP2	0.677**	0.000	COM2	0.646**	0.000
QP3	0.633**	0.000	COM3	0.603**	0.000
QP4	0.567**	0.000	COM4	0.610**	0.000
D1	0.674**	0.000	COM5	0.652**	0.000

The results showed that all the items were correlated positively with the total degree of the questionnaire, so; the questionnaire is valid.

3.7.2 Reliability of the Questionnaire

The reliability of the questionnaire was calculated using (Cronbach Alpha) formula, and it was measured to be as Table 3.3 shows:

Table 3. 3: Results of Cronbach's Alpha Test

Dimension	N	# of items	Cronbach's Alpha
Organizing Workplace	94	22	0.945
Waste Elimination	94	4	0.805
Process Efficiency	94	5	0.836
Quality of Product/Service	94	4	0.807
Lean Management Tools	94	35	0.963
Definition	94	5	0.864
Measurement	94	5	0.850
Analysis	94	5	0.836
Improvement	94	5	0.859
Control	94	5	0.874
DMAIC Model	94	25	0.957
Quality	94	4	0.799
Trust	94	3	0.831
Communication	94	5	0.812
Customer Satisfaction	94	12	0.916
Total Degree			**0.91**

The reliability was tested using Cronbach's Alpha test to ascertain the reliability and consistency of the survey. Cronbach's Alpha for the survey instrument was 0.91, respectively, indicating very good reliability and consistency, as the total degree and dimensions degrees are all above the minimum values acceptable for reliability which is 0.70(Sekaran and Bougie, 2016). Therefore, the reliability of the instrument for this study is very good, so the researcher can proceed with the study (Sekaran and Bougie, 2016).

3.8 Statistical Analysis

The questionnaire items were rated on a 1–5 Likert scale (1=Strongly Disagree to 5=Strongly Agee), and the highest score indicates a high level of applying lean management tools toward food waste reduction. Descriptive statistics gauged the prevalence of DMAIC and Lean

management tools at the hospital from the perspectives of employees, among the sampled population using the following mean key:

Mean	**Degree**
1.00-2.33	Low
2.34-3.67	Average
3.68-5.00	High

Additionally, the following statistical techniques were measured: Regression coefficient, T-test, One-way analysis of variance, Tukey test, Cronbach's Alpha, and Pearson Correlation using SPSS.

3.9 Ethical Concerns

With this study, four ethical concerns should be raised. First, respondents were informed of the study's goal on the questionnaire's cover page. Also, responders' information is held under the strictest confidence. Furthermore, the data that were amassed during the study are not being reported in a way that intentionally misrepresents or distorts them. Finally, there is no financial conflict between this research on the one hand and any other party on the other.

Chapter Four: Data Analysis and Discussion

4.1 Introduction

This chapter presents the results of the study, through the respondents' response to the paragraphs included in the study tool (questionnaire) that relate to identifying the application of lean management tools toward food waste reduction at Bethlehem Arab Society for Rehabilitation. The chapter presents the answers to study questions and the results of examining the hypotheses that emerged from them related to the variables.

4.2 Answering the Questions of the Study

First Question: What are the lean six sigma tools that can applied in hospital meal service in Arab Rehabilitation Society hospital in Bethlehem (Workplace organization, Waste Elimination, Process Efficiency, and Quality of Products?

To answer this question means and standard deviations have been extracted for all dimensions of lean six sigma. As following:

Table 4. 1: Organizing Workplace - Sorting section arranged in descending order

	Items	Mean	Std. Deviation	degree
SO1	Food is distributed and served within the hospital in an efficient and non-random manner.	4.12	0.88	high
SO3	The equipment necessary for eating meals is placed in places close to patients and hospital staff	3.90	1.00	high
SO2	Meals within the hospital are divided into meals for patients and meals for staff.	3.86	1.05	high
SO4	Labels and stickers are used on meals for patients and staff.	3.83	1.10	high
	total degree	3.93	0.79	high

The most important item concerning the sorting section was ” Food is distributed and served within the hospital in an efficient and non-random manner”, with a mean equal to (4.12), followed by " The equipment necessary for eating meals is placed in places close to patients and hospital staff", with mean equal to (3.90), then comes " Meals within the hospital are

divided into meals for patients and meals for staff", with mean equal to (3.86), and last comes " Labels and stickers are used on meals for patients and staff" with mean equal to (3.83).

This means that the sorting function of lean sigma related to food waste reduction at the hospital is undertaken effectively and within a disciplinary method. The conclusion is that the food service department at the hospital is aware of the importance of this dimension and applying it effectively. This result adapts with the argument of Page (2010), who argued that the sorting dimension of lean six sigma is an important contributor to applying strategies for reducing food waste.

Table 4. 2: Organizing Workplace - Set In Order section arranged in descending order

	Items	Mean	Std. Deviation	degree
SIO3	Tools related to preparing and eating meals are returned to their place once they are used.	3.97	0.93	high
SIO5	Safety requirements are provided where meals are eaten.	3.89	0.92	high
SIO1	Files and tools related to providing meals to patients and staff are classified and arranged effectively and clearly.	3.83	0.88	high
SIO4	Arranging where to eat meals takes a short time.	3.80	0.90	high
SIO2	The equipment for eating meals was quickly serviced.	3.72	0.94	high
	total degree	3.84	0.71	high

The most important item concerning set in order section was" Tools related to preparing and eating meals are returned to their place once they are used" with a mean equal to (3.97), followed by " Safety requirements are provided where meals are eaten" (3.89), then " Files and tools related to providing meals to patients and staff are classified and arranged effectively and clearly" (3.83), followed by " Arranging where to eat meals takes a short time" (3.80), and last comes " The equipment for eating meals was quickly serviced" with mean equal to (3.72).

In conclusion, this dimension related to the arranging of food services tools, tools related to preparing and eating meals is returned to their place once they are used. Safety requirements

are provided where meals are eaten, as well as files and tools related to providing meals to patients and staff are classified and arranged effectively and clearly. This is adapting with Ruben et al. (2017) when discussed that setting in order all tools and instructions, is one of the main functions of lean six sigma strategies.

Table 4. 3: Organizing Workplace - Shine section arranged in descending order

	Items	Mean	Std. Deviation	degree
S2	The meals provided are in good condition.	4.00	0.90	high
S4	The environment where food is eaten is clean and hygienic.	3.87	0.98	high
S3	Cupboards and table tops used for serving and eating food are kept clean and in good condition.	3.82	0.95	high
S1	The place for eating meals, whether for patients or workers, is always clean.	3.82	1.00	high
	total degree	3.88	0.79	high

The most important item concerning the shine section was " The meals provided are in good condition" with a mean equal to (4.00), followed by " The environment where food is eaten is clean and hygienic" (3.87), then comes " Cupboards and table tops used for serving and eating food are kept clean and in good condition" and " The place for eating meals, whether for patients or workers, is always clean" with mean equal to (3.82) for each one of them.

We can conclude here that employees affirmed that the meals provided are in good condition, and the environment where food is eaten is clean and hygienic. As Shahada &Alsyouf(2012) stated the shine and cleaning of food services tools, is the most important factor toward customer satisfaction, which is affected by lean six sigma tools.

Table 4. 4: Organizing Workplace - Standardization section arranged in descending order

	Items	Mean	Std. Deviation	degree
ST3	There is discipline in the process of providing food to patients and workers in terms of time.	3.84	0.90	high
ST2	Written steps are adhered to for each catering process.	3.80	0.87	high
ST4	Scientific methods are used while making decisions about serving meals to patients and staff.	3.76	0.77	high
ST1	Continuous improvement projects for the process of providing meals to patients and hospital staff are implemented according to clear and written procedures: such as identifying weaknesses that need improvement, measuring their importance and necessity, and others.	3.64	1.05	average
	total degree	3.76	0.69	high

The most important item concerning Standardization section was " There is discipline in the process of providing food to patients and workers in terms of time" (3.84), followed by " Written steps are adhered to for each catering process" (3.80), then comes " Scientific methods are used while making decisions about serving meals to patients and staff" (3.76), and last comes "Continuous improvement projects for the process of providing meals to patients and hospital staff are implemented according to clear and written procedures: such as identifying weaknesses that need improvement, measuring their importance and necessity, and others" with mean equal to (3.64).

In conclusion, employees confirmed that there is discipline in the process of providing food to patients and workers in terms of time, and written steps are adhered to for each catering process. The discipline applied to any service is considered important according to literature (Antasouras et al., 2022)and real ground, in which discipline makes the appliance of any strategy possible.

