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Improving Receiving and Storing Accessory Products at Al-Mimi United Company for Wood and Trading Using Lean Six Sigma Methodology

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Declaration

I'm Shawqi Abd-Al Rahman Mousa Alhaj Hasan, master candidate of Quality Management program, I bear witness that I have been adhering to all instructions, policies and guidelines related to Arab American University of Palestine. Moreover, I have restricted to all scientific and educational morals. I confirm that this master thesis is my own work, and I have documented all sources and materials used; no other work's has been used without acknowledgment. All references have been precisely quoted, and all sources of information have been specifically acknowledged. I would take the full responsibility if it's discovered that this master thesis has been accepted in any other previous application, in whole or in part.

Acknowledgement

I'm Shawqi Alhaj Hasan, I was born in the far north city in West Bank, Jenin. On 9th of July, 1993 I came to this life as a new chance of possessing a male-sex child for his parents, after my brother had been struck by a vehicle and went into four months of stupefaction. Through the six years after my coming, I used to be treated as a doll. Actually, a doll which controlled by his three sisters and one brother.

Therefore, I used to go anywhere they go, I eat anything they eat, I buy everything they buy and I used to have anything they have. Nevertheless, I was giving each of them everything I could. I would like to admit that I don't have enough fingers to point a blessing on whoever is responsible for giving me such a good life with great siblings.

I want to dedicate this thesis to my mother. Thank you for your unconditional encouragement, love, and support. I owe you everything in my life. I would never have been able to succeed and be here without you. I love you.

I also want to acknowledge the inspirational instruction and guidance of Dr. Ashraf Al-Mimi. Thank you for all the advice, feedback, encouragement and time you have given me.

I want to dedicate this work to my classmates who have been there for me during these past amazing two years, especially Ayman, Luna, Amaal, Ashraf, Renad and Baha.

I would like to give a special feeling of thanks and gratitude to Ahmad Faza' and YazanSabbah. You have always stood by my side, supported me, and believed in me. You will always be like brothers to me.

Abstract

In recent days, the domestic competition between wood companies has become more intense. Each one of them intends to focus its efforts on either improving the business operations or providing high quality products/services with reasonable prices, and the effect of such actions on the financial position of their companies. Thence, Al-Mimi United Company for Wood and Trading represented by its general manager and all employees of Ramallah branch, in cooperation with the researcher, being the team leader, has united to achievea mutual purpose.

At the outset, the team, which comprises six people, has decided based on customers' needs and the stakeholders' interests to reduce the amount of accumulated inactive accessory products (as the sales of accessory products was going into decreasing trend), hopefully aiming to improve Receiving and Storing Accessory Products. The Define phase has started by constructing a Project Charter, SIPOC diagram, Project Contract and have verified the data. In the second phase or Measure Phase, the objective was to understand Receiving and Storing Accessory Products' steps by drawing an integrated flow chart and conducting eight wastes analysis for each process step. As the Measure Phase endeavors to evaluate the current process performance, it was important to identify the accessory products' contribution to sales as a reliable measure or metric. A control chart was used to understand current performance of inactive accessory products' contribution to sales using 16data points.The control chart has an average inactive accessory products' contribution to sales of zero value and both the upper and lower control limits of the control chart also had a value of zero. That meant, Receiving and Storing Accessory Products at AUC-WT was suffering critical issue and it is necessary to investigate the main causes.

After full understanding of Receiving and Storing Accessory Productsat AUC-WT, the next step is to discover and understand the root causes of accessory products' accumulation. Therefore, by daily observations and brainstorming sessions the team proposed possible causes, and a cause and effect diagram based on eight P's categories (Price, Promotion, People, Process, Place, Policies, Procedures and Products) was created. As a result, it was concluded that the causes could be divided into two categories: 1- the causes of current accumulation of accessory products (Inappropriate warehouse layout, scrap and old products, no showroom for inactive products, having no special offers), 2- the causes of Receiving and Storing Accessory Products such as: selling with a relatively high price, lack of promotion and advertisements, lack of discipline and responsibility, no organizational structure and job descriptions, no systematic technique in ordering step and the lack of standardized storing procedures.

With regards to the Improve phase's purpose, the team was not aiming only to find solutions for current problem, but they also intended to prevent the causes from reoccurring in the future. Therefore, solutions were treating two kinds of causes: causes of current accumulation of accessory products and causes of Receiving and Storing

Accessory Products. Thence, the first kind of solutions are: first three steps of 5S tool (Sort, Shine and Straighten), creating showroom for inactive products, promoting all inactive products, and making a special price offers for customers. The other kind of improvements for Receiving and Storing Accessory Products which deemed as a preventive action are comprised of three main P's categories: Price (having a standard ordering technique and importing directly from foreign suppliers), Policies (outsourcing consultancy firm to build a new organizational structure, and job descriptions for accessory department employees) and Procedures (implementing 5S tool).

At the end, the team members have successfully achieved the desired outcomes and results, and they continually seek for continuous improvement. Therefore, a new detailed flowchart for Receiving and Storing Accessory Products at AUC-WT has been built, a control chart as a monitoring tool for the new process has been used and a checklist for the general manager has been created to make sure that employees will stick to instructions and procedures.

List of Abbreviations

- DMAIC: Define, Measure, Analyze, Improve and Control
- TQM: Total Quality Management
- JIT: Just-In-Time Manufacturing
- BPR: Business Process Reengineering
- LSS: Lean Six Sigma
- AUC-WT: Al-Mimi United Company for Wood and Trade
- UCL: Upper Control Limit
- LCL: Lower Control Limit
- DPMO: Defects Per Million Opportunity

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Chapter One: Introduction

1.1 Background

Worldwide economy has been changing in its conditions, such as global competition, reduction in operating and non-operating costs, growing profit margins, customers' seeking for high quality products and services etc., This resulted in a profound impact on institutes' own vision, culture, and their system thinking. In response to these changes, industries havebegun changing the current way of processing or implementing new fast-based quality management strategies and transforming strategies into implementation, such as, Total Quality Management, Kaizen, Just-in-time manufacturing, Lean Six Sigma and Business Process Reengineering etc. (Desai&Shrivastava, 2008).

Six Sigma is a philosophy properly defined as business performance improvement strategy that aims to reduce the number of defects to as low as 3.4 defects per million opportunities and the word sigma is defined as a statistical gauge of process observations' variation about the average for both service and manufacturing sectors. The methodology of Define, Measure, Analyze, Improve and Control (DMAIC) Six Sigma cycle for continuous improvement has been rapidly adopted regardless of the nature of industries, to improve productivity, flexibility, quality performance and to seek for robust process. Six Sigma is considered the most effective technique in quality management for enabling institutes to achieve essential enhancements in their front-line Gemba by designing and controlling everyday operating activities in ways which reduce all types of non-value added activities and maximize customers' satisfaction as high as possible. (Desai&Shrivastava, 2008). Antony(2004) defines six sigma as business improvement strategy intended to reduce wastes, costs of quality and enhance profitability and the effectiveness and efficiency of operational processes. Also, six sigma is defined as a business improvement methodology and program that aims to detect and remove causes of defects from product, process and transaction (Snee, 2004).

All organizations have to run in best efficient and effective way to survive and grow (Kumar &Kaushish, 2015). AUC-WT as well has to improve the quality of Recieving and Storing Accessory Products to be able to save more costs, exploit efficient layout of store and satisfy customers. Generally, the most concern for AUC-WT is the increasing of inactive products in warehouse. In addition to the main issue of accumulation of inactive products at Almimi United Company for Wood and Trading, the increasing of opportunity costs from storing inactive accessories and the ordering of unneeded items are related issues that need to be addressed.Therefore, this study will implement the Lean Six Sigma DMAIC methodology to clearly and thoroughly detect the root causes and provide solutions to decrease the quantity of inactive-selling supplies.

The expected accomplishments of this study is to reduce the percentage amount of total inactive products, increasing inactive products contribution's to sales revenue and saving opportunity cost from acquiring more store space in warehouse.

1.2 Company Profile

AUC-WT was established back in 1972 in Ramallah city as a family business. AUC-WT's mission statement is as follow: "To be the standard of excellence and the provider of high quality products and services for our customers in the woodworking and building industry. We continually strive for excellence by building and maintaining a team of professionally skilled and highly motivated employees who are responsible for providing quality wood and accessories products and services to our customers"

The company has two branches, the first in Ramallah industrial district and the second in Al-Ram city. The main products that the company sell are all types of wood, roof tiles, wood accessories and all carpentries' needs. The company has 35 employees and its customers spread in the middle and north of West Bank. Its customers include wholesalers, carpenters, contractors, engineers and end users. The list of the company's products includes:

1- All types of timber for construction.
2- All types of natural wood lumbers for kitchens, bed rooms, furniture, ETC,.
3- Two types of wooden panels (hardwood and softwood plywood).
4- Prefinished wood panels.
5- Hardwood and softwood veneers.
6- Composite wood Panels.
7- Decorative Overlays (Cabinet interiors and door backs, Modesty panels, Desk pedestals, Slot wall and various vertical surfaces, Bookcases, Cabinets and Shelving)
8- Iron corners and Profiles.
9- Bricks and brick woods.

1.3 Problem Statement

As mentioned before, the world has become highly competitive and aggressive, each organization seeks for excellence by improving its internal operations or providing good-quality service/ product. Since competition has been increased lastly in retail industryat Ramallah and the number of retailers is continuously increase,my problem statement is to limit the increasing amount of inactive accessory products using Lean Six Sigma Methodology.

1.4 Purpose of Study

The main purpose of this quantitative and qualitative study is to not only limit the increasing of inactive accessory products, but to decrease the products' amount and value in AUC-WT's Ramallah branch. In addition, investigate how Receiving and Storing Accessory Products would be improved through implementing Lean Six Sigma DMAIC methodologysince the phases included in lean six sigma could point out, detect, remove and improve many problems in the process.

1.5 Study Question

How implementing lean Six Sigma methodology would improve Receiving and Storing Accessory Products and reduce the value of total inactive accessory products?

1.6 Expected Outcomes

Following the implementation of improvements for Receiving and Storing Accessory Products at AUC-WT, the following include some of the main expected outcomes:

1- Reducing the total amount of inactive accessory products in AUC-WT's warehouse.
2- Increasing the sales contribution of total inactive accessory products.
3- Saving more opportunity cost by acquiring a space floor for storing.
4- Improving the Storing process, through storing all products in the right location by implementing the 5S lean management tool.
5- Improving the ordering process,by limiting unneeded amount of ordered product after implementing DMAIC methodology.
6- Identifying possible solutions to the price-issue for accessory products, and trying to create a new experience for existing customers in order to increase accessory's sales.

1.7 DMAIC Methodology

The DMAIC methodology which is one of the most efficient and effective quality management and continuous improvement methodology will be used. DMAIC problem solving, process improvement and change management style model of Lean Six Sigma will be implemented.

1.7.1 Study design

The DMAIC model consists of five associated phases (i.e. define, measure, analyze, improve and control) which followed in this study that consistently aids any organization to detect and solve problems and enhance its processes. According to Dale et al. (2007) DMAIC phases are defined as follows:

- Define Phase – this stage encompasses defining the strategic issues of process improvement, based on customers' requirements and expectations (voice of customers), forming team members and their roles, project scope and boundary, and the objective of selected study (Gijoet al. 2011).
- Measure Phase – this stage includes flowcharting, streamlining and standardizing the targeted process by identifying the detailed flowchart, quality concerns, eight wastes and quick wins. Also, it involves selecting the measurement factors that need improvement and defining a proper structure to asses, compare, monitor and evaluate current performance (Stamatis, 2003).
- Analyze Phase – this stage focuses on identifying sources of wastes, creating smooth flow and balancing the work. Moreover, it centers in determining root cases of defect

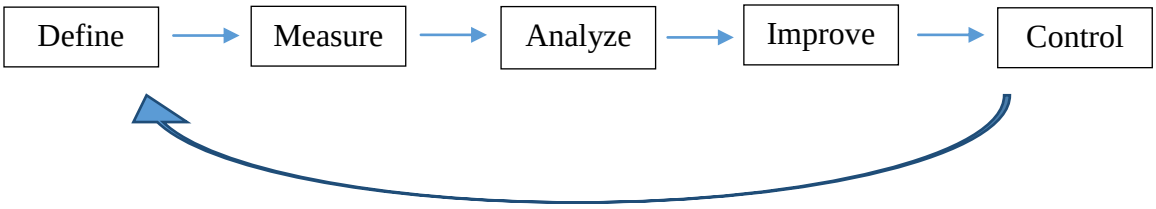
and understanding why causes have taken place in addition to prioritizing, verifying and selecting the root cause (Adamset al. 2003).