Table 4. 5: Organizing Workplace -Sustainability section arranged in descending order

	Items	Mean	Std. Deviation	degree
SU1	The hospital employs full-time and part-time staff to improve catering services for patients and staff.	4.01	0.87	high
SU2	In the hospital, compliance with the system is monitored and followed up in the departments responsible for providing food services.	3.93	0.86	high
SU5	There is a checklist with food service providers for each stage of providing food services to patients and hospital staff.	3.82	0.96	high
SU4	The hospital incentivizes the food preparation and service department that implements workplace organization processes.	3.77	0.96	high
SU3	The hospital uses a variety of training so that workers in food service departments can acquire the knowledge and skills necessary to fulfill their responsibilities.	3.74	0.94	high
	total degree	3.85	0.69	high

The most important item concerning the Sustainability section was " The hospital employs full-time and part-time staff to improve catering services for patients and staff" (4.01), followed by " In the hospital, compliance with the system is monitored and followed up in the departments responsible for providing food services" (3.93), then " There is a checklist with food service providers for each stage of providing food services to patients and hospital staff" (3.82), followed by " The hospital incentivizes the food preparation and service department that implements workplace organization processes" (3.77), and last comes " The hospital uses a variety of training so that workers in food service departments can acquire the knowledge and skills necessary to fulfill their responsibilities" with mean equal to (3.74). When looking at the sustainability section of lean six sigma, the researcher considers this dimension is the most important and comprehensive., Whenever the functions and tools of Lean Six Sigma are applied, the sustainability of this implementation must be applied as well, to sustain the food waste reduction taking into consideration the period, and developing issues. As Mustapha et al. (2019) stated senior administration involvement and accountability as a CSF in the implementation of lean six sigma initiatives.

Table 4. 6: Waste Elimination section arranged in descending order

	Items	Mean	Std. Deviation	degree
WE2	In the hospital, performance measures are linked to strategic quality objectives related to catering services	3.78	0.75	high
WE1	The hospital translates patients' and staff's needs and expectations about the food services provided into quality goals	3.76	0.84	high
WE4	The hospital works in an organized manner to detect different types of waste and try to get rid of them	3.70	1.04	high
WE3	The hospital systematically uses a set of metrics as indicators of catering ability to assess improvements in catering.	3.67	0.91	average
	total degree	3.73	0.71	high

The most important item concerning the Waste Elimination section was " In the hospital, performance measures are linked to strategic quality objectives related to catering services" with a mean equal to (3.78), followed by " The hospital translates patients' and staff's needs and expectations about the food services provided into quality goals" (3.76), then comes " The hospital works in an organized manner to detect different types of waste and try to get rid of them" (3.70), and last comes " The hospital systematically uses a set of metrics as indicators of catering ability to assess improvements in catering" with mean equal to (3.67). This means that the hospital management is aware of food waste reduction and elimination importance, and they apply rules and strategies toward food waste elimination in a way that serves quality management. This is related to Duarte's (2011) results, who found that the management of the department must be aware of food waste elimination tools and procedures, and the appliance of those tools guarantees the elimination of food waste.

Table 4. 7: Process Efficiency section arranged in descending order

	Items	Mean	Std. Deviation	degree
PE1	Food service delivery processes for patients and staff are studied and reviewed to make improvements on an ongoing basis.	3.82	1.02	high
PE2	Clear instructions for work are given to workers in food service departments.	3.80	0.82	high
PE5	The quantities of resources and materials needed to provide services and meals in the hospital are checked periodically, such as: the process of rationalizing resource consumption.	3.79	1.01	high
PE3	Statistical techniques are widely used to reduce variance in food service delivery processes.	3.77	0.85	high
PE4	The hospital focuses on human resources in terms of high cohesion and morale in the food service departments.	3.64	0.95	average
	total degree	3.76	0.73	high

The most important item concerning the Process Efficiency section was " Food service delivery processes for patients and staff are studied and reviewed to make improvements on an ongoing basis" (3.82), followed by " Clear instructions for work are given to workers in food service departments" (3.80), then comes " The quantities of resources and materials needed to provide services and meals in the hospital are checked periodically, such as the process of rationalizing resource consumption" (3.79), then comes " Statistical techniques are widely used to reduce variance in food service delivery processes" (3.77), and last comes " The hospital focuses on human resources in terms of high cohesion and morale in the food service departments" (3.64).

This means that the food department at the hospital has a rational structure and functions that serve the quality management of food services, and food waste reduction. Adapting to the results of (Gouvea et al., 2013; and Protzman et al., 2018), who discussed that waste is any activity taken during an encounter that is not anticipated to produce something or provide a service that is dependent on predetermined instructions.

Table 4. 8: Quality of Product/Service section arranged in descending order

	Items	Mean	Std. Deviation	degree
QP4	Clearly required steps are adhered to in the food service delivery process.	3.93	0.79	high
QP1	The quality of catering services is emphasized, especially with regard to the time of service and the quality of products.	3.86	1.07	high
QP3	In general, in the process of manufacturing meals provided to patients and staff, an effort is made to provide them in a high-quality manner.	3.82	0.92	high
QP2	The various departments concerned with catering services within the hospital coordinate with each other in the process of developing catering services.	3.71	0.96	high
	total degree	3.83	0.75	high

The results show that the Quality of Product/Service applied in high degree with mean equal to (3.83). The most important item concerning the Quality of Product/Service section was "Clearly required steps are adhered to in the food service delivery process" (3.93), followed by " The quality of catering services is emphasized, especially concerning the time of service and the quality of products" (3.86), then comes " In general, in the process of manufacturing meals provided to patients and staff, an effort is made to provide them in a high-quality manner" (3.82), and last comes " The various departments concerned with catering services within the hospital coordinate with each other in the process of developing catering services" with mean equal to (3.71).

This means that the food services department and the senior management of the hospital are paying high attention to the service quality, as well as the whole process of producing and offering the food services, toward raising customer satisfaction. Mustapha et al. (2019), stated that senior administration participation ensures the program's benefit to the organization by cooperating with trust and communication. In addition, senior management encourages staff to participate in methodologies and strategies for greater quality by showing gratitude for them.

Second Question: How are the DMAIC six sigma components applied toward food waste in the Arab Rehabilitation Society hospital?

To answer this question, the means and standard deviations of the items in each dimension have been extracted as follows:

Table 4. 9: DMAIC Model - Definition section

	Items	Mean	Std. Deviation	degree
D1	There is complete and comprehensive clarity among patients and hospital staff about catering services.	3.93	0.89	high
D4	The hospital administration is ready to detect and treat problems with the quality of catering services.	3.82	0.89	high
D2	The hospital administration includes fixed paragraphs in its meetings on the quality of catering services.	3.76	0.92	high
D3	Patients and hospital staff are fully aware of the horizontal and vertical ways of communication between departments and departments regarding catering services.	3.73	0.92	high
D5	The hospital administration is aware of the concepts, principles, and tools related to the Six Sigma methodology related to catering services.	3.69	0.95	high
	total degree	3.79	0.74	high

The results show that the Definition of the DMAIC Model applied to a high degree with a mean equal to (3.79). The most important item concerning the Definition section was "There is complete and comprehensive clarity among patients and hospital staff about catering services" (3.93), then comes " The hospital administration is ready to detect and treat problems with the quality of catering services" (3.82), followed by " The hospital administration includes fixed paragraphs in its meetings on the quality of catering services" (3.76), then comes " Patients and hospital staff are fully aware of the horizontal and vertical ways of communication between departments and departments regarding catering services" (3.73), and last comes " The hospital administration is aware of the concepts, principles, and tools related to the Six Sigma methodology related to catering services" with mean equal to (3.69). This means that hospital management and the food department provide all customers

and staff with obvious instructions for both parts of the way treating food services and materials.

Table 4. 10: DMAIC Model - Measurement section

	Items	Mean	Std. Deviation	degree
M4	The hospital administration employs new people with experience and competence with quality requirements in the catering services departments in accordance with the quality requirements related to catering services.	3.81	0.93	high
M1	The hospital administration adopts a documented context to accurately determine and review the requirements for food services and meals for patients and hospital staff.	3.67	0.97	average
M2	The ability of the hospital administration to meet the requirements of patients and staff with regard to catering services is constantly evaluated	3.59	0.88	average
M5	The hospital administration is seeking to change the operations related to catering services to patients and their staff that take place within the hospital in order to achieve quality.	3.57	0.99	average
M3	The hospital management implements effective arrangements to deal with the feedback and observations from patients and hospital staff about the catering services.	3.55	0.91	average
	total degree	3.64	0.74	average

The results show that the Measurement of the DMAIC Model applied an average degree with a mean equal to (3.64). The most important item concerning Measurement section was "The hospital administration employs new people with experience and competence with quality requirements in the catering services departments in accordance with the quality requirements related to catering services" (3.81), then comes " The hospital administration adopts a documented context to accurately determine and review the requirements for food services and meals for patients and hospital staff" (3.67), followed by " The ability of the hospital administration to meet the requirements of patients and staff with regard to catering services is constantly evaluated" (3.59), then comes " The hospital administration is seeking to change the operations related to catering services to patients and their staff that take place within the hospital in order to achieve quality" (3.57), and last comes " The hospital

management implements effective arrangements to deal with the feedback and observations from patients and hospital staff about the catering services" with mean equal to (3.55). This might be related to the non-frequent evaluation and assessment of food services, on the other hand, management of the hospital just provides the clients and staff with instructions, and the evaluation and measurement of food services quality is conducted between long times.