- Improve Phase – this stage defined as a step of testing possible improvements using experimental and statistical tools and gauges, studying and evaluating results and identifying the proper improvements, finally implementing selected actions to reduce the amount of quality problems (Omachonu& Ross, 2004).
- Control Phase – this final stage focuses on standardizing improvement actions to ensure that all improvements are persistent, continuous monitoring performance and finally documenting process improvements (Omachonu& Ross, 2004).

The DMAIC methodology is adopted to perform the improvement study since it provides a proven framework for problem solving. The DMAIC methodology based on three fundamental principles: first, result-focused; driven by data, facts and metrics. Secondly, project-based and project-structured. Finally, it consists of a combination of various tools, tasks and outcomes for each step and phase (Hambleton, 2007).

While data is being collected through Measure phase by reviewing literature, team member brainstorming and interviewing many company's employees, customers, suppliers, competitors and sufficient mining of information from BISAN accounting software, a proper statistical and quality management tools are identified to be executed in each phase of DMAIC model.

The DMAIC methodology follows the phases: define, measure, analyze, improve and control, which is implemented in this study as 1, 2, 3, 4 and 5 phases represented by figure 1 (Pyzdak& Keller, 2014). Although DMAIC methodology is being used as a general framework for this study, Plan-Do-Check-Act cycle is also being used in measure and improve phases of DMAIC.



(Figure 1:The DMAIC Methodology)

This study is based on practical research work executed by the project team as part of improving the Receiving and Storing Accessory Products at AUC-WT.

1.7.2 Targeted Group

As the study purpose is to improve Receiving and Storing Accessory Products, and this process is typically operated under different levels of management and different departments' employee. Therefore, the targetedgroup for this studydefined to include the general manager, top management, accounting department's employee, sales and marketing employees and Accessory products department's employees. As a result, the studytargeted group is consisting of 14 employees, all of these employees are male, two

of them are under 30 years old and the rest are above 30. All employees are living in Ramallah metropolis and its surroundings.

For some studies, the population may be small enough to guarantee the inclusion of all of them in the study. The population of this study is consisted only from 14 employees, in which the accessibility for all of them is somehow easy.According to that, the entire population is itself the target sample of this study.

Hence, we can conclude that the requested information is gathered from the whole population of 14 employees.This kind of sampling is called“census sampling” in which the sample is representative of the population because the sample is the population. This sampling method is being used, because the population base is small enough to adopt sampling technique.

1.7.3 Thesis Structure

This study has four main parts: an introduction, the literature review, DMAIC methodology and results, recommendations and lessons learned.

1- The introduction part explains what the thesis is bout: the problem that the thesis is concerned with, the purpose of study, the study question, expected outcomes, study methodology, historical background and company profile.
2- The literature review part which is the knowledge required before a reader can understand the study. This section consists of three main topics: Six Sigma (the origin of Six Sigma, the definition of Six Sigma, Six Sigma for all industries, requirements to apply Six Sigma perfectly), Lean Management (the origin of the Lean Thinking, the definition of Lean Thinking, eight wastes and Lean Management is not only for manufacturing sector) and Lean Six Sigma (the origin of Lean Six Sigma, definition of Lean Six Sigma, Lean Six Sigma is not restricted only on manufacturing sector, requirements needed to apply Six Sigma perfectly, DMAIC approach to reduce wastes and Lean Six Sigma in retail and supply chain industry).
3- The DMAIC Methodology part is the core work my study concerns with. It consists the five phases of DMAIC methodology: Define Phase, Measure Phase, Analyze Phase, Improve Phase and Control Phase. In each Phase, Lean tools and practices were used, besides to another helpful techniques.
4- The final part is defined as the conclusion part, which consists of three main sections: Results, Recommendations and Lessons Learned. In this part all the contributions of the study by executed interpretation and analysis has been illustrated and explained.

This study was started on February, 2018 and accomplished on July 2018. The table below provide further details about study milestones:

Milestone	Purpose	Start Date	End Date	Duration
• Idea Generation • Introduction • Literature Review	Submitting an efficient and effective master study.	1st of Febraury,2018	The end of February, 2018	**1 month**
Define Phase	Identifying the main issue to be improved.	1st of March, 2018	15th of March, 2018	**2 weeks**
Measure Phase	Collecting information and evaluate current performance of process	16th of March, 2018	23th of March, 2018	**1 week**
Analyze Phase	Identifying the main cause of problem	23th of March, 2018	1stth of April	**1 week**
Improve Phase	Proposing, testing and implementing solutions	1st of April	1st of June	**2 months**
Control Phase	Assuring that process is operating under continuous improvement	1st of June	19st of July	**1.5 month**
Conclusions and Recommendations	Absorbing the final situation and proposing some helpful recommendations	19st of July, 2018	26st of July, 2018	**1 week**

(Table2: Timeline frame for study)

Chapter Two: Literature Review

2.1 Six Sigma

This section contains the history behind origin of Six Sigma philosophy, the definition of Six Sigma, the possibility to apply Six Sigma in all industries and illustrating the needed requirements to apply Six Sigma in perfect manner.

2.1.1 The Origin of Six Sigma

The core idea behind Six Sigma is that if organizations can identify the quantity of defects in their operations, they can methodically detect them to reach as "close to zero" as possible. Defect is defined as anything that caused customer dissatisfaction, and the quality level of Six Sigma is equal to 3.4 defects per million opportunity (DPMO). Opportunity is defined as the possibility of a product to have a potential nonconformity characteristic. Implementing Six Sigma with allowed defects percentage (3.4 DPMO) will reduce and save costs as well as providing what customers need and demand (Madhani, 2017). The name of Six Sigma is derived from the Greek alphabet symbol sigma, used in statistic as a measure for process variance and inconsistency. Sigma is defined as statistical gauge to measure the process deviation from the perfection (Pandeet al. 2000).

Six Sigma has developed over time. It's more than just a quality function and system, it's a way of doing business. Actually it's many things, it could be viewed as a vision, a philosophy, a symbol, a metric, a goal and methodology (Tennant, 2001), for this reason, Six Sigma could have multiple perspectives of definitions. Six Sigma is considered as business improvement program that aims to reduce process variation. A case study was executed by Indian manufacturing company illustrates how successfully Six Sigma implementation had forced the company to excel in all the domains of manufacturing including quality, cost, delivery and flexibility, and improved its process operations (Krishna et al.2008).

2.1.2 Six Sigma Definition

In fact, Six Sigma is accepted as an effective tool for improving processes continuously. The Six Sigma approach talks itself highly effective in terms of delivering cost saving and increased customer satisfaction (Bendell, 2006). Six Sigma could also be considered as an improvement approach for reducing variation, which focuses on continuous and breakthrough improvement. Six Sigma focuses on reducing costs and increasing customer satisfaction by applying DMAIC methodology(Anderssonet al. 2006).

Six Sigma is a robust strategy that supportsorgananizations to reduce their poor quality costs and increasing revenues by improving existent processes, reducing costs, terminating defects and increasing customer satisfaction (Nabhani&Shokri, 2009). Six Sigma has been implemented for defect reduction, process improvement, financial

prosperity and customer satisfaction (Naslund, 2008). Moreover, Six Sigma is considered to be a business excellence strategy (Antony, 2004); customer driven, project driven and business driven methodology (Savolainen&Haikonen, 2007), which lead to performance improvements in organization's process, product and service, using statistical and non-statistical measures (Nakhai&Neves, 2009). The main difference between Six Sigma and other quality methodologies is that it concentrates on producing only 3.4 defects per million opportunity, and reducing the number of opportunities that could lead to defects by changing the concern from fixing defective product to producing good products at the first time (Antony, 2004).

2.1.3 Six Sigma in Industries

In fact, Six Sigma methodology is not customized only for manufacturing process in order to reduce errors and defects, yet it has a huge impact on enhancing transactional processes such as: improving delivery time, reducing lead time, hiring and training time for fresh employees, improving sales forecasting and the quality of customer services (Mehrjerdi, 2013). Six Sigma has enough elasticity to be applied to different and diverse business activities such as sales and marketing. According to Kumar&Kaushish(2015), a Six Sigma implementation case studywas conducted in the United State of America for improving the service system of consumer electronics and appliance retailing company, in order to decrease the number of returned items and complaints. Also, De Mast &Bisgaard(2007)have declared that Six Sigma methodology can and should be implemented to service activities for achieving customer satisfaction, and to implement Six Sigma efficiently and directly towards customers.

As mentioned before, Six Sigma Methodology could be used as a revolutionary and transformational tool for all sectors and industries, from being as a state of loss to a state of profit organizations. Six Sigma methodology used in all sectors such as telecommunication, healthcare, hospitals, customer service agencies and educational institutions (Drakeet al. 2008). In accordance to Bandyopadhyay&Lichtman (2007), Six Sigma was used to improve the quality and productivity in higher-education institutions due to high and continuous seeking of universities and colleges for higher quality under the pressure of public critical examination and cuts in private, state and federal funding. They also suggest that Six Sigma could be used to help accreditation efforts and engaging students in university processes' improvement. Despite challenges and obstacles of implementing Six Sigma Methodology in academic environment, yet many studies have proved that implementing such methodology was effective in many university institutions. Thus, several studies have been conducted on implementing Six Sigma in educational institutions from the view of the role of Six Sigma in improving the quality of academic sector, including e-learning (Burns, 2005; Little, 2003; Mitra, 2004); Six Sigma in empirical learning (Box, 2006); a Six Sigma framework for academic institutions (Jenickeet al. 2008); adopting Six Sigma for university housing design (Johnson et al. 2006); improving self-service at university libraries (Kumi& Morrow,

2006); and the integration of Six Sigma concepts in management, statics and other classes (Zahn, et al.2003).

2.1.4 Requirements to apply Six Sigma Perfectly

In order to apply Six Sigma approach perfectly, whole organization commitment, top management involvement, preparing suitable foundation and infrastructure and organizational training are considered the most important issues that must be taken into consideration.Naslund (2008), also assured on many characteristics for any organization that intend to apply Six Sigma, such as: expected and delivered bottom-line results, top management leadership, a disciplined approach, rapid project completion, success measurement, solid infrastructure, focus on customers and process, and statistical approach for improvement.Morgan (2006) has identified three core elements to implement LSS efficiently and effectively: focus on the customers and identify their critical to quality factors, ensure that processes are designed to meet the critical to quality and ensure that there are effective gauges to measure how customer requirements and perceptions are being met.In addition, Dahlgaard (2006), illustrated six steps of applying Six Sigma by Motorola: identify physical and functional requirements of the customers, determine the critical characteristics of products, determine for each characteristic, whether controlled by part, process or both, determine the maximum rate of each characteristic, determine process variation for each characteristic and redesign materials, products and process as required in case the process capability is less than two.

2.2 Lean Management

This section consists the origin behind Lean Thinking philosophy, the definition of Lean Management, clarifying the eight wastes and explaining that Lean Management is applicable not only for manufacturing sector.

2.2.1 The Origin of Lean Thinking

The origins of lean innovations can be found at stores in Japanese manufacturers - especially Toyota Motor Corporation (Monden, 1983; Ohno, 1988). These innovations come from deficiency of resources and high domestic competition in the Japanese market for automobiles, included the just-in-time (JIT) production system, the Kanban method of pull production and high levels of employee problem-solving and/or automated mistake proofing. This lean operations management design approach focused on the elimination of waste and excess from the operational product flows at Toyota. Early work at Toyota has been applied to automobile engine manufacturing under OhnoTaiichi's leadership, from automobile engine manufacturing to automobile assembly and wide supply chains in the 1950s (Schonberger, 1982). At this last point, a supplier manual was produced, and the "secret" of the lean approach was shared for the first time with a company outside Toyota. These manuals were written in Japanese, and have been around for almost 10 years before the first English literature was available (Schonberger, 1982; Monden, 1983; Åhlström, 1998).

After 1990, there was a gradual extending of focus away from the shop-floor, a trend often ignored by omission, error or design by many detractors. The process of "expansion" was also accelerated by the promotion of successful western case emulation by businesses in various sectors that had adapted their production systems to include a new design based upon "lean principles". These principles involved the identification of customer value, the management of the value stream, developing the capability to flow production, the use of "pull" mechanisms to support flow of materials at restricted operations and finally the pursuit of perfection through reducing all forms of waste in the production system to the level of zero (Womack & Jones, 1997).According to Huber (1991), the evolution of the lean concept can be linked to organizational learning through four main stages (Cells and assembly lines, Shop-floor, Value stream and value systems).

2.2.2 The Definition of Lean Thinking

Lean is one the most influential new paradigms in manufacturing and has extended beyond the original application on the shop floor of vehicle manufacturers and suppliers in the auto industry, ranging from heavy industries to aerospace businesses (Womack & Jones, 1997). When the concept of "Lean" applied to sectors outside the high-volume iterative manufacturing environment, lean production has reached its limitations, and a range of other approaches to counter variability, volatility and variety have been suggested (Christopher&Towill, 2001). However, you can integrate other approaches – particularly the tools they offer- without the discrepancy of the core objective of lean to provide customer values.In other words, even if no on-site lean tools such as Kanban, level scheduling, or takt time are used, all concepts that provide value to customers can be matched with Lean strategies (Goldratt, 1990).

As John Krafcik (1988) has introduced the concept of "Lean" for the first time, Lean can be summarized as the systematic pursuit of perfect value by eliminating all kinds of waste in all organization's processes (Bandell, 2006). Therefore, all companies which want to be successful should focus on eliminating waste as well as increasing value-added activities (Naslund, 2008).Lean Management extends the reach of the Toyota Production System by providing an enterprise-wide concept that aggregates and combines the five elements of a product development process, a supplier management process, a customer management process, and a policy concentration process for an entire organization. (Holweg, 2007). According to Womack & Jones (1996), the main target of lean thinking is focused on the individual product and its value stream (identifying value added and non-value added activities), and to eliminate all waste in all areas and functions within the entire organization.

2.2.3 Eight Wastes

The foundation of the Lean vision is still a focus on the individual product and its value stream (identifying value-added and non-value added activities), and eliminating wastes in all areas and functions within the system is the main target of Lean thinking. It is

extremely important for organizations to understand the nature of its waste and how to eliminate it, in order to create a successful lean organization (Brunt & Taylor, 2001). Initially, the implementation of Lean should start by recognizing the types and the sources of waste in the system. According to Bicheno (2008), the following forms of Ohno's seven waste were originally recognized in manufacturing environment:

1- When transportation is defined as waste, we try to reduce the excess moving factors, such as conveyors, busy forklifts, stacking and unstacking of components. It also important to eliminate any widely spread equipment.
2- Inventory as waste, on the other hand means factors such as work in process and finished goods that are not processed. This leads into old dates in materials, deteriorating materials, meaning materials that are getting worse, which leads into exceeding the storage volume.
3- As considering motion, we should focus on eliminating all excess movement. All tools and other components should be easily reachable, the layout of the facility should be standardized and double handling should be not appear.
4- All waiting that is possible to eliminate, should be eliminated. Waiting between process steps should not appear. Operators waiting for another operator and operators that are slower than the process, line are considered as waste and should be eliminated. In logistics a good example of waiting is missing products, lost materials or delayed order due to poorly organized operations.
5- Overproduction (uncoordinated production- too early or just in case) is a huge waste in logistics, as well as in manufacturing. Overproduction makes smooth flow of goods challenging and forms excessive lead-time. This appears when production is ahead of demand, which means that the work in process is piling up.
6- Over processing appears when certain methods are not being standardized. When there is variation between operators methods over processing appears. Methods should be standardized and make statistically capable to avoid over processing.
7- Defects are part of daily logistics. High number of customer complaints, high inspection level and broken products are good examples of defects. Defects should be minimized. These can't be totally eliminated, as we are working with human beings (Brunt & Taylor, 2001).

Ohno was reported to have said that the real objective of the Toyota Production System was "to create thinking people' (TPS: Thinking People System). so, this new waste is directly linked to Ohno. The 8th waste is:

8- The waste of untapped human potential or waste of creativity, which defined as the lack of utilization of creativity and ideas of the employees in the improvement of process and practices. Human potential does not just need to be free. It requires clear communication as to what is needed both from management and to management, it requires commitment and support, a culture of trust mutual respect, and it requires interest and involvement at the workplace.

2.2.4 Lean Management Is Not Only for Manufacturing Sector

At the outset, lean system was introduced only for manufacturing sectors, but nowadays, it is also adopted to service sectors. Although the concept of lean operation was applied only for manufacturing system, but it can also be applied to service operations such as capacity management, process flow and material support (Beckman &Rosenfield, 2008). They also initiate many helpful methodologies that used in lean management such as: producing product anywhere customers exist, maintaining production as a constant level to the degree possible, reducing lot size as much as possible, achieving short and predictable lead times, seeking for a linear flow of production to the extent possible, positioning suppliers to supply frequently and small lots, restricting number of suppliers and interacting with them in material management, quality and design, combining design cycles with manufacturing, using concurrent engineering and reducing lead times as much as possible, reducing demand variability and engaging the workforce in the process. Furthermore, Womack and Jones (1996), have specified many lean management methodologies, such as: elimination of waste or Muda, identification of value stream, achievement of flow process, pacing by a pull system or Kanban and the continuous pursuit of perfection.

Since Lean methodologycan contribute to considerable positive effect,worldwide commercial security company has implemented lean approach in less than 6 months to improve supply chain performance.The scope of the Lean Supply Chain Transition project included cost savings and increased productivity goals for all operations such as sales, production, distribution and branch operations. As a result, applying lean supply chain transformation technology "streamlined branch operations, improved customer experience and standardized supply chain processes" within a period of six months has a significant impact on the company's financial situation. Within the 6 months of improvements, operating cost has declined by 20%, annual saving has arisen to $9.5 million, capacity has improved by 30% as a result of delivered knowledge that workers gains, order-to-delivery cycle time was cut in half, revenue productivity has increased by 10%(Fernie& Sparks, 2014).

2.3 Lean Six Sigma

This section contains the history behind the origin of LSS, the definition of LSS methodology, illustrating that LSS is not restricted only for manufacturing sector, what are the requirements that needed to apply LSS methodology perfectly, how DMAIC methodology can reduce wastes and the LSS methodology in Retailing Industry.

2.3.1 Origin of Lean Six Sigma (LSS)

The phrase "Lean Six Sigma" is used to describe the integration of Lean and Six Sigma philosophy (Sheridan, 2000). Lean Six Sigma supplements the Lean philosophy as well as providing the tools and appropriate ways to address specific problems identified through Lean journeys (Wheat et al. 2003).The integration of Lean and Six Sigma aims at every possible opportunity to improve and maintain the organization. The integration of

the two methodologies provides authorization at every stage of the process, allowing employees to actually own the process. But, if the two philosophies are implemented in isolation, the outcome can result in neither being done effectively nor efficiently.

Lean Six Sigma has been, in many ways, a part of the business world for years. The LSS revolution began in post-World War Two. At a level unseen before, Japanese manufacturing companies start creating a quality-focused culture. Later, LSS came to the foreground of American companies after adoption by General Electric (GE) and others. Over time, the LSS concept has moved from shop floors into back offices within manufacturing sites, and eventually to the core transactional and service environments. Nowadays, LSS has become common in financial service, insurance, health care and many other industries, even expanding into government and US military. Recently, Retail industry has begun to join the LSS movement besides to other industries (Omachonu& Ross, 2004).

2.3.2 Definition of Lean Six Sigma

With the Lean Six Sigma approach, organizations can differentiate themselves from their competitors by producing less, faster, better and at the lowest cost of waste. LSS is a methodology if it is implemented properly, the entity improves efficiency and attain competitive advantage (Chen &Shady, 2010). Lean Six Sigma is a business management strategy commonly used in manufacturing industry to improve process, efficiency and quality. During the past decade, this process improvement technique has been applied increasingly outside the manufacturing sector (Omachonu& Ross, 2004).

The success adoption of Lean Six Sigma in manufacturing was the powerful reason for other industries to apply the principles and practices of Lean Six Sigma. In fact, Lean Six Sigma methodology was used by health care firms after evaluating the considerable effect of such a methodology on cost reduction and performance improvements in traditional process companies. Many popular health care companies have implemented Lean Six Sigma such as Commonwealth Health Corporation. In fact, they reported and declared fundamental accomplishments with the implementation of Lean Six Sigma, such as improving patient processing and discharge, decreasing medical errors and medical costs, improving work performance by using visual aids, capturing and gauging metrics, and presenting actual performance measures for all employees (Sehwail&DeYong, 2003).

2.3.3 Lean Six Sigma is Not Only for Manufacturing Sector

As Lean Six Sigma methodology could be applied to nearly all industries, organizations that are facing issues with cost, quality, or service find that adopting Lean Six Sigma is always the fastest, most convenient approach to solve and improve those issues, increasing customer satisfaction and maintaining their supply chains(Lawson&Samson, 2001). Big consulting firms for instance: MkKinsey, Deloitte, Bain & Company, and Booze Allen have confirmed that applying Lean Six Sigma approach led to improvements in organizational design, product quality, supply chain management, logistics, innovation finance & market share and customer satisfaction. The use of Lean Six Sigma provides excellent and proven tools to evaluate, measure and improve

inefficient or poor outcomes areas within a company such as costs, delivering time and free-damaged product (Palagyi et al. 2003). In addition, Palagyi et al. (2003), stated that consulting firms that are certified in Lean Six Sigma have more capability for identifying problems and resolving issues than consulting firms that have not been trained or educated in Lean Six Sigma. As a result, this fact has led business consulting companies to adopt a mandatory Lean Six Sigma training program for their consultants, suppliers and clients to achieve the most immediate outcome from implementing Lean Six Sigma (Palagyi et al. 2003).

2.3.4 What Are Needed to Apply Lean Six Sigma Perfectly

Surie& Hazy (2006), indicated that the following elements are important to foster successful implementation of Lean Six Sigma principles: a diversity of experiences to allow sharing of relevant knowledge from various sources, repeated practices and/or cognitive search, champions and entrepreneurs who isolate the employees from daily pressures and provide resources to achieve sustained and focused activities on specific projects, providing a challenging environment in which any organization would highly depend on to survive and to utilize of innovations through rapid market testing to gain reviews, make justifications and determine whether to continue pursuing specific innovation path. They also highlight the importance of understanding the effect of decision making on the customer, taking a good attention of affirmation that programs designed to add value don't end up with hurting the customer. Moreover, Češnovar (2006), stated that integrated effort toward organizational goals and priorities, clear strategic direction, consistent framework for decision-making and high concentration on the external environment and development of a methodical and problem solving approach are significant components for any organization that seeks to successfully implementa proven strategy such as Lean Six Sigma. According to Kolar (2007), we can conclude that the ground base for company's successful implementation of Lean Six Sigma starts with leadership understanding and supporting a data-driven approach to achieving efficient outcomes. Leaders can achieve value in the decision-making process through four levels of using data: collection, summarization, analysis and synthesis.

Three senior technology researchers who are officers in the US, Asia and Europe found that management reported and ranked executive leadership support as the most important competency for Lean Six Sigma principles, changes and innovation implementation (Davilaet al. 2012). Moreover, Loewe &Dominiquini (2006), emphasize that aligning organization members with common concepts of quality, change and innovation is the base of successful deployment for Lean Six Sigma Methodology. Another vital factor that affect a successful implementation of Lean Six Sigma is culture. As a conclusion of theoretical and empirical studies, culture is described as the principles, contentment and norms that control and direct behavior in organizations (Lemaket al. 2002).

Recently, Lean Six Sigma is deemed as most famous continuous improvement and widely-used initiatives. LSS methodology start with understanding the current state of any organization operation, then setting up targets for future state of all operations and

activities. LSS uses DMAIC (Define, Measure, Analyze, Improve and Control) framework besides value stream mapping, 5S etc. to detect and eliminate any waste and obstacle and improve the organization processes (Chen &Shady, 2010).

2.3.5 DMAIC Approach to Reduce Wastes

Lean Six Sigmainitiators are continuously seeking for reaching to zero defects, zero inventories and declining costs.We can say that companies could identify and decline non-value- added activities within their organizational process by adopting lean approach (Anderssonet al. 2006). They identified key issues that contribute to removing non-value added activities from overproduction, over fitting, delays, shipping, inventory, defects, and movement. In addition, they have proposed and described many approaches to eliminate waste such as value flow analysis, total production management, Kaizen, cost analysis, engineering and change management, and document management. Waste or (Muda) can exist in every activity, department or division. It can be part of production and distribution activities and can also appear in related activities, such as: design, inventory management and work assignments. Therefore, managers should identify, analyze and try to eliminate all waste as possible in every activity in all aspects of organizational operations (Beckman &Rosenfield, 2008).