Table 4. 11: DMAIC Model - Analysis section

	Items	Mean	Std. Deviation	degree
A1	The hospital administration applies several strategies and methodologies in order to identify the causes of problems related to catering services within the hospital.	3.79	0.88	high
A2	The hospital administration has the infrastructures in order to determine the requirements for future tasks regarding services for providing meals to patients and workers.	3.79	0.90	high
A3	The hospital administration applies statistical methods to control the quality of catering services.	3.77	0.80	high
A5	The hospital administration applies various methodologies in order to analyze future risks that may face the process of providing food services to patients and workers, and work to avoid them.	3.70	0.87	high
A4	The hospital administration uses analysis tools commensurate with the required accuracy of the results of the process of providing food to patients and workers.	3.60	0.81	average
	total degree	3.73	0.66	high

The results show that the Analysis of DMAIC Model applied in high degree with mean equal to (3.73).The most important item concerning Analysis section was " The hospital administration applies several strategies and methodologies to identify the causes of problems related to catering services within the hospital" and " The hospital administration has the infrastructures to determine the requirements for future tasks regarding services for providing meals to patients and workers" with mean equal to (3.79) for each one of them, followed by " The hospital administration applies statistical methods to control the quality of catering services" (3.77), then comes " The hospital administration applies various

methodologies to analyze future risks that may face the process of providing food services to patients and workers, and work to avoid them" (3.70), and last comes " The hospital administration uses analysis tools commensurate with the required accuracy of the results of the process of providing food to patients and workers" with mean equal to (3.60).

This result supports that hospital management implements strategies and policies toward guaranteeing the running of the food services process. In addition to that the hospital administration might apply statistical methods to control the quality of catering services.

Table 4. 12: DMAIC Model - Improvement section

	Items	Mean	Std. Deviation	degree
I3	The hospital administration works on continuous improvement of the quality of catering services to raise the level of patient and staff satisfaction	3.77	0.91	high
I5	The hospital management believes that the continuous improvement of catering services for patients and employees provides the necessary environment for applying the Six Sigma methodology	3.73	0.95	high
I2	The hospital management focuses on continuous improvement programs to achieve quality goals within the quality policy and data analysis related to catering services.	3.72	1.01	high
I1	The hospital administration is keen on continuous improvement efforts in the catering departments.	3.67	1.05	average
I4	The hospital administration takes appropriate measures to remove the causes and problems of the quality of providing food services and to prevent their recurrence.	3.62	0.97	average
	total degree	3.70	0.78	high

The results show that the Improvement of the DMAIC Model applied to a high degree with a mean equal to (3.70). The most important item concerning the Improvement section was " The hospital administration works on continuous improvement of the quality of catering services to raise the level of patient and staff satisfaction" (3.77), followed by " The hospital management believes that the continuous improvement of catering services for patients and employees provides the necessary environment for applying the Six Sigma methodology" (3.73), then comes " The hospital management focuses on continuous improvement

programs to achieve quality goals within the quality policy and data analysis related to catering services" (3.72), followed by " The hospital administration is keen on continuous improvement efforts in the catering departments" (3.67), and last comes " The hospital administration takes appropriate measures to remove the causes and problems of the quality of providing food services and to prevent their recurrence" with mean equal to (3.62).

This is a logic due to the analysis and identification of the food services problems and consequences, which are being implemented by the management toward improving the food services at the hospital.

Table 4. 13: DMAIC Model - Control section

	Items	Mean	Std. Deviation	degree
C1	The hospital employs workers in the catering services departments with appropriate skills.	3.80	0.95	high
C5	The hospital administration can, with the help of self-resources, train workers in the catering services departments on the concepts and tools of the Six Sigma methodology.	3.67	0.99	average
C2	Workers in the catering services departments are characterized by specialized education, skill and experience to achieve the required quality.	3.66	0.89	average
C3	The hospital administration encourages the enrollment of workers in the catering services departments in the courses of contemporary quality programs internally and externally.	3.59	0.96	average
C4	The hospital administration has financial allocations for training activities directed towards the quality of catering services	3.59	0.92	average
	total degree	3.66	0.74	average

The results show that the Control of the DMAIC Model applied an average degree with a mean equal to (3.66). The most important item concerning the Control section was " The hospital employs workers in the catering services departments with appropriate skills" (3.80), followed by " The hospital administration can, with the help of self-resources, train workers in the catering services departments on the concepts and tools of the Six Sigma methodology" (3.67), then comes " Workers in the catering services departments are characterized by specialized education, skill, and experience to achieve the required quality"

(3.66), followed by " The hospital administration encourages the enrollment of workers in the catering services departments in the courses of contemporary quality programs internally and externally" and " The hospital administration has financial allocations for training activities directed towards the quality of catering services" with mean equal to (3.59) for each one of them.

Third Question: What is the level of customer satisfaction with the food services applied in Bethlehem Arab Rehabilitation Society Hospital?

To assess the level of customer satisfaction with food services applied in Bethlehem Arab Rehabilitation Society Hospital means and standard deviations have been extracted as Tables4.14, 4.15, and 4.16 show:

Table 4. 14: Customer Satisfaction - Quality section

	Items	Mean	Std. Deviation	degree
QU1	Patients and hospital staff are well satisfied with the catering staff's treatment of them	3.91	0.98	high
QU2	Patients are satisfied with the decision to choose the hospital in terms of catering services	3.80	0.76	high
QU3	Patients are generally satisfied with the catering services provided within the hospital.	3.56	0.85	average
QU4	Hospital workers consider catering services a job advantage that they are satisfied with.	3.51	0.99	average
	total degree	3.69	0.71	high

The results show that the Customer Satisfaction concerning satisfaction of the food services were in high degree with mean equal to (3.69).The most important item concerning Quality section was "Patients and hospital staff are well satisfied with the catering staff's treatment of them" (3.91), followed by "Patients are satisfied with the decision to choose the hospital in terms of catering services" (3.80), then comes " Patients are generally satisfied with the catering services provided within the hospital" (3.56), and last comes "Hospital workers consider catering services a job advantage that they are satisfied with" with mean equal to (3.51).

Table 4. 15: Customer Satisfaction - Trust section

	Items	Mean	Std. Deviation	degree
TR2	The follow-up of the workers in the departments providing food services to the needs of patients and workers inside the hospital is good.	3.73	0.97	high
TR3	Patients and hospital staff trust the quality of the food service provided by the hospital.	3.72	0.94	high
TR1	The service is provided in a timely manner to the patient and the staff.	3.61	1.14	average
	total degree	3.96	0.88	high

The results show that Customer Satisfaction concerning Trust in food services was of a high degree with a mean equal to (3.96). The most important item concerning the Trust section was " The follow-up of the workers in the departments providing food services to the needs of patients and workers inside the hospital is good" (3.73), followed by " Patients and hospital staff trust the quality of the food service provided by the hospital" (3.72), and last comes " Patients and hospital staff trust the quality of the food service provided by the hospital", with mean equal to (3.61).

Table 4. 16: Customer Satisfaction - Communication section

	Items	Mean	Std. Deviation	degree
COM1	The employees of the catering services departments are in constant contact with patients and workers regarding catering services.	3.83	0.90	high
COM3	Meals are provided to patients within the hospital based on the recommendations of the nursing department.	3.78	0.83	high
COM5	Hospital management urges workers in food service departments to deal friendly with patients and staff who receive meal services in the hospital.	3.71	1.00	high
COM4	There are staff from the catering departments who handle complaints from patients and staff about catering services within the hospital.	3.53	0.90	average
COM2	Food service departments list the food available to employees on a daily basis.	3.49	1.10	average
	total degree	3.67	0.72	average

The results show that Customer Satisfaction concerning Communication with the food services was on an average degree with a mean equal to (3.67). The most important item

concerning the Communication section was " The employees of the catering services departments are in constant contact with patients and workers regarding catering services" (3.83), followed by " Meals are provided to patients within the hospital based on the recommendations of the nursing department" (3.78), then comes " Hospital management urges workers in food service departments to deal friendly with patients and staff who receive meal services in the hospital" (3.71), followed by "There is staff from the catering departments who handle complaints from patients and staff about catering services within the hospital" (3.53), and last comes " Food service departments list the food available to employees daily" with mean equal to (3.49).

This means that customers are satisfied well with the provided food services, and they trust the food services provided in the hospital more than other hospitals. In addition, the food services staff communicates respectfully and asks for feedback from patients frequently. In conclusion, we can say that whenever measuring customer satisfaction on provided services, those three dimensions are the most important, because quality of service leads to trust and better communication.

4.3 Results of Examining Hypothesis

Main Hypothesis:

H_o: There is no potential for applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital.