DMAIC is used as quality and productivity improvement strategy in a manufacturing enterprise in order to reduce the welding defects in factory. Before adopting DMAIC, the factory had a 9.6 defects/section, yet this rate has been reduced by 50% to reach 4.8 defects/ section. This decreasing trend in defect reworks has also improved the ROI to become 0.2 after it was 0.08 (Soni et al. 2013). Also, DMAIC used in a furniture company as an approach to quantify opportunities, show evidence for improvements and show potential benefits to be gained. A Furniture Company used Lean Six Sigma to optimize the production process and in turn decrease the defects rate. As a result, it concludes that optimal conditions of producing wood furniture would reduce the presence of defects by 25% and increase the profitability in the manufacturing process in the company (Guerrero et al. 2017).

According to Arafeh, (2015) case study, DMAIC methodology has been applied in local company specialized in manufacturing safety and fire resistance metal doors, windows and frames, aligning with lean manufacturing concepts and tools in order to improve the productivity and efficiency of the company. As a result, many improvements had been executed to improve the company operation: reducing production cycle time from 216 min to 161 min, identifying and eliminating non-value added activities in the different process, reducing transportation distance from 322.6m to 189 m (reduction of 41%), utilizing plant layout and space from 16% to 7%, and reduce backtracking for machine reconfiguration from 62% to 7%. Moreover, defective doors' percentage that needed rework dropped from 100% to only 15%.

The DMAIC methodology was applied in real conditions of two furniture manufacturing enterprises with a different level of quality management system. As a result, the number of non-conformities decreased by 500 pieces, and the total value of non-conforming

products in the process has been decreased by nearly 5000 (from 34,277 to 29,833) euro. The improvement also include a DPMO category, in which the value of DPMO declined by 30,000 defects and the effectiveness has increased by 3% (Sujovaet al. 2016).

2.3.6 Lean Six Sigma in Retail and Supply Chain Industry

Lean Six Sigma is a continuous improvement methodology that integrates two of the most powerful improvement concepts available to business. Lean provides mechanisms for quickly and dramatically slashing cycle time and waste in any process, and in any department in the organization. Six Sigma presents the tools and organizational guidelines that establishes an infrastructure for sustained, data-based improvements in strategically important, critical values for customers.

Recently, retailers have become interested in building continuous improvement as a technique that helps them become more competitive, grow and achieve high ultimate performance.For this reason, retailers become more convinced today to adopt store management percept to sustain and improve the handling skills with crisis and problems. Therefore, some leading retailers such as Best Buy, Staples and Tesco are discovering the value of implementing Lean Six Sigma to provide a disciplined and proven methodology to solve problems, accomplish planned changes and make process-change decisions. Actually, these leaders have greatly improved their operational capabilities, performance, customer satisfactions and not only gained financial results and shareholder return, yet also improved their ability to grow in the increasing competitive retail industry (Guerrero et al. 2017).

As mentioned before, applying Lean Six Sigma as a problem solving methodology has been highly adopted by retailers to identify certain problem and start to make improvements. One example of successful quick implementation of LSS methodology in retail industry is that retail stores' team found about 6% of the stores redeemed 0% of the coupons during the fiscal quarter. The team promptly apply LSS in attempting to identify the potential causes of this problem, the team identified several quick, simple awareness and metrics-reporting solutions to the stores by providing visibility to the financial and program metrics to the stores. As a result, the stores achieved 100% coupon redemption, resulting in an annual financial gains of $12.7 million(Guerrero et al. 2017)

Another example of LSS successful implementation, executed by building products division in North-America. The company adopt Lean Six Sigma methodology by streamlining branch operation, improving customer experience and standardizing lean supply chain process to achieve accelerated order delivery, lean process improvement and cost reduction benefits. As a result, applying Lean Six Sigma helped the company to cut order-to-delivery cycle time by 50%, reducing operating costs by 20% which in turn, improve revenue productivity by 10%, reaching $9.5 million of annual saving and increase capacity improvement by 30% (Grossmann, 2005).

A case study forLean Six Sigma implementation in retail environment, aimed to improve Dell's company supply chain management by reducing the number of damaged

customer-received products. In point of fact, researcher has observed and discovered that the warehouse was lacking of capable and robust quality program to prevent significant number of products (televisions, laptops, desktop computers and servers) being damaged while trailer-loading process is running in each factory. Dell's partners refused entire trailer loads that worth $1 million or more, so, Dell forced to remanufacture expedited delivery again. Therefore, Dell utilized the value of implementing Lean Six Sigma for the assessment of each step in the retail logistics process, pointing out the root causes of logistics process problems and executing some of proposed solutions to attain desired objectives. As a result, the percentage of trailers arriving at Dell's retail partners arrived with some form of damage was reduced from 40% to 1% after implementation of Lean Six Sigma. In addition to the improved customer experience that experienced by Dell's partners, there were a significant financial impacts on Dell's performance, such as: a) shipping cost decreased by $6 million annually through network optimization, funneling more freight into lanes and increasing the density of palletized shipments, b) truckload shipping cost was reduced by $8.5 million annually (Ladd, 2013).

Chapter Three: DMAIC Methodology

DMAIC is best described as a data-driven quality strategy and problem solving methodology for improving process, and an integral part of the company's Lean Six Sigma quality initiative. DMAIC is an acronym for five interconnected and overlapped phases: Define, Measure, Analyze, Improve and Control.

The Define Phase is the first phase of the Lean Six Sigma improvement methodology.In this phase, and after knowing the goal of this study, Receiving and Storing Accessory Products was definedas an issue needed improvements. Moreover, the team project creates a Project Charter, SIPOC Diagram, Project Contract and Verified Process with data.

In the second phase of DMAIC methodology namely Measure Phase, the team gained a full understanding of Receiving and Storing Accessory Products by creating an integrated flowchart. Thereafter, the current performance of Receiving and Storing Accessory Products was evaluated usingInactive accessory products' contribution to sales revenue metric.

In the third phase of DMAIC or the Analyze phase, Ishikawa Fishbone Diagram or Cause and Effect was created based on eight P's category (Price, Promotion, People, Process, Place, Policy, Procedure and Product) to identify and discover two types of problems' causes: causes of current accumulation of accessory products, and causes ofReceiving and Storing Accessory Products' issue.

In the Improve Phase of DMAIC, and after all root causes have been identified and recognized, improvements have been executed to overcome both problems. In order to reduce the accumulation of inactive accessory products,the project team implemented first three S's of 5S approach (Sort, Shine and Set in order), created a well-organized showroom for inactive products, provided a special price offers, and promoted all inactive accessory products. The team also employed Pricing, Policy and Procedure improvements to boost Receiving and Storing Accessory Products' issue.

Lastly, in the Control Phase of DMAIC, the Receiving and Storing Accessory Products performance was monitored through collecting sixteen data points after implementing the new process, then, the team formed a modified and improved flowchart for Receiving and Storing Accessory Products, and checklist of instructions and procedures.

This DMAIC study is deemed to be as an empirical improving study for Receiving and Storing Accessory Products at AUC-WT. The project team has implemented all possible Six Sigma and Lean tools in each phase of DMAIC cycle methodologyin order to fully address the root causes and create an improved system and culture within the Accessories department to preserve the improvements in the future.

3.1 Define Phase

The first phase of the DMAIC Six Sigma methodology is "Define". This stage determines the strategic process issue for improvement, study's scope and boundary, as well as identifying the customers' requirements and expectations "Voice of Customer" (Gijoet al. 2011). before carrying out these steps, the Six Sigma team needs to be formed. In this improvement study, the team consists of the following six people: General Manager, Head of Accessories department, Financial Accountant, Accessories specialist person, Accessories supervisor and team leader.

The next step in the Define phase of the DMAIC methodology is creating the study's scope. According to Nonthaleerak& Hendry (2008), Six Sigma study should be selected based on company's strategic issue declared by customers' requirements. However, selection of study's criteria should not serve only customer voice of requirements, but also has important and positive impacts on stake-holders' interests such as: absorbing monetary revenues and obtaining financial savings (Murugappan&Keeni, 2000). According to these propositions, the selected problem to be improved through this study is to reduce the amount of accumulated inactive products (i.e. Obsoletes and Scrap) at AUC-WT which affects customers' expectations and growing revenues. Listening to the voice of customers which mean identifying, prioritizing and implementing customers' needs is important for any company's success. Therefore, voice of customer was used in this study to define reduction of accumulated accessory products as the study objective (Griffin& Hauser, 1993).

In order to have a high level of assurance that the study focuses on reducing accumulated inactive accessory products, it was necessary to focus only on accessory product department as a boundary of the study. The improvement team decided to focus on accessory product department due to the high amount of obsolete and scrap products that increase the company's opportunity costs by occupying a large space of warehouse.

Thereafter, team members have adopted SIPOC diagram to absorb a deep understanding of Receiving and Storing Accessory Products. SIPOC is an acronym for the five words: Supplier, Inputs, Process, Outputs and Customers. It is one of the diagrams widely used in Define phase to start planning for improvements before mapping, measuring and improving the process (Pyzdak& Keller, 2014). A SIPOC diagram is used by a team to identify all relevant elements of process improvement study before the work begins. The diagram demonstrates suppliers of the process, the inputs of the process, the process itself, the outputs of the process and the customers who receive the process outputs.

3.1.1 Project Charter

The Project charter is a tool used to document the study's objectives and targets, the business case, key players, study's scope, study's enablers and obstacles, and estimate of support needed. Figure 3 below shows the AUC-WT's project charter.

study Sponsor	General Manager, Dr. Ashraf Al-Mimi
Team Leader	ShawqiAlhajHasan
Study Title	***To improve Receiving and Storing Accessory Products***
Date	March, 2018
Issue	Version 1

1. Problem Definition and Purpose

Al- Mimi Company has an enormous amount of inactive accessory products during the past period resulted from Receiving and Storing Accessory Products. Therefore, the study aims to reduce these inactive products during the following 5 months, and increasing their contribution to sales revenue

2. Business Case (Issues to be addressed/process to be improved)

Accumulation of inactive products during the past period has a profound impact on company's sales and savings, customer's motion and warehouse store space.

Key Players		**Scope**
Sponsor	General Manager, Dr. Ashraf Al-Mimi	**In scope:** Accessories Department, Inactive Products.
Team Leader	ShawqiAlhajHasan	
Team Members	Head of Accessories Dep., Mr. Baker Mimi Financial Accountant, Muath Accessories Specialist, Mohammed Accessories Supervisor, Mousa	**Out of scope:** Accessories department in Al-Ram Branch and the other departments.
Other Key People	Company's employees	

Enablers/Risk Mitigation	**Barriers/Risks**
Team Work, Employee Involvement, Employee engagement, Ongoing Monitoring, Standard Procedures and Top Management Initiative.	Partial attendance of team leader

Support Estimates

Additional human resource, Shelves, Cartoons Boxes, Promotion Facilities

(Figure 3: Project Charter of DMAIC of AUC-WT)

3.1.2 SIPOC Diagram

SIPOC diagram is widely used in the Define Phase of the DMAIC methodology as a problem solving tool. According to Pyzdek (2003), SIPOC diagram is usually used to map a process at a high-level. Figure 4 shows a Receiving and Storing Accessory Products SIPOC diagram at high-level for AUC-WT.