To examine this hypothesis, one sample T-Test has been applied using SPSS v22, and the results are revealed as Table 4.17 shows:

Table 4. 17: One sample T-test results for differences between LSS and DMAIC

Variable	N	Mean	Std. Deviation	d.f.	t	p-value
Lean management tools	94	3.82	0.62	93	12.800	0.000
DMAIC	94	3.70	0.65	93	10.496	0.000

The results show that the Lean management tools and DMAIC were applied to a high degree, the lean management tools were applied with a mean equal to (3.82), and DMAIC were applied with a mean equal to (3.70).

This means that there is a potential for applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital. Therefore, the null hypothesis is rejected, and the alternative hypothesis is accepted.

H0 (1): There are no significant differences among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to Gender.

Table 4. 18: T-test results for the differences among Gender

Gender	N	Mean	Std. Deviation	d.f.	T	p-value
Male	41	3.96	0.61	92	1.903	0.060
Female	53	3.72	0.62			

The results of the t-test show that there are no significant differences at ($\alpha \leq 0.05$) among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to the Gender variable. (p-value= 0.060>0.05). This means that both genders males and females confirm that there is a potential of applying lean six sigma tools for food waste at Bethlehem Arab Rehabilitation Society Hospital.

H0 (2): There are no significant differences among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to Practical Experience.

Table 4. 19: ANOVA test results for the differences among Practical Experience

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.566	3	0.522	1.361	0.260
Within Groups	34.118	89	0.383		
Total	35.684	92			

The results of the ANOVA test show that there are no significant differences at ($\alpha \leq 0.05$) among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to the Practical Experience variable. (p-value= 0.260>0.05). This means that employees at the hospital within all categories of experience confirm that there is a potential of applying Lean Six Sigma tools for food waste at Bethlehem Arab Rehabilitation Society Hospital.

H0 (3): There are no significant differences among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to Educational Level.

Table 4. 20: ANOVA test results for the differences among Educational Level

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.952	2	0.476	1.314	0.274
Within Groups	32.251	89	0.362		
Total	33.204	91			

The results of the ANOVA test show that there are no significant differences at ($\alpha \leq 0.05$) among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to the Educational Level variable. (p-value= 0.274>0.05). This means that all employees within different educational levels confirm that there is a potential of applying lean six sigma tools for food waste at Bethlehem Arab Rehabilitation Society Hospital.

H0 (4): There are no significant differences among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to Position at the Hospital.

Table 4. 21: ANOVA test results for the differences among Positions at the Hospital

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.129	3	1.710	4.960	0.003
Within Groups	30.679	89	0.345		
Total	35.808	92			

The results of the ANOVA test showed that there are significant differences at ($\alpha \leq 0.05$) among applying Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital, according to the Position at the Hospital variable. (p-value= 0.003<0.05).

Table 4. 22: Tukey test for the differences among Positions at the Hospital variable

Comparisons	Nurse	Doctor	Administrative	Other
Nurse		0.639	0.167	0.517**
Doctor			-0.471	-0.121
Administrative				0.350
Other				

The results of the Tukey test show that the differences were between the nurse and other positions, in favor of nurses, who apply Lean Six Sigma Tools for Food Waste Reduction in Bethlehem Arab Rehabilitation Society Hospital more than others.

Table 4. 23: Means, and Std. Deviations for differences between Positions at the Hospital

Position at Hospital	N	Mean	Std. Deviation
Nurse	63	3.98	0.55
Doctor	2	3.34	0.89
Administrative	4	3.81	0.47
Other	24	3.46	0.68

Testing Hypothesis 6 & 7:

H6: There is no impact of applying LSS tools on customer satisfaction in the Arab Rehabilitation Society hospital in Bethlehem.

H7: There is no impact of food waste and food reduction on customer satisfaction in the Arab Rehabilitation Society hospital in Bethlehem.

To test the hypotheses that Lean Six Sigma and Food Waste Reduction have no impacts on Customer satisfaction in the Bethlehem Arab Society for Rehabilitation, the multiple linear

regression analysis is used. This analysis is selected since we are interested in explaining the variance in one dependent variable (customers' satisfaction) using more than one independent variable (LSS & Food Waste Reduction).

But before running the multiple regression model, it is important to check the adequacy of the regression. More specifically, the order of the regression model has to be checked. For example, if a multiple linear regression model is to be run, it is assumed that the phenomenon behaves linearly (linearity assumption). In addition, the errors are assumed to be normally distributed. Moreover, the errors are assumed to have constant variance (homoscedasticity assumption). Each of these assumptions is briefly discussed below.

Linearity requires that the independent variables in the regression model have a straight-line (linear) relationship with the dependent variable. To test the assumption of linearity, the scatter plot matrix between LSS and customer Satisfaction, in addition to Food Waste Reduction and customer satisfaction is shown in Figure 4.1, 4.2.

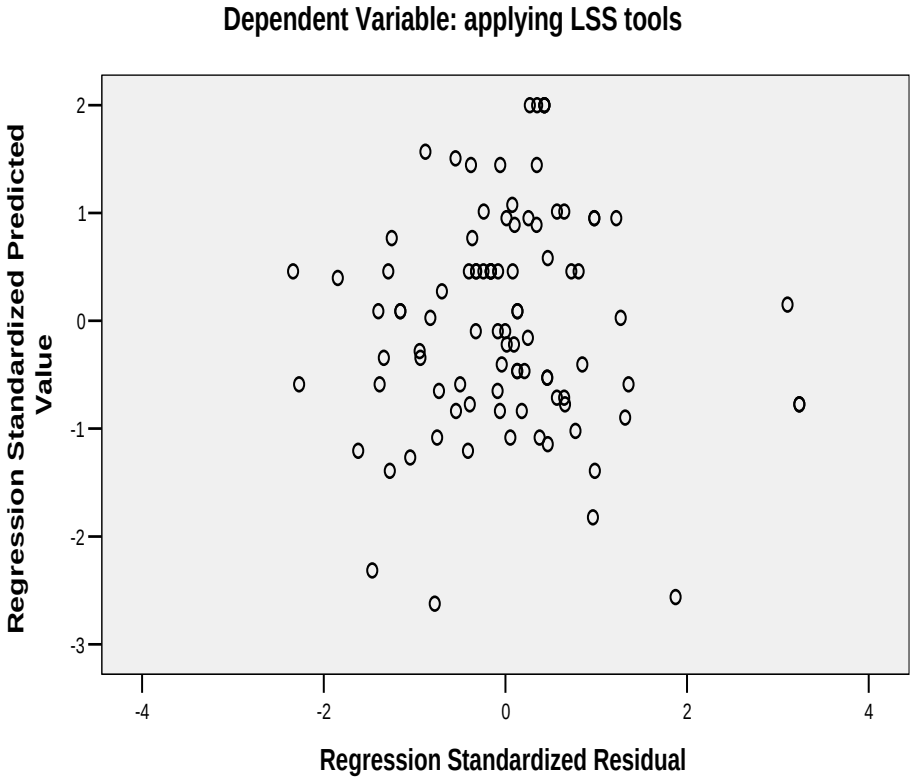


Figure 4. 1: Scatter Plot Matrix for LSS

It is clear from Figure 4.1 that applying lean six sigma in the hospital and its relationship with customer satisfaction is linear.

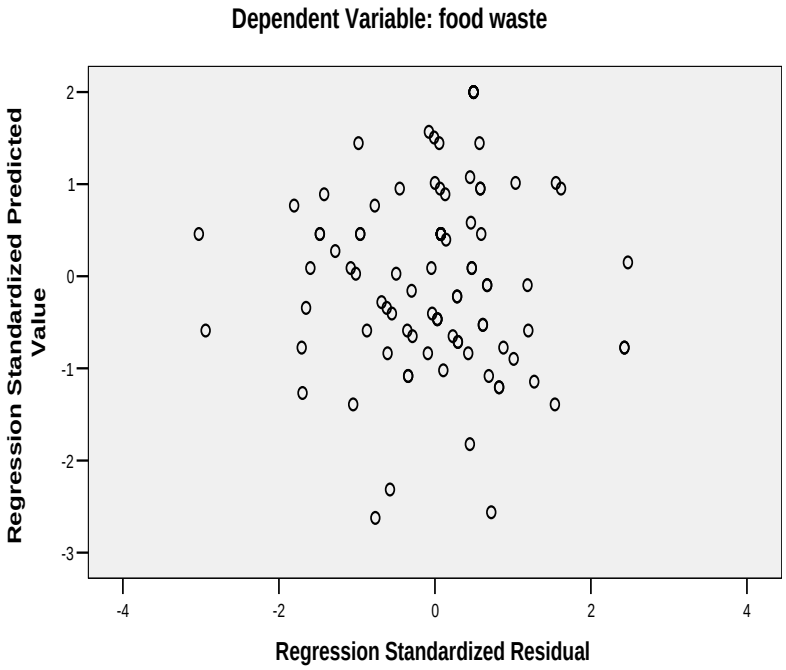


Figure 4. 2: Scatter Plot Matrix for Food Waste Reduction

It is clear from the scatter plot matrix that the relationship between Food Waste Reduction and customer satisfaction is linear. Therefore, the multiple linear regression model is chosen. The normality assumption requires the residuals of the regression model to be normally-distributed. To test this assumption, the normal predicted probability (P-P) plot is used as shown in Figures 4.3, and 4.4.