Key Business Process Name: Receiving and Storing Accessory Products				
Suppliers	**Input**	**Process**	**Output**	**Customers**
Domestic Suppliers	Accessories Products	**Process Purpose:** To store Accessories products in warehouse **Process Owner:** Head of Accessories Department, MrBakir Al-Mimi	Accessories products stored in designated location	Internal Customers (Accessories dep. Employees and top management) & External Customers (Clients)

Process Steps (High Level)	Ordering Accessories Products	Receiving Accessories Products	Unloading Products quantity	Inspecting Products' quantity	Recording Products into Software	Storing Accessories products	**Results Measures**	**Customer Needs**
Process Measures	Volume of ordered accessory products	Delivering time for products to be received	Cycle time of unloading accessory products	# of unmatched products	# of recording errors	# of storing mistakes	Amount or value of accessory products' contribution to sales revenue.	Right amount of products are stored in the designated location.
Present Data	Order Report	No Data	No Data	Order and Receipt Report	BISAN accounting software	No Data		
Goal Performance	Zero over ordering	Receive items with time limit "no delay more than four days"	Unload with time limit "no delay more than 2 hours"	Zero excess product	Zero error in recording products	Zero storing mistakes	**Results Concerns** Increasing accessory products' contribution to sales more than zero consistently.	**Date** Feb-July/2018
Sources of Variation & Waste	Unclear recognition of available products	Either traffic or emergency case	Either absence or busy workers	Either workers mistakes in counting or accept the excess products	Both of batch recording and unintended speed in recording	No compliance with storing standards and procedures		**Version** First Version
Impact on Performance	Ordering unneeded items	Loss of external customers	Delay in other tasks	Excess inventory and absorb more costs	Wrong financial information	Uncountable products		

(Figure 4:SIPOC Diagram of DMAIC)

3.1.3 Verifying Performance with Data

In this phase, voice of customer (VOC) and voice of business (VOB) have been perceived in order to startidentifying improvement opportunities. Customers could be classified as internal or external. In this study,internal customers' voice known as the voice of the employee (VOE) represented by accessory department employees and top administrative managershavehigher level of attention than external customers. The voice of business (VOB) is derived from company financial information and data.The voice of Process (VOP) is also used to evaluate how the process is performing since it islinked with the voice of customer and the voice of business

Internal customers (accessory products 'department and top management)claimed that a value of 90,000 NIS of Accessory Productshave been accumulated since the past four years with zero NIS contribution to sales. For this reason, internal customers seek for improving the sales value of accessory products, in addition to investigating the main reasons behind low customers' purchasing.

Paying high attention to voice of customer (VOC), voice of business (VOB) and voice of process (VOP), have assisted team members to identify the poorly performing process and employ all the information to identify and prioritize potential improvement projects.

3.1.4 Project Contract

The project contract is a modified version of project charter. The Project contract includes a milestone section which demonstrates the main pro study ject activities, their purposes, and start and finish times for each activity along with project charter components(Pandeet al. 2000). Figure 5 shows the project Contract for AUC-WT.

<table>
<tr><td>Project Sponsor</td><td colspan="2">General Manager, Dr. Ashraf Al-Mimi</td></tr>
<tr><td>Team Leader</td><td colspan="2">ShawqiAlhajHasan</td></tr>
<tr><td>Project Title</td><td colspan="2">To improve Receiving and Storing Accessory Products</td></tr>
<tr><td>Date</td><td colspan="2">May, 2018</td></tr>
<tr><td>Issue</td><td colspan="2">Version 2</td></tr>
<tr><td colspan="3">3. Problem Definition and Purpose</td></tr>
<tr><td colspan="3">Al- Mimi Company has an enormous amount of inactive accessory products during the past period resulted from Receiving and Storing Accessory Products. Therefore, the study aims to reduce these inactive products during the following 5 months, and increasing their contribution to sales revenue more than zero co</td></tr>
<tr><td colspan="3">4. Business Case (Issues to be addressed/process to be improved)</td></tr>
<tr><td colspan="3">Accumulation of inactive products during the past period has a profound impact on company's sales and savings, customer's motion and warehouse store space.</td></tr>
<tr><td colspan="2">Key Players</td><td>Scope</td></tr>
<tr><td>Sponsor</td><td>General Manager, Dr. Ashraf Al-Mimi</td><td rowspan="2">In scope:
Accessories Department, Inactive Products.</td></tr>
<tr><td>Team Leader</td><td>ShawqiAlhajHasan</td></tr>
</table>

Team Members	Head of Accessories Dep., Mr. Bakir Mimi Financial Accountant, Muath Accessories Specialist, Mohammed Accessories Supervisor, Mousa	**Out of scope:** Accessories department in Al-Ram and the other departments.
Other Key People	Company's employees	

Milestones

Milestone	Purpose	Start Date	End Date	Duration
Define Phase	Identifying the main issue to be improved.	1st of March, 2018	15th of March, 2018	**2 weeks**
Measure Phase	Collecting information and evaluate current performance of process	16th of March, 2018	23th of March, 2018	**1 weeks**
Analyze Phase	Identifying the main cause of problem	23th of March, 2018	1st th of April	**1 week**
Improve Phase	Proposing, testing and implementing solutions	29th of March	1st of June	**2 months**
Control Phase	Assuring that process is operating under continuous improvement	1st of June	19st of July	**1 month**

Enablers/Risk Mitigation	**Barriers/Risks**
Team Work, Employee Involvement, Employee engagement, Ongoing Monitoring, Standard Procedures and Top Management Initiative.	Partial attendance of team leader,

Support Estimates

Additional human resource, Shelves, Cartoons Boxes, Promotion Facilities

(Figure 5: Project Contract of DMAIC)

3.2 Measure Phase

The Measure Phase is considered the second phase of DMAIC six sigma methodology. In this phase, the project team has gained a full understanding of Receiving and Storing Accessory Products, collected data, and evaluated the process performance. The project team had a clear understanding by creating integrated flowchart for Receiving and Storing Accessory Products at AUC-WT. This flowcharthelped in identifying quality concerns for each business process step, and visualizing, recognizing and separating value-added activities from non-value added activities through eight wastes-based analysis.

The next step was identifying and establishing accessory products' contribution to sales as a reliable metric to evaluate the process performance (Pyzdek& Keller, 2014). Therefore, a quantitative and qualitative data was collected during the measure phase to reach for a clear and obvious explanation of the current situation, and this avail as a baseline to predict potential solutions.After that, accessory products' contribution to sales' measure was evaluated during sixteen weeks (30th September, 2017- 15th of March, 2018) using control chart. Then, the project team hasrecognized that transferring inactive accessory products from Ramallah branch to Al-Ram branch as quick win solution.

As the project team concluded that Measure Phase issimply consisted of three main milestones as the following:

1- Understanding the process
2- Data collection
3- Evaluating current performance of process

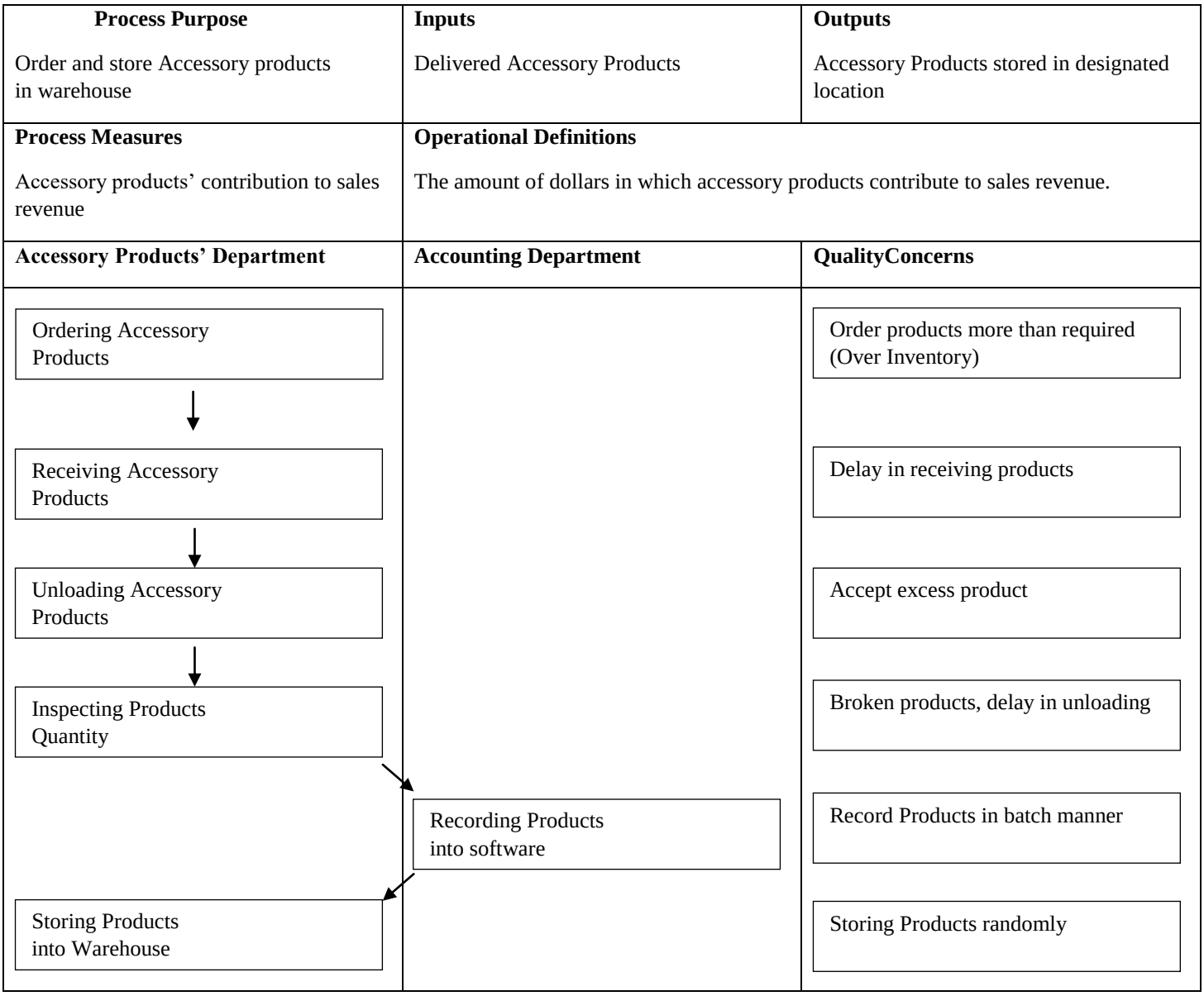
3.2.1 Understanding the Process

The first milestone is understanding Receiving and Storing Accessory Productsat AUC-WT. In order to have a good understanding of the process, many steps have been adopted as follow:forming integrated process flowchart for Receiving and Storing Accessory Products, analyzing the eight waste for each process step,identifying the customer requirements, choosing the key measure of process, and selecting quick potential solutions.

3.2.1.1 Integrated Flowchart

In this step, the flowchart of Receiving and Storing Accessory Products has been created. Flowchart consists of: Process Purpose, Inputs, Outputs, Process Measures, Operational Definition, Process Steps, and Quality Concerns for each step.Figure 6 shows the process flowchart of Receiving and Storing Accessory Products starting from orderingstep till storing accessory products, it also points out some quality concerns for each process step.

The next step in understanding process is explaining allthe process steps (Ordering Accessory Products, Receiving Accessory Products, Unloading Accessory Products, Inspecting Products Quantity, Recording Products into Software and Storing Products in Warehouse), and finding out the wastes in each one.



(Figure 6: Integrated Flow Chart of Receiving and Storing Accessory Productsat AUC-WT)

3.2.1.2 Receiving and Storing Accessory Products Steps (Eight Wastes)

3.2.1.2.1 Ordering Accessory Products

The first step of Receiving and Storing Accessory Products is ordering accessory products. The ordering decision is primarily based on either accessory supervisor's manual inspecting of available accessory products at warehouse store or fulfillment external costumers requirements. As a result of such inspecting of product would obviously lead to order more than needed quantity of accessory products.

Moreover, a manual phone calls and social network are being used as ordering tool for accessory products, instead of adopting official and formal techniques such as formal

order report. These actions also lead to potential mistake or error in ordering products quality and quantity. Besides all of these issues, no negotiating sessions were held with various domestic suppliers to gain the best price offer.

3.2.1.2.2 Receiving Accessory Products

This Process is deemed to be a mediator activity between ordering and unloading accessory product. After ordering accessory products, a period between (2 to 4) days takes to receive all amount of required products from domestic suppliers.

3.2.1.2.3 Unloading Accessory Products

This process is considered the second main step in Receiving and Storing Accessory Productsafter they have been received. Unloading process usuallydoesn't takelong time in case workers are available.

3.2.1.2.4 Inspecting Products' Quantity

The process of inspecting products' quantity is deemed to be the third main step in Receiving and Storing Accessory Products, after all accessory products have been unloaded into warehouse. In this step, the Accessory department's supervisor seeks to be assured that all received products are matched with all ordered products in numbers, but, excess received products were often being accepted and stored in the warehouse.

3.2.1.2.5 Recording Products into Software

Recording products into the software is considered the fourth main step in Receiving and Storing Accessory Products, after all products quantity have been inspected. In this step, the accountant receive the product ledger from accessory department's supervisor, and start recording the items into BISAN accounting software. Yet, the weakness points in this step are: recording products in batch manner due to low-standardization of categorizing the accessory products in BISAN software, and all received products with low monetary amount would not be recorded, which lead to inaccurate recorded products at BISAN software.

3.2.1.2.6 Storing Products in Warehouse

Storing products in accessory warehouse is the final step in Receiving and Storing Accessory Productsafter all products have been recorded into BISAN software. Storing step is only based on accessory supervisor's experience, since the accessory products' supervisor is the only person who has the related knowledge in storing process. Moreover, there are no clear and specified storing zones and locations, nor standardized procedures for each accessory products.

In conclusion, Receiving and Storing Accessory Productshas three main milestones: the ordering step, the inspecting step and storing products in warehouse step. As we mentioned before, the first step is based only on manual inspecting of accessory department's supervisor and external customers' requirements, which lead to order over needed products. In inspecting step, the supervisor inspect the received products quantity with the ordered products quantity, but excess products were accepted anyway, which leads to over-stored products in warehouse. The final step is storing accessory products in

warehousewith unstandardized storing procedures, resulting in untidy and randomly stored accessory products

3.2.1.3 Meeting Customer Requirements

Organizations invest a lot of time to understand precisely customers' requirements and needs, andtry hardto satisfy their customers. In the case of Receiving and Storing Accessory Products at AUC-WT which is considered as a retailing business, requirement of internal customers at first priority is having such a procedure or technique to eliminate the huge accumulation amount of inactive accessory products in warehouse and increase inactive products' contribution to sales. Therefore, the aim of this study is to detect the root cause, and improve Receiving and Storing Accessory Productsusing Lean Six Sigma methodology (DMAIC) as a problem solving technique.

3.2.1.4 Selecting Key Measure and Operational Definition

According to internal customers' requirements (VOC) which is represented by reducing the amount of inactive accessory products and increasing their contribution to sales revenue, the project team has defined inactive accessory products' contribution to sales revenue as the appropriate metric to evaluate the current performance of Receiving and Storing Accessory Products. Inactive accessory products' contribution to sales is defined as the total value realized from selling inactive accessory products in a specified period.

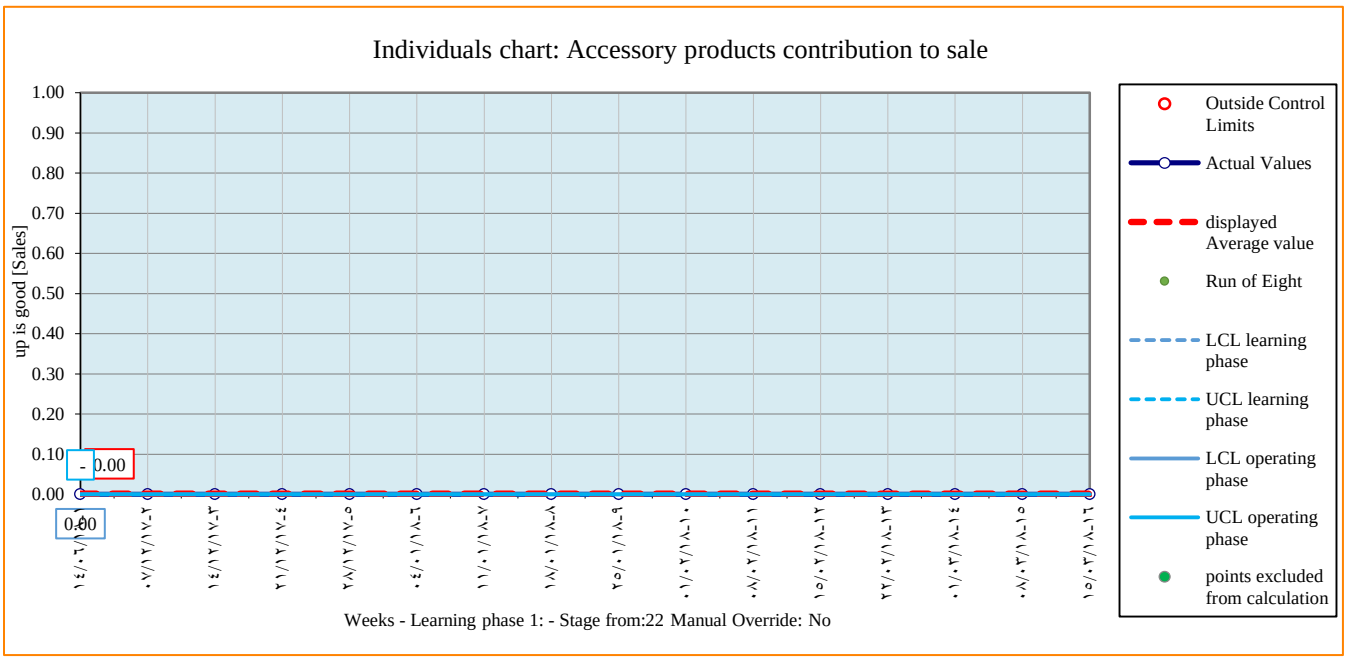
3.2.2 Data Collection

After the project team has identified inactive products' contribution to sales revenue as proper and valid metric to be used in measure phase, it was necessary to start collecting relevant data. Thenceforth, the team highly dependedon one-to-one interviews with Ramallah branch's employees and inferential observations since they are the most technical, doable and low cost data collection methods.All collected data were directly documented after each interview and observation. The project team has identified collected data as quantitative and qualitative data.

As a result of collecting data (VOC), the project team realized that accumulation of inactive accessory products was the mutual concern for all employees.But, lacking of standard storing procedure, incurring opportunity cost by occupying much space of warehouse, and having no sales contribution were also employees' concerns. Therefore, collecting data from employees made customers requirement heard, documented and taken into consideration.

3.2.3 Current Performance of Process

After all relevant data have been collected, the measure phase nearly reached to the end, the current process performance was needed for evaluation. Evaluation was conducted as shown belowin figure 7 by using control chart over sixteen weeks (30/Sep/2017_15/March/2018) to estimate the sales contribution of inactive accessory products:



(Figure 7: Control Chart for Accessory Products' contribution sales at learning phase)

As mentioned before, control chart was implemented as performance evaluation tool for inactive accessory products' contribution to sales revenue over sixteen weeks.Inactive accessory products' contribution to sales revenue has an average value, upper control limit and lower control limit of zero NIS during the full period of sixteenweeks of learning phase. These values affirmed thatAUC-WT had a critical issue in accessory departments, especially in Receiving and Storing Accessory Products.

3.2.4 A Quick Win

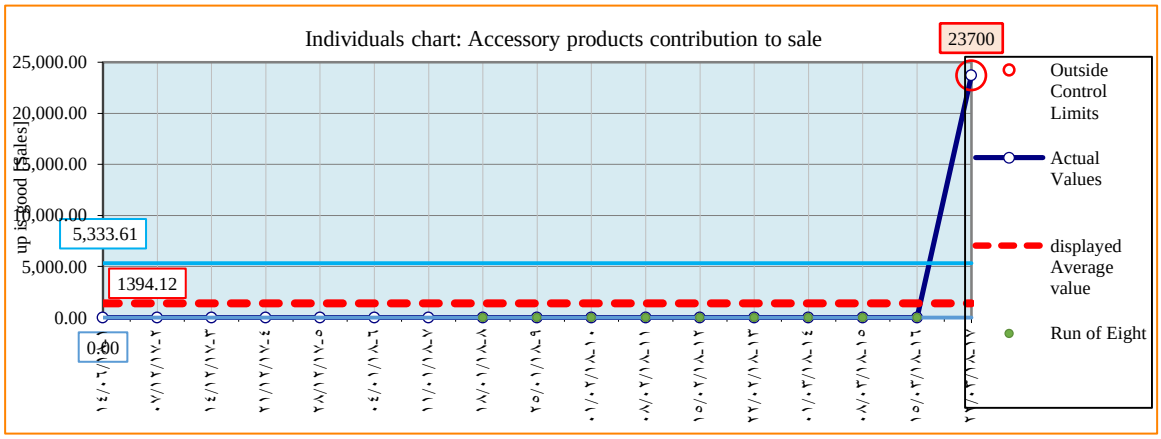
A quick win is an improvement technique that is visual, on-spot gain, and can be implemented quickly during the study. The quick win does not necessarily have to be either profound or long-term impact on the organization, yet it needs to be something –by stakeholders' consensus- that can be quickly done and has a profit returnable action. Anyway, a quick win can be easily attached during deep understanding of business process through detailed business process flowchart and all collected data. The best quick winis simply defined as the following criteria: having known quality concern, taking no long time to achieve, incurring low cost, having low risk in case of unsuccessful implementation and having the authority by project team to implement the improvement changes (Coronado &Antony, 2002).See Appendix 1

In the case of Receiving and Storing Accessory Productsat AUC-WT, the best doable quick win between three potential solutions for accumulation of inactive accessory products quality concern wastransferring highly demanded products into Al-Ram Branch. This quick win was compliance with the following four categories as shown in table above.

Since transferring inactive products into Al-Ram branch has been met all required categories and considered as a quick win solution to minimize the amount of inactive accessory products at AUC-WT's Ramallah branch, the accessory products' supervisor of Al-Ram branch selected the most demandable and high selling products. Appendix 2 shows the items, quantity and value of these products:

After performing a quick win (transferring accessory products to Al-Ram branch), contribution to sales revenue was equal 23,700 NIS. A new control chart for Accessory products' contribution to sales has an average contribution to sale of 1,394.12 NIS, an upper control limit of 5,333.61 NIS and lower control limit of zero.

As a result, the quick win point lies out of UCL which meansthat the process was out of control, but deep investigationhas been conducted to assure that the main reason behindthe out of control point was a normal effect of quick win action. This quick win has spread a good vibes of potential amplifying in sales contribution for inactive accessory products in the upcoming period. Figure 8shows control chart for accessory products' contribution to sales revenue during the sixteen weeks of learning phase and quick win date:



(Figure 8: Control Chart for Accessory Products' contribution sales at learning phase and Quick Win)

After an overview of current performance for inactive accessory products' contribution to sales hasbecomemore understandable, the project teamstarted the next phase of DMAIC methodology "Analyze" to find out the potential root causes of inactive accessory products' accumulation.

3.3 Analyze Phase

The analyze phase is considered the third step of theDMAIC Lean Six Sigma methodology. It includes comprehensive analysis to figure out and understand all possible causes ofthe problem to reduce the gap between current and desired performance (Garza-Reyes et al. 2010). In this Phase, the project team has used Cause and Effect Diagram,which is based on the collected data and the created process map to attain all

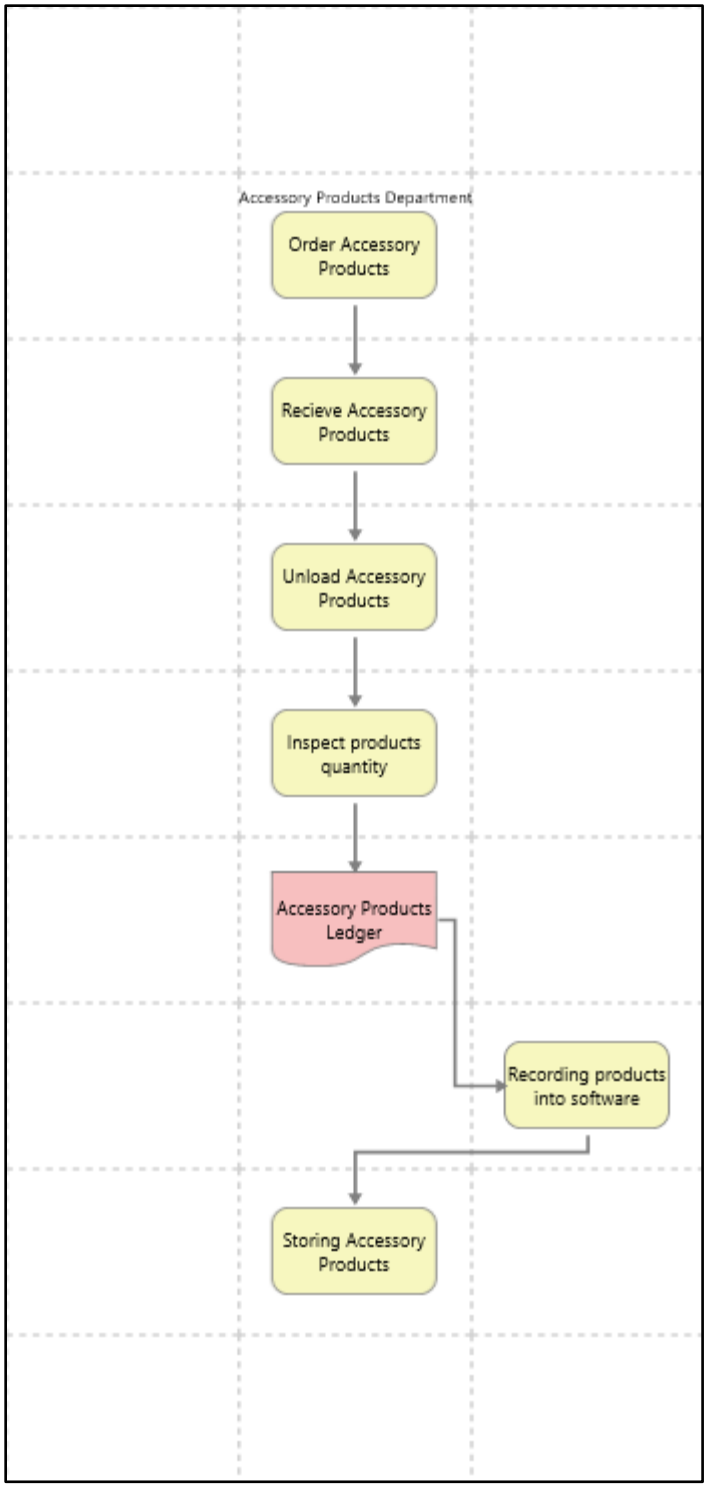
potential causes that contribute to the process problems and to find out the root causes of these problems(Madhani, 2017).