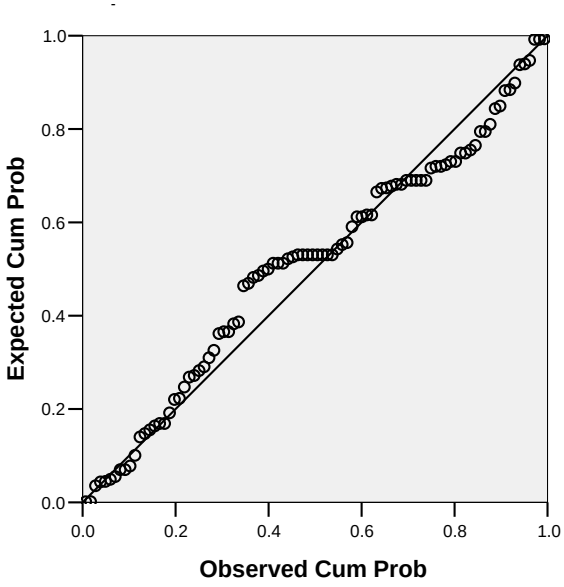


Figure 4. 3: P-P Plot of Regression Residuals for LSS

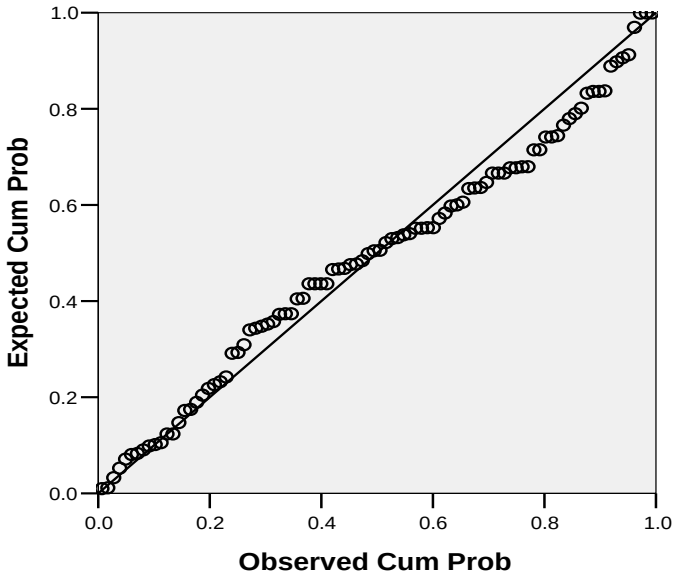


Figure 4. 4: P-P Plot of Regression Residuals for Food Waste Reduction

The P-P plots show that the little circles follow the normality line with a little bit of deviation. Therefore, the assumption that the residuals are normally distributed is established. The homoscedasticity assumption requires the variance of the residuals to be constant. To test this assumption, the standardized predicted values are plotted against the regression standardized residuals as shown in Figures 4.3, and 4.4. The scatter plots in Figures 4.1, and 4.2 show that as the regression predicted values increase, the variation in the regression residuals is roughly the same. Therefore, the homoscedasticity assumption is established.

Testing the Significance of the Regression Model

The overall significance of the regression model is tested using the analysis of variance (ANOVA) as shown in Table 4.24:

Table 4. 24: ANOVA Test for Significance of Regression Model

Model	Some of Squares	Degrees of Freedom	Mean Square	F-Statistic	Sig.
Regression	24.485	1	24.485	194.938	0.000*
Residual	11.555	92	0.126		
Total	36.040	93			

* The regression model is significant at the 0.001 level.

The ANOVA Table indicates that the F-value of 94.938 is significant at the 0.0001 level. This means that the overall regression model is significant. Under the "Degrees of Freedom" in the same Table, the first number represents the number of independent variables (1), the second number (92) is the total number of complete responses for all the variables in the regression model (93), minusthe number of independent variables (2) minus 1.

Tests on Individual Regression Coefficients

The results of regressing the Lean Six Sigma tools and Food Waste Reduction on customers' satisfaction in the Bethlehem Arab Society Hospital are shown in Table 4.25.

Table 4. 25: Results of Regression Analysis

Constant and Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	0.894	0.213		4.202	0.000*
Customer Satisfaction	0.791	0.057	0.824	13.962	0.000*

* Significant at the 0.001 level, ** Significant at the 0.05 level

Table 4.25 indicates that the results of the linear regression indicate that there is an impact of applying LSS tools on customer satisfaction in the Arab Rehabilitation Society hospital in Bethlehem, (p-value = 0.000 <0.05), and 67.9% of the patient's satisfaction was explained by applying LSS tools as indicated from (R square) in Table 4.26:

Table 4. 26: Linear Regression Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.824	0.679	0.676	0.35440

In addition, the results of the linear regression indicate that there is an impact of food waste and food reduction on the customer's satisfaction in Arab Rehabilitation Society hospital in

Bethlehem, (p-value = 0.000 <0.05), and 53.7% of the patient's satisfaction were affected by food waste and food reduction as indicated from (R square) in Table 4.27:

Table 4. 27: Linear Regression Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.732	0.537	0.532	0.48338

This result is compatible with Ben Ruben et al. (2017), who stated that Lean Six Sigma is an effective information-driven strategic method of thinking that is centered on eliminating waste, reducing process variation, and providing the best possible customer experiences and satisfaction. As well, consumer satisfaction was considered the primary goal of LSS, along with cultural change and a shift in employee perspectives (Mustapha et al., 2019; Kumar et al., 2006), when both studies concluded that productive collaboration, LSS working gatherings, team member responsibilities, and obligations, lead to the integration of LSS with consumer satisfaction.

This means that H6 and H7 are not supported, and the alternative hypotheses are supported.

Chapter Five: Conclusions and Recommendations

5.1 Introduction

In this chapter, the conclusions and recommendations are presented, which might be beneficial for the management of Bethlehem Arab Society for rehabilitation toward developing the use of Lean Six Sigma and quality management. Moreover, this chapter presents suggestions for future studies and the limitations of the recent study.

5.2 Conclusion

Based on the results of the study we can conclude that:

1- There is a potential to apply Lean Six Sigma to reduce food waste at Bethlehem Arab Society for Rehabilitation.

2- The senior management of the hospital is involved in applying the Lean Six Sigma strategy and controlling the overall process and procedures.

3- The food services department is applying steps and procedures that relate to Lean Six Sigma strategy and procedures, but there are no initiatives toward formalizing the appliance of Lean Six Sigma.

4- Despite some tools and functions running in a moderate degree, the management can develop and improve those functions, because it has the vision and skills toward applying the lean six sigma management tools.

5- Customers are satisfied with the food services provided by the hospital in terms of the quality of products and services provided.

6- Food service providers' "staff" frequently communicate with patients and employees, toward gaining feedback about the food services. Which allows food service providers to improve the weaknesses of the food services.

7- The frequent communication between food service providers and customers besides improving the services upon the feedback of customers, plays a vital role in building trust between providers of the food services and the customers.

8- Customer satisfaction is affected by applying the Lean Six Sigma management tools, and food waste reduction strategies.

5.3 Recommendations

Based on the results and conclusion the authors recommend the following:

- The hospital's food services division must proactively promote and spread policies built on a resource-efficient supply chain that takes into account the entire production system.
- Food service providers need to place more emphasis on identifying suitable substitute uses for leftover raw materials as well as composting options, as well as decreasing raw material waste as much as is practically practicable.
- Food services staff and healthcare staff must develop their communication skills with patients and their relatives, to obtain higher customer satisfaction.
- Food service helpers are better able to grasp the unique requirements of residents and patients when they have access to the nutrition biographies of the individuals.
- In the healthcare industry, innovative solutions are required to optimize organization-specific food supply procedures. In general, it is best to avoid moving food waste up the supply chain.

5.4 Future Researches

This study recommends researchers study the potential of applying lean six sigma toward food waste reduction in public hospitals, restaurants, hotels, and other places that provide food services; as well as to apply this study from the perspectives of customers. In addition, it is recommended to measure the mediating role of food waste reduction in the relationship

between Lean Six Sigma management tools and customer satisfaction. Additionally, research on the use of digital applications and how they contribute to reducing food waste as well as implementing lean six sigma, within the extensive usage of modern information and communications technology (ICT), is advised.

5.5 Limitations of the Study

- The study has been conducted based on a random sampling technique, which covers 87 % of the whole representative sample.
- The study is limited to national development NGO employees, in which there might be different results when applying the study at public or private hospitals.
- The study is limited to the employees of the hospital, in which the results reflect the employees' point of view.