In this phase, the project team started to gainfull understanding of the Receiving and Storing Accessory Products at AUC-WT, which is necessary requirement for improvement according to Aguilar-Saven (2004). Thus, Process Map with full explanation of eight wastes for each step in Receiving and Storing Accessory Products at AUC-WT has been created to understand all process's inputs and outputs. Moreover, the project team used the Cause and Effect Diagram to identify all possible causes of problems. Cause and Effect Diagram is also known as Ishikawa or Fishbone diagram, is a systematic questioning technique for detecting, illustrating and categorizing root causes of inactive accessory products' accumulation problem (Slack, 2015). It consists of eight main categories as follows: Price, Promotion, People, Process, Place, Policies, Procedures and Products (Daleet al. 2007). Therefore, many brainstorming sessions based on top management and employees' work experiencewere conducted to identify all possible causes of inactive accessory products' accumulation in Receiving and Storing Accessory Products.

3.3.1 Mapping the Process

As mentioned in Define and Measure phases, the first step of the process is ordering accessory products, and ordering isonly based either on manual inspecting of products by accessory products supervisor, or special orders from external customers, which incur accumulation of accessory products. Once the ordered accessory products arriveand unloaded into AUC-WT's warehouse, the accessory products supervisor inspects products quantity, andany excess amount of some products are being accepted, which lead to accumulate of extra accessory products in the warehouse. Recording accessory products in BISAN software by accounting employees is the next step after inspecting the quantity of products. Recording is executed in batch and non-categorized manner, which result in having imprecise amount of existing inventory. The last step in the process has a profound effect on products' accumulation in warehouse due to following reasons: 1- there is noorganized space floor in warehouse (area layout) 2- no systematic and organized proceduresfor storing process.

Figure 9 shows all steps of Receiving and Storing Accessory Products at AUC-WT. The process begins with ordering accessory products in an unstandardized way and ends with unorganized storing procedures. The process map shows clearly how Receiving and Storing Accessory Products was running in simple and linear flow, yet in unorganized manner. In the end, the project team has concluded that Receiving and Storing Accessory Products lacked standard and organized procedures.



(Figure 9: The Map of Receiving and Storing Accessory Products)

3.3.2 Cause and Effect Analysis

AfterReceiving and Storing Accessory Products has been well understood at AUC-WT, the project team used Cause and Effect Diagram to categorize and graphically display all potential causes of problem. Thus, personal interviews with accessory products employees and inquisitive observations were held in order to collect all potential causes for accessory products' accumulation problem.

As shown in Figure 10, the Cause and Effect Diagram summarize and categorize all potential causes of accessory products accumulation based on eight main categories: Price, Promotion, People, Process, Place, Policies, Procedures and Product. These eight P's are derived from the original product-marketing 4 P's: Price, Product, Promotion and Place. Using these eight categories in cause and effect diagram represented a model of suggestive presentation for the correlation between the problem and its multiple causes. This eight categories-based diagram helpedproject team to investigate problem causesand to identify the most critical areas where data should be gathered for further studies (Ilie&Ciocoiu, 2010).

All potential causes are presented in the Cause and Effect Diagram below. Then, root causes are identified by executing frequent interviews with employees and top managers, and persistent observations for AUC-WT's warehouse. Causes were divided into two categories:

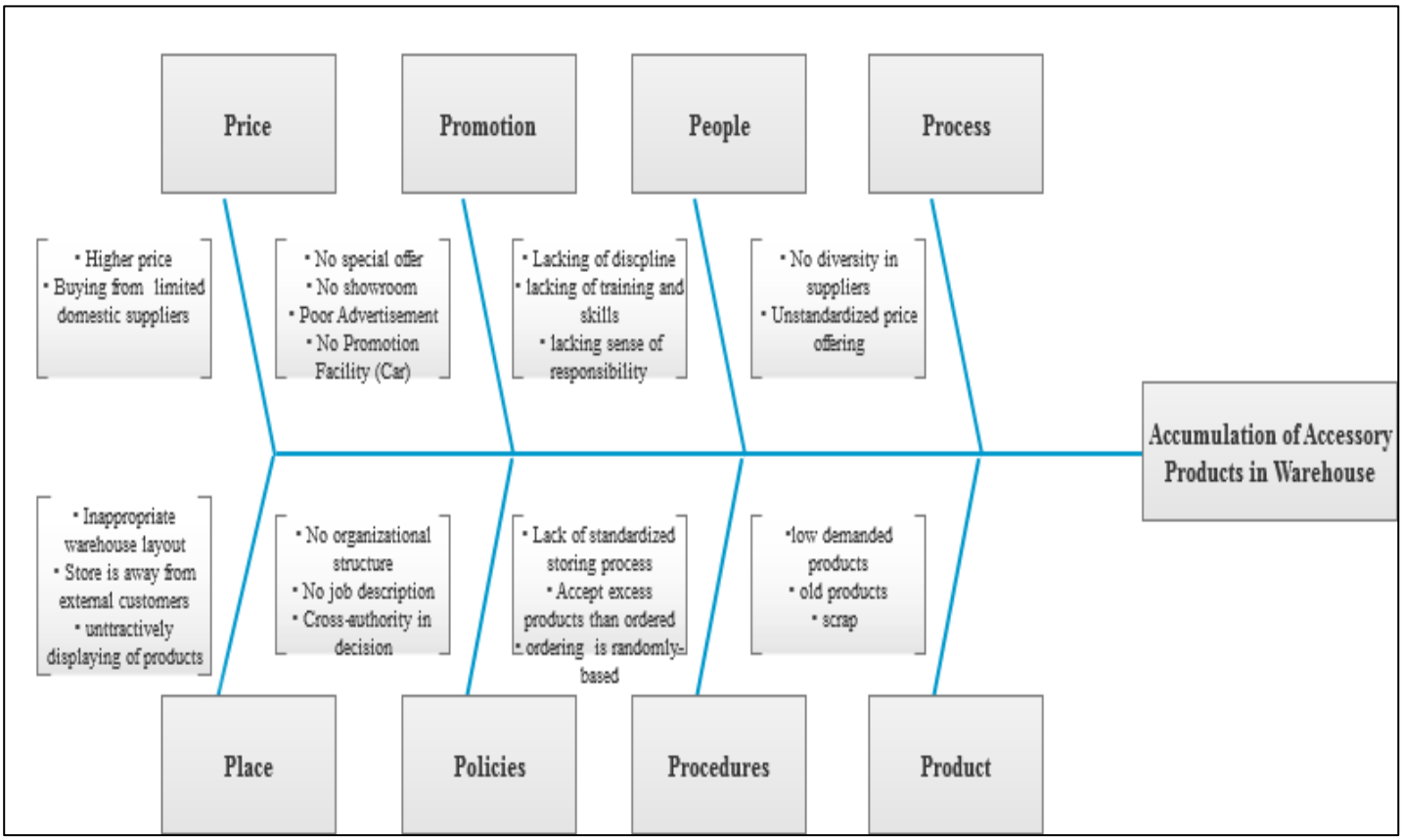
1- Causes of current problem of accessory products accumulation.
2- Causes of Receiving and Storing Accessory Products' issue

Root causes for current problem of product accumulation are:

1. Scraps and old products.
2. Inappropriate warehouse layout and having no showroom for inactive products.
3. Having no special price offers for consumers.

Root Causes for Receiving and Storing Accessory Products'issue are:

1. Price (buying from limited domestic suppliers).
2. Promotion (no promotion facility, lack of advertisement).
3. People (lack of discipline, training, skills and responsibility).
4. Policies (no organizational structure and job description).
5. Procedures (ordering is based on manual counting and mental memorization, recording aspects, lack of standardized storing procedures).



(Figure 10: Cause and Effect Diagram)

3.3.3 Prioritization Matrix

After identifying the three causes of products' accumulation, the next step wasprioritizing each cause based on two factors: the impact and easy to fix cause. Impact factor means: how much the cause has an effect toward the problem? The impact factoris classified in three levels: (V) very severe, (S) somewhat severe and (N) not severe. Easy to fix factor is best described as: how easily the cause could be fixed? It is also classified in three levels: (V) very easy, (S) somewhat easy and (N) not easy. This matrix has been identified based on employees' and managers' management experience.

Appendix 3 presents each cause with its level of impact and easy to fix. The cause which has the double V is the most prior cause to be addressed and improved, whilst the cause that has double S would be the least prior cause.

According to the causes level of impact and easy to fix table above, the project teamhas started with VV and then VS rank. As a result, project team started handling the scrap and old products, inappropriate warehouse layout and having no showroom for inactive products and having no special price offers respectively.

In addition to the importance of the two factors in prioritization matrix, the project team has realized that those causes should be handled respectively. For this reason, solving the cause depends on solving the previous one.

3.4 Improve Phase

The Improve Phase is considered the fourth step of the DMAIC Lean Six Sigma Methodology. This phase focuses on developing potential solutions to address root causes of the problems, then testing those solutions to figure out whether they are valid and having substantial effect on fixing problem (Kumar &Kaushish, 2015).After root causes have been identified in this study, the next stepis to identify solutions in order to reduce and manage these causes (Omachonu& Ross, 2004). Improvementeffortswere not restricted only for finding solutions for problem causes, yet they also prevent causes from reoccurring again and reduce the variability of process (Goldsby&Martichenko, 2005).

In this phase all potential improvement actionshave been identified to treat two majorproblems' causes as follow: causes of current accessory products' accumulationand causes of Receiving and Storing Accessory Products' issue. Therefore, the main objectives of this phase were: suggesting, implementing, and testing these improvements in order to solve both kinds of problems (Sirvanci, 2004).As a result, two kinds of improvements were adopted to solve the two problems:

1- Short-term improvements for current accessory products' accumulation problem.
2- Long-term improvements for Receiving and Storing Accessory Products'issue.

3.4.1 Improvements for Current Problem (Accessory Products' Accumulation)

In the first type of improvement, project team executed employees' brainstorming sessionsin order to attain as many ideas as possible, select the most practical solutions, implement selected solutions, test these solutions, and assess testing results to solve the problem of accessory products' accumulation.

3.4.1.1 Suggesting and Implementing Improvements

As mentioned before, the current problem that neededimprovement is the accumulation of accessory products during the past period. Accumulation problem had considerable effects on AUC-WTas follows: absorbing financial loss, incurring more opportunity cost by occupying large space of warehouse. Therefore, it was concluded in the analyze phase that following causes have the major effect on accumulation problem:

- Scrap and inactive products.
- Inappropriate warehouse layout and having no showroom for inactive products.
- Having no special price offers for consumers.

As a result, the project teamhasagreed that implementing first 3S's of 5S tool, creating showroom for inactive accessory products, having a special price offer and promoting all inactive accessory products as improvements for current problem of accumulation.

3.4.1.1.1 Sort and Shine

Over past years of operation, AUC-WT was always thinking to implement such technique for dividing accessory products and identifying the inactive from active one. Thus, the first 2S's of 5S "Sorting and Shining" were being conducted as the most actions to make the problem visible, despite they took long time of executing and completing. So, the project team decided to implement three-color tagging technique for product identification. Three-color tagging technique is simple tool used to identify each product as follow: activeproducts is tagged with green tag, inactiveproduct is tagged with yellow tagand product to be scrapped is tagged withred tag. As a result, the project team immediately began labelling each product with its own color according Appendix 4.