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Appendices:

Appendix A

Questionnaire in English:

Questionnaire

Ladies/gentlemen

The researcher is conducting a study entitled:

Evaluation of the possibility of applying Lean Six Sigma tools to reduce food waste in the Arab Rehabilitation Society Hospital in Bethlehem

This study aims to examine the extent to which the Arab Rehabilitation Society Hospital in Bethlehem can apply lean management tools in order to develop its services and meet the needs of its beneficiaries.

This study comes as a completion of the requirements for obtaining a master's degree in the (Quality Management) program from the Arab American University.

In order to achieve this goal, I request your assistance in providing honest, accurate, and objective answers to the questions contained in this questionnaire, which depend on your experience, noting that filling out the questionnaire takes approximately 5 minutes.

With an emphasis that all data will be treated in strict confidentiality and will only be used for scientific research purposes. If you have any questions, you can e-mail me at:

Student: Raghda Al-Ama

First Section: Demographic Information

Gender	☐Male ☐Female
Age	☐20-29 ☐30-39 ☐ 40-49 ☐ 50 Years and More
Years of Experience	☐1-5 ☐6-10 ☐11-15 ☐16-20 ☐ 21 Years and More
Education	☐Diploma ☐Bachelor ☐High Diploma ☐Graduate Studies ☐Other/Specify: ……
Position at Hospital	☐Nurse ☐Doctor ☐Administrative ☐Other/Specify:…….

Second Section: Lean Management Tools

This section consists of 5 parts, please answer all of them, by placing a circle around the number that represents the best description, so that the score is divided from (1-5) as shown below, noting that the higher number indicates the highest degree of agreement while the number indicates least to the lowest degree of approval

#	Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1- Organizing Workplace						
A. Sorting						
SO1	Food is distributed and served within the hospital in an efficient and non-random manner.					
SO2	Meals within the hospital are divided into meals for patients and meals for staff.					
SO3	The equipment necessary for eating meals is placed in places close to patients and hospital staff.					
SO4	Labels and stickers are used on meals for patients and staff.					
B. Set In Order						
SIO1	Files and tools related to providing meals to patients and staff are classified and arranged effectively and clearly.					

SIO2	The equipment for eating meals was quickly serviced.					
SIO3	Tools related to preparing and eating meals are returned to their place once they are used.					
SIO4	Arranging where to eat meals takes a short time.					
SIO5	Safety requirements are provided where meals are eaten.					
C. Shine						
S1	The place for eating meals, whether for patients or workers, is always clean.					
S2	The meals provided are in good condition.					
S3	Cupboards and table tops used for serving and eating food are kept clean and in good condition.					
S4	The environment where food is eaten is clean and hygienic.					
D. Standardization						
ST1	Continuous improvement projects for the process of providing meals to patients and hospital staff are implemented according to clear and written procedures: such as identifying weaknesses that need improvement, measuring their importance and necessity, and others.					
ST2	Written steps are adhered to for each catering process.					
ST3	There is discipline in the process of providing food to patients and workers in terms of time.					
ST4	Scientific methods are used while making decisions about serving meals to patients and staff.					
E. Sustainability						
SU1	The hospital employs full-time and part-time staff to improve catering services for patients and staff.					
SU2	In the hospital, compliance with the system is monitored and followed up in the departments responsible for providing food services.					
SU3	The hospital uses a variety of training so that workers in food service departments can acquire the knowledge and skills necessary to fulfill their responsibilities.					

SU4	The hospital incentivizes the food preparation and service department that implements workplace organization processes.					
SU5	There is a checklist with food service providers for each stage of providing food services to patients and hospital staff.					
2. Waste Elimination						
WE1	The hospital translates patients' and staff's needs and expectations about the food services provided into quality goals					
WE2	In the hospital, performance measures are linked to strategic quality objectives related to catering services.					
WE3	The hospital systematically uses a set of metrics as indicators of catering ability to assess improvements in catering.					
WE4	The hospital works in an organized manner to detect different types of waste and try to get rid of them					
3. Process Efficiency						
PE1	Food service delivery processes for patients and staff are studied and reviewed to make improvements on an ongoing basis.					
PE2	Clear instructions for work are given to workers in food service departments.					
PE3	Statistical techniques are widely used to reduce variance in food service delivery processes.					
PE4	The hospital focuses on human resources in terms of high cohesion and morale in the food service departments.					
PE5	The quantities of resources and materials needed to provide services and meals in the hospital are checked periodically, such as: the process of rationalizing resource consumption.					
4. Quality of Product/Service						
QP1	The quality of catering services is emphasized, especially with regard to the time of service and the quality of products.					
QP2	The various departments concerned with catering services within the hospital coordinate with each other in					

	the process of developing catering services.					
QP3	In general, in the process of manufacturing meals provided to patients and staff, an effort is made to provide them in a high quality manner.					
QP4	Clearly required steps are adhered to in the food service delivery process.					

Third Section: DMAIC Model

#	Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Definition						
D1	There is complete and comprehensive clarity among patients and hospital staff about catering services.					
D2	The hospital administration includes fixed paragraphs in its meetings on the quality of catering services.					
D3	Patients and hospital staff are fully aware of the horizontal and vertical ways of communication between departments and departments regarding catering services.					
D4	The hospital administration is ready to detect and treat problems with the quality of catering services.					
D5	The hospital administration is aware of the concepts, principles and tools related to the Six Sigma methodology related to catering services.					
2. Measurement						
M1	The hospital administration adopts a documented context to accurately determine and review the requirements for food services and meals for patients and hospital staff.					
M2	The ability of the hospital administration to meet the requirements of patients and staff with regard to catering services is constantly evaluated.					
M3	The hospital management implements effective arrangements to deal with the feedback and observations from patients and hospital staff about the catering services.					
M4	The hospital administration employs new people with experience and competence with quality requirements in the catering					

	services departments in accordance with the quality requirements related to catering services.					
M5	The hospital administration is seeking to change the operations related to catering services to patients and their staff that take place within the hospital in order to achieve quality.					
3. Analysis						
A1	The hospital administration applies several strategies and methodologies in order to identify the causes of problems related to catering services within the hospital.					
A2	The hospital administration has the infrastructures in order to determine the requirements for future tasks regarding services for providing meals to patients and workers.					
A3	The hospital administration applies statistical methods to control the quality of catering services.					
A4	The hospital administration uses analysis tools commensurate with the required accuracy of the results of the process of providing food to patients and workers.					
A5	The hospital administration applies various methodologies in order to analyze future risks that may face the process of providing food services to patients and workers, and work to avoid them.					
4. Improvement						
I1	The hospital administration is keen on continuous improvement efforts in the catering departments.					
I2	The hospital management focuses on continuous improvement programs to achieve quality goals within the quality policy and data analysis related to catering services.					
I3	The hospital administration works on continuous improvement of the quality of catering services to raise the level of patient and staff satisfaction.					
I4	The hospital administration takes appropriate measures to remove the causes and problems of the quality of providing food services and to prevent their recurrence.					

I5	The hospital management believes that the continuous improvement of catering services for patients and employees provides the necessary environment for applying the Six Sigma methodology					
5. Control						
C1	The hospital employs workers in the catering services departments with appropriate skills.					
C2	Workers in the catering services departments are characterized by specialized education, skill and experience to achieve the required quality.					
C3	The hospital administration encourages the enrollment of workers in the catering services departments in the courses of contemporary quality programs internally and externally.					
C4	The hospital administration has financial allocations for training activities directed towards the quality of catering services.					
C5	The hospital administration can, with the help of self-resources, train workers in the catering services departments on the concepts and tools of the Six Sigma methodology.					

Fourth Section: Customer Satisfaction

#	Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A. Quality						
QU1	Patients and hospital staff are well satisfied with the catering staff's treatment of them.					
QU2	Patients are satisfied with the decision to choose the hospital in terms of catering services.					
QU3	Patients are generally satisfied with the catering services provided within the hospital.					
QU4	Hospital workers consider catering services a job advantage that they are satisfied with.					
B. Trust						
TR1	The service is provided in a timely manner to the patient and the staff.					

TR2	The follow-up of the workers in the departments providing food services to the needs of patients and workers inside the hospital is good.					
TR3	Patients and hospital staff trust the quality of the food service provided by the hospital.					
C. Communication						
COM1	The employees of the catering services departments are in constant contact with patients and workers regarding catering services.					
COM2	Food service departments list the food available to employees on a daily basis.					
COM3	Meals are provided to patients within the hospital based on the recommendations of the nursing department.					
COM4	There are staff from the catering departments who handle complaints from patients and staff about catering services within the hospital.					
COM5	Hospital management urges workers in food service departments to deal friendly with patients and staff who receive meal services in the hospital.					

Appendix B

استبيان جمع معلومات

السيدات/ السادة المحترمون

تجري الباحثة دراسة بعنوان:

تقييم إمكانية تطبيق أدوات ستة سيجما الرشيقة للتقليل من هدر الطعام في مستشفى الجمعية العربية للتأهيل في بيت لحم

حيث تهدف هذه الدراسة الى فحص مدى امكانية مستشفى الجمعية العربية للتأهيل في بيت لحم لتطبيق ادوات الادارة الخالية من الهدر من أجل تطوير خدماتها وتلبية احتياجات المستفيدين من خدماتها.

وتأتي هذ الدراسةاستكمالاً لمتطلبات الحصول على درجة الماجستير في برنامج (إدارة الجودة) من الجامعة العربية الأمريكية.

ومن أجل تحقيق هذه الغاية، أرجو مساعدتكم في توفير إجابات صادقة، دقيقة، وموضوعية على الأسئلة الواردة في هذا الاستبيان والتي تعتمد على خبرتكم، علماً بأن تعبئة الاستبانة تستغرق 5 دقائق تقريباً.

مع التأكيد على أنه سيتم التعامل مع جميع البيانات بسرية تامة ولن يتم استخدامها الا لأغراض البحث العلمي. إذا كان لديكم أي استفسار، يمكنكم مراسلتي على البريد الإلكتروني:

البريد الالكتروني:

الطالبة: رغدة الأعمى

القسم الأول: معلومات ديمغرافية

الجنس	☐ذكر ☐أنثى
العمر (بالسنوات)	☐ 29-20 ☐ 39-30 ☐ 49-40 ☐ 50 فأكثر
عدد سنوات الخبرة	☐1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21 سنة فأكثر
المؤهل العلمي	☐ دبلوم ☐ بكالوريوس ☐ دبلوم عالي ☐ دراسات عليا ☐غير ذلك (يرجى التحديد): .....
العمل داخل المشفى	☐ممرض☐ طبيب ☐موظف إداري ☐غير ذلك (يرجى التحديد): .....

القسم الثاني: أدوات الإدارة الخالية من الهدر

تكون هذا القسم من 5 أجزاء، يرجى الإجابة عليها جميعاً، وذلك بوضع دائرة حول الرقم الذي يمثل أفضل وصف، بحيث يتم تقسيم الدرجة من (1-5) كما هو موضح أدناه، مع ملاحظة أن الرقم الأعلى يشير إلى أعلى درجة موافقة بينما يشير الرقم الأقل إلى أدنى درجة موافقة

#	الفقرة	أو افق بشدة	أو افق	محايد	أعارض	أعارض بشدة
1- تنظيم موقع العمل "5s"						
أ- التصنيف "Sorting"						
SO1	يتم توزيع وتقديم الطعام داخل المستشفى بطريقة فعالة وتخلو من العشوائية.					
SO2	يتم فرز وجبات الطعام داخل المستشفى إلى وجبات مخصصة للمرضى ووجبات مخصصة للعاملين.					
SO3	يتم وضع المعدات اللازمة لتناول وجبات الطعام في أماكن قريبة من المرضى والعاملين بالمستشفى.					
SO4	يتم استخدام العلامات والملصقات على وجبات الطعام للمرضى والعاملين.					
ب- تنظيم موقع العمل "Set in Order"						
SIO1	يتم تصنيف الملفات و الأدوات المتعلقة بتقديم وجبات الطعام للمرضى والعاملين و ترتيبها بشكل فعال وواضح.					
SIO2	تم صيانة المعدات المتعلقة بتناول وجبات الطعام بشكل سريع.					
SIO3	يتم إرجاع الأدوات المتعلقة بتحضير وتناول وجبات الطعام إلى مكانها فور الانتهاء من استخدامها.					
SIO4	ترتيب مكان تناول وجبات الطعام يحتاج إلى وقت قصير.					
SIO5	متطلبات السلامة متوفرة في مكان تناول وجبات الطعام.					

ت- النظافة "Shine"						
C1	مكان تناول وجبات الطعام سواء للمرضى أو العاملين يتسم بالنظافة بشكل دائم.					
C2	وجبات الطعام المقدمة تكون في حالة جيدة.					
C3	الدواليب وأسطح الطاولات المستخدمة لتقديم الطعام وتناوله تبقى نظيفة وفي حالة جيدة.					
4C	بيئة المكان الذي يتم فيه تناول الطعام نظيفة وصحية.					
ث- التنميط "Standardization"						
ST1	يتم تنفيذ مشاريع التحسين المستمر لعملية تقديم وجبات الطعام للمرضى والعاملين بالمستشفى وفقاً لإجراءات واضحة ومكتوبة: مثلتحديد نقاط الضعف التي بحاجة إلى التحسين، وقياس أهميتها وضرورتها وغيرها.					
ST2	يتم الالتزام بالخطوات المكتوبة لكل عملية تقديم طعام.					
ST3	هنالك انضباط في عملية تقديم الطعام للمرضى والعاملين من الناحية الزمنية.					
ST4	يتم استخدام الأساليب العلمية أثناء اتخاذ القرارات المتعلقة بتقديم وجبات الطعام للمرضى والعاملين.					
ج- التثبيت "Sustainability"						
SU1	يستخدم المستشفىطاقم بدوام كامل وبدوام جزئي لتحسين خدمات تقديم الطعام للمرضى والعاملين.					
SU2	يتم في المستشفى مراقبة ومتابعة الالتزام بالنظام في الأقسام المسؤولة عن تقديم خدمات الطعام.					
SU3	يستخدم المستشفىتدريباًمتنوعاً حتى يتمكن العاملين في أقسام تقديم خدمات الطعام من الحصول على المعرفة والمهارات اللازمة للوفاء بمسؤولياتهم.					
SU4	يقوم المستشفى بتحفيز قسم تحضير وتقديم خدمات الطعام التي تطبق عمليات تنظيم موقع العمل.					
SU5	توجد قائمة تفتيش مع مقدمي خدمات الطعام لكل مرحلة من مراحل تقديم خدمات الطعام للمرضى داخل المستشفى والعاملين فيه.					
2- الحد من الهدر"Waste Elimination"						
WE1	يترجم المستشفى احتياجات المرضى والعاملين فيه وتوقعاتهم حول خدمات الطعام المقدمة إلى أهداف جودة					
WE2	في المستشفى ترتبط مقاييس الأداءبأهداف الجودة الاستراتيجية المتعلقة بخدمات تقديم الطعام.					
WE3	يستخدم المستشفى بشكل منهجي مجموعة من المقاييس كمؤشرات لقدرة خدمات تقديم الطعام لتقييم تحسينات عملية تقديم الطعام.					
WE4	يعمل المستشفى بشكل منظم على كشف انواع الهدر المختلفة ومحاولة التخلص منها					

3- فعالية العمليات "Process Efficiency"						
PE1	يتم دراسة ومراجعة عمليات تقديم خدمات الطعام للمرضى والعاملين لإجراء تحسينات بشكل مستمر.					
PE2	يتم إعطاء تعليمات واضحة للعمل للعاملين في أقسام تقديم خدمات الطعام.					
PE3	يتم استخدام التقنيات الإحصائية على نطاق واسع لتقليل الاختلاف في عمليات تقديم خدمات الطعام.					
PE4	يركز المستشفى على الموارد البشرية من حيث التماسك العالي والروح المعنوية في أقسام تقديم خدمات الطعام.					
PE5	يتم التأكد بشكل دوري من كميات الموارد والمواد اللازمة لتقديم خدمات ووجبات الطعام في المستشفى، مثل: عملية ترشيد استهلاك الموارد.					
4- جودة المنتج / الخدمة "Quality of Product / service"						
QP1	يتم التأكيد على جودة خدمات تقديم الطعام و خاصة فيما يتعلق بوقت تقديم الخدمة و جودة المنتجات .					
QP2	تنسق الإدارات المتعددة المعنية بخدمات تقديم الطعام داخل المستشفى بين بعضها في عملية تطوير خدمات تقديم الطعام.					
QP3	بشكل عام، في عملية تصنيع وجبات الطعام المقدمة للمرضى والعاملين يتم بذل جهد لتقديمها بشكل ذات جودة عالية.					
QP4	يتم الالتزام بالخطوات المطلوبة بوضوح في عملية تقديم خدمات الطعام.					

القسم الثالث: نموذج ستة سيجما (DMAIC)

الرقم	الفقرة	أو افق بشدة	أو افق	محايد	أعار ض	أعارض بشدة
1- التعريف						
D1	هنالك وضوح كامل وشامل لدى المرضى والعاملين بالمستشفى حول خدمات تقديم الطعام.					
D2	تدرج إدارة المستشفى فقرات ثابتة في اجتماعاتها عن جودة خدمات تقديم الطعام.					
D3	المرضى والعاملين في المستشفى يدركون بشكل كامل طرق الاتصال الأفقية والعمودية بين الدوائر والأقسام فيما يتعلق بخدمات تقديم الطعام.					
D4	إدارة المستشفى مستعدة للكشف عن مشكلات جودة خدمات تقديم الطعام وعلاجها.					
D5	إدارة المستشفى على اطلاع بالمفاهيم والمبادئ والأدوات ذات العلاقة بمنهجية ستة سيجما المتعلقة بخدمات تقديم الطعام.					
2- القياس						
M1	تعتمد إدارة المستشفى سياق موثق للتحديد الدقيق لمتطلبات خدمات ووجبات الطعام للمرضى والعاملين في المستشفى ومراجعتها.					

M2	تقيَم باستمرار مقدرة إدارة المستشفى على تلبية متطلبات المرضى والعاملين فيما يتعلق بخدمات تقديم الطعام.					
M3	تنفذ إدارة المستشفى ترتيبات فاعلة للتعاطي مع التغذية الراجعة والملاحظات من المرضى والعاملين في المستشفى حول خدمات تقديم الطعام.					
M4	تقوم إدارة المستشفى بتوظيف أشخاص جدد ذو خبرة وكفاءة بمتطلبات الجودة في أقسام خدمات تقديم الطعام وفقاً لمتطلبات الجودة المتعلقة بخدمات تقديم الطعام.					
M5	تسعى إدارة المستشفى إلى عملية تغيير للعمليات المتعلقة بخدمات تقديم الطعام للمرضى والعاملين فيها التي تتم داخل المستشفى بهدف تحقيق الجودة.					
3- التحليل						
A1	تقوم إدارة المستشفى بتطبيق عدة استراتيجيات ومنهجيات لهدف التعرف على أسباب المشاكل التي تتعلق بخدمات تقديم الطعام داخل المستشفى.					
A2	تتوفر في إدارة المستشفى البنى الارتكازية بهدف تحديد متطلبات المهام المستقبلية فيما يتعلق بخدمات تقديم وجبات الطعام للمرضى والعاملين.					
A3	تطبق إدارة المستشفى الأساليب الإحصائية في السيطرة على جودة خدمات تقديم الطعام.					
A4	تستخدم إدارة المستشفى أدوات تحليل تتناسب مع الدقة المطلوبة لنتائج عملية تقديم الطعام للمرضى والعاملين.					
A5	تقوم إدارة المستشفى بتطبيق منهجيات مختلفة بهدف تحليل المخاطر المستقبلية الذي قد تواجهعملية تقديم خدمات الطعام للمرضى والعاملين، والعمل على تجنبها.					
4- التحسين المستمر						
I1	تحرص إدارة المستشفى على جهود التحسين المستمر للوظائف في أقسام خدمات تقديم الطعام.					
I2	تركز إدارة المستشفى على برامج التحسين المستمر لتحقيق أهداف الجودة ضمن سياسة الجودة وتحليل البيانات المتعلقة بخدمات تقديم الطعام.					
I3	تعمل إدارة المستشفى على التحسين المستمر لجودة خدمات تقديم الطعام لرفع مستوى رضا المرضى والعاملين.					
I4	تتخذ إدارة المستشفى إجراءات مناسبة لإزالة أسباب ومشكلات جودة تقديم خدمات الطعام ومنع تكرارها.					
I5	تعتقد إدارة المستشفى ان التحسين المستمر لخدمات تقديم الطعام للمرضى والعاملين يوفر البيئة اللازمة لتطبيق منهجية ستة سيجما					
5- التحكم والسيطرة						
C1	يقوم المستشفى بتوظيف عاملين في أقسام خدمات تقديم الطعام بمهارات مناسبة.					

C2	العاملين في أقسام خدمات تقديم الطعام يتميزون بالتعليم المتخصص والمهارة والخبرة لتحقيق الجودة المطلوبة.					
C3	تشجع إدارة المستشفى على انخراط العاملين في أقسام خدمات تقديم الطعام في دورات برامج الجودة المعاصرة داخلياً وخارجياً.					
C4	تتوفر في إدارة المستشفى تخصيصات مالية للأنشطة التدريبية الموجهة نحو جودة خدمات تقديم الطعام.					
C5	تتمكن إدارة المستشفى وبالاستعانة بإمكانات ذاتية من تدريب العاملين في أقسام خدمات تقديم الطعام على مفاهيم وأدوات منهجية ستة سيجما.					

القسم الرابع: رضا الزبائن

#	الفقرة	أو افق بشدة	أو افق	محايد	أعارض	أعارض بشدة
-A	**Quality**					
QU1	المرضى والعاملين بالمستشفى راضون بشكل جيد عن معاملة موظفي خدمات تقديم الطعام لهم.					
QU2	المرضى راضون عن قرار اختيار المستشفى من حيث خدمات تقديم وجبات الطعام.					
QU3	المرضى راضون بشكل عام عن خدمات تقديم الطعام المقدمة داخل المستشفى.					
QU4	العاملين داخل المستشفى يعتبرون أن خدمات تقديم الطعام لهم ميزة وظيفية راضون عنها.					
-B	**Trust**					
TR1	تقدم الخدمة في وقتها للمريض والعاملين.					
TR2	متابعة العاملين في أقسام تقديم خدمات الطعام لاحتياجات المرضى والعاملين داخل المستشفى جيد.					
TR3	يثق المرضى والعامليناالمستشفى بنوعية وجودة خدمة تقديم الطعام التي تقدمها المستشفى.					
-C	**Communication**					
COM1	يقوم موظفي أقسام خدمات تقديم الطعام بالتواصل الدائم مع المرضى والعاملين فيما يتعلق بخدمات تقديم الطعام.					
COM2	تقوم أقسام خدمات الطعام بإدراج قائمة الطعام المتوفرة للعاملين بشكل يومي.					
COM3	تقدم وجبات الطعام للمرضى داخل المستشفى بناءً على توصيات قسم التمريض.					
COM4	هنالك موظفين من أقسام خدمات تقديم الطعام يقومون بمعالجة الشكاوى الواردة من المرضى والعاملين حول خدمات تقديم الطعام داخل المستشفى.					
COM5	تحث إدارة المستشفى العاملين في أقسام خدمات تقديم الطعام على التعامل الودود مع المرضى والعاملين الذين يتلقون خدمات وجبات الطعام في المستشفى.					

تقييم إمكانية تطبيق أدوات ستة سيجما الرشيقة للتقليل من هدر الطعام في مستشفى الجمعية العربية للتأهيل في بيت لحم

الباحثة: رغدة خالد الأعمى

إشراف: د. يحيى صالح

الملخص

تهدف هذه الدراسة إلى تقييم إمكانات تطبيق أدوات Lean Six Sigma للحد من هدر الطعام في مستشفى جمعية إعادة التأهيل العربية في بيت لحم. وبناءً على ذلك استخدمت الدراسة المنهج الوصفي والتحليلي المناسب لهدف الدراسة. وقد تم اتباع هذه الأساليب في جميع أدوات جمع البيانات المستخدمة في الدراسة، والإجراءات المتبعة لإنجاز الدراسة. وفقًا لموضوع الدراسة، تم استخدام منهج الأسلوب الكمي في جمع البيانات المطلوبة والشاملة من وجهة نظر الموظف. منذ ذلك الحين، تألف مجتمع الدراسة من جميع الموظفين العاملين في جمعية بيت لحم العربية لإعادة التأهيل، والذين يبلغ عددهم 150 موظفًا بما في ذلك (ممرضات، أطباء، إداريون). اتبع المؤلف أسلوب أخذ العينات العشوائية في جمع المعلومات المطلوبة من العاملين في المستشفى. وهكذا، شارك 94 موظفًا في جمعية بيت لحم العربية لإعادة التأهيل في الاستبيان.

وبناءً على ذلك، كشفت الدراسة أن أدوات الإدارة الرشيقة مستخدمة بشكل كبير في مستشفى الجمعية العربية للتأهيل في بيت لحم، بالإضافة إلى مكونات نموذج DMAIC. حيث خرجت عناصر القياس والتحكم الخاصة بـــ DMAIC بدرجة متوسطة. بالإضافة إلى ذلك، كشفت النتائج عن درجة عالية من رضا العملاء عن الخدمات الغذائية المقدمة في المستشفى، حيث جاء بعد الاتصال لرضا العملاء بدرجة متوسطة.

بناءً على ذلك، توصي الدراسة بضرورة أن يقوم قسم خدمات الطعام بالمستشفى بالترويج بشكل استباقي ونشر السياسات المبنية على سلسلة التوريد ذات الكفاءة في استخدام الموارد والتي تأخذ في الاعتبار نظام الإنتاج بأكمله. علاوة على ذلك، يحتاج مقدمو الخدمات الغذائية إلى التركيز بشكل أكبر على تحديد الاستخدامات البديلة المناسبة للمواد الخام المتبقية بالإضافة إلى خيارات التسميد، بالإضافة إلى تقليل نفايات المواد الخام بقدر ما هو ممكن عملياً. بالإضافة إلى ذلك، يجب على موظفي الخدمات الغذائية والعاملين في الرعاية الصحية تطوير مهاراتهم في التواصل مع المرضى وأقاربهم، من أجل الحصول على رضا العملاء بشكل أكبر.