After sorting and labelling all products with distinct color, the next step was cleaning all accessory warehouse area, and discarding all unused things. Unused things consist of scrap products, unused electronic appliances and worn-out office furniture. Moreover, shining action focused on cleaning and flicking floor, shelves and products from dust using janitorial supplies.

3.4.1.1.2 Straightening and Creating Showroom for Inactive Products

After sorting and shining the warehouse, the next step wasstraightening. In this case, straightening means:arranging all inactive productsaltogether in one place, organizing a new showroom space for all inactive products in accessory warehouse, and all scraps in specific area as shown in figure 11.

After sorting and labelling all accessory products into three criterions, all inactive products have been labeled by yellow tag and gathered in one place as shown in the right.

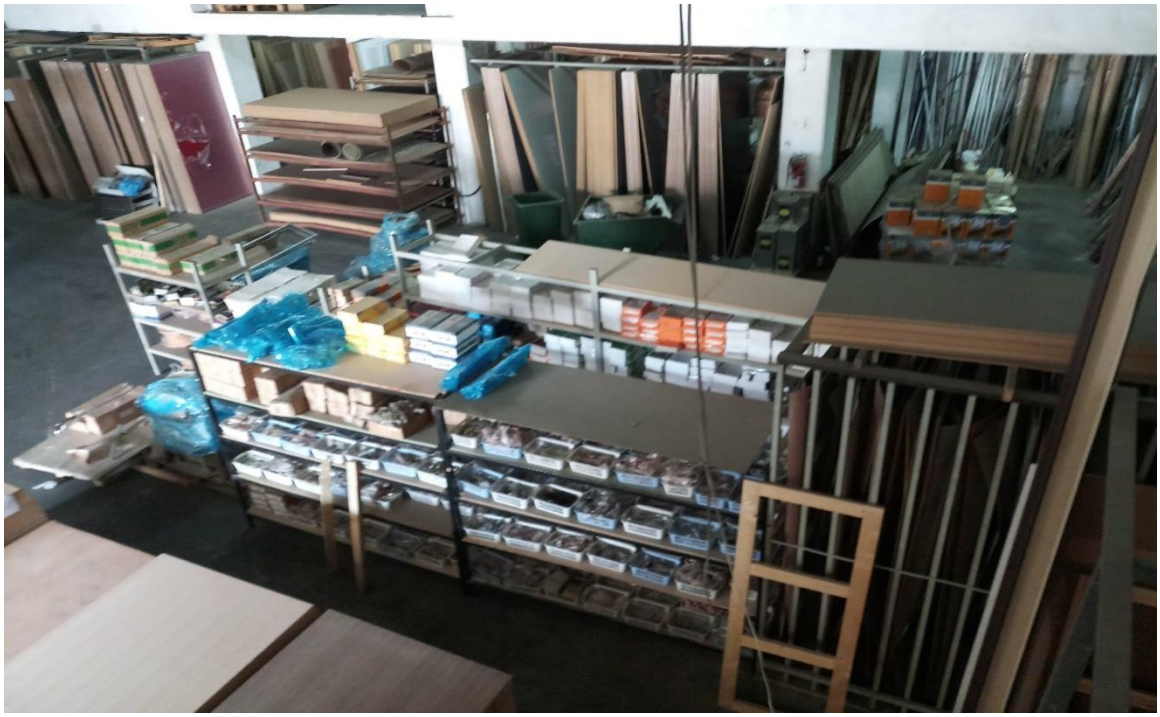
Also, all scrap and unused products have been labelled by red tag and gathered in one place in order to be discarded outside the warehouse area.

After the first 3S's of 5S tool have been implemented, a showroom for inactive accessory products has been created to promote all products nicely for customers.

(Figure 11: Collecting all scrap, collecting all inactive and showroom for inactive products)

Figure 12& 13represent how surprisingly the area has been transformed from unused space floor into arranged, proper and attractive showroom for inactive accessory products:

(Figure 12: Showroom Space, Before Improvement)



(Figure 13: Showroom Space, After Improvement)

3.4.1.1.3 Having a Special Price Offer

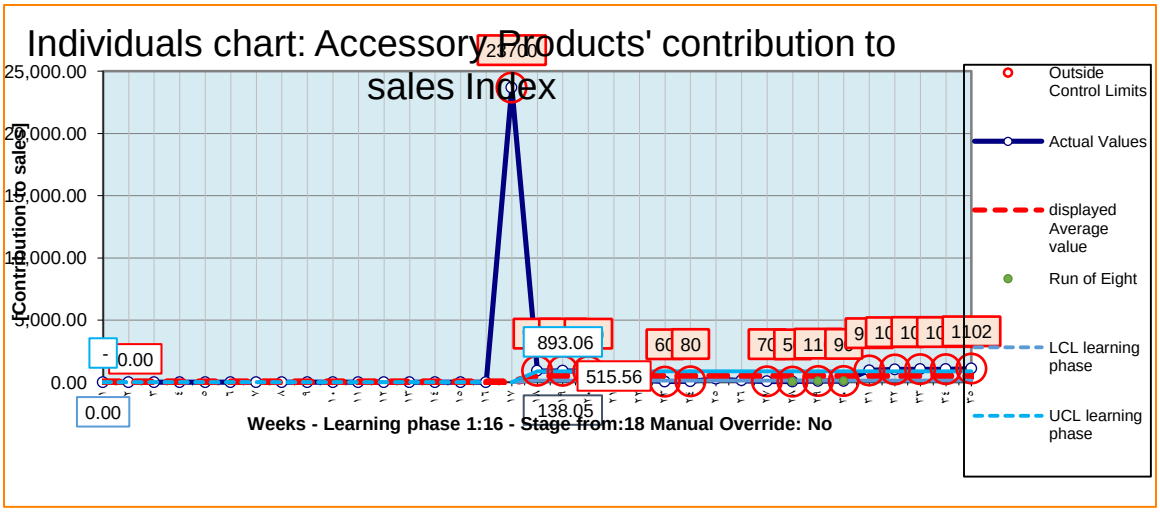
The third solutionwas selling inactive accessory products with special price offer. This solution was chosen as most enhancement action for accessory products' accumulation problem due to many reasons: most inactive products are obsolete, which means majority of products have more than 5 years of operating life, and these obsolete products have a high price if compared to the same products in competitor's store.As a result, and regarding to project team, selling inactive products with relatively low price was more profitable and effective than holding them in silent motion.

3.4.1.1.4 Promoting Inactive Accessory Products

Since AUC-WT has possessed a special space as showroom for inactive products and selecting proper price for each product, marketing step became necessary to promote all inactive accessory products. A marketing plan focusedon attracting as many customers to buy accessory products as possible by: recalling old customers, announcing for special offers on social network, attracting usual customersof wood section and rebuilding long-term contract with wood craftsmen.

3.4.1.2 Testing Improvements

The improvement testing action has helped project team in determining the positive effects of those four solutions on accessory products' accumulation problem. Testing solutions was conducted through eighteen observations(each week has two observations) for inactive products' contribution to sales revenue. A Control chart below (figure 14) represents the previous sixteen points, quick win point and eighteen points of testing for the period between 29th of March to 24th of May.

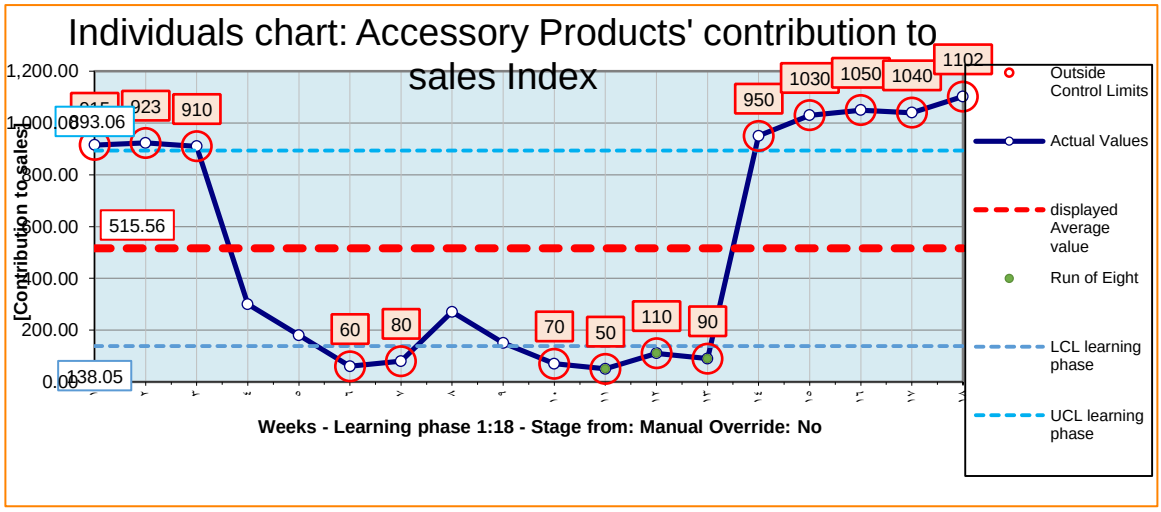


(Figure 14: Contribution to sales' Control Chart from the 16 points of performance to 18 points of testing)

Figure 15shows the eighteen points of testing periodfor inactive accessory products' contribution to sales with an average contribution to sales value of 515.56NIS, lower control and upper control limits of 138.05 NIS and 893.06 NIS respectively.The total

contribution to sales during the testing period was equal 10,420 NIS, which means, accessory products' contribution to sales revenue hada higher value during testing periodmore than learning phase period.

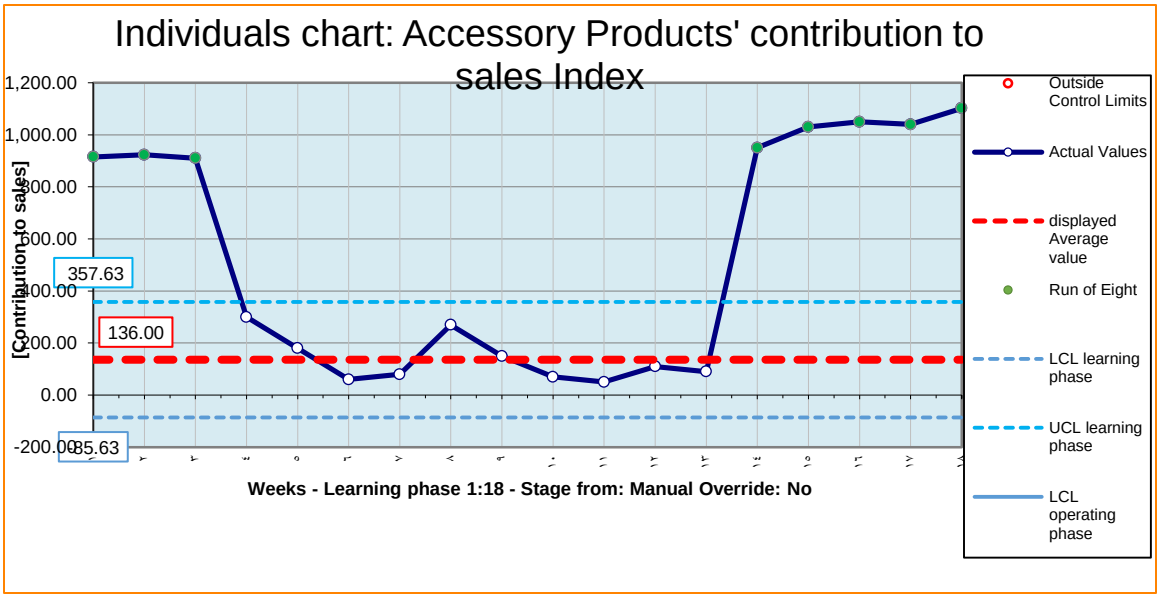
As shown in figure 15, there are eight out of control points, and the reason behind these points wasimplementing promotion techniques as improvement solution.In fact, it had a considerable effect on the level of information presented in control chart.



(Figure 15: Contribution to sales' Control Chart for Testing Period)

As mentioned before, external promotion technique by a procurement agent (Israa') had a considerable effect on control chart observation points. These eighteen points have two levels of information as follows: eight points of external promotion technique and ten points of daily sales. Actually, eight points have a higher value than UCL (893.06 NIS), because they were a result of heavy selling days, when the other ten points represented usual daily selling. Therefore, these eight points of observation have been omitted from the control chart.

Figure 16 shows a balanced testing period of control chart with an UCL, average, LCL values of 357.63, 136, 85.63 NIS respectively.These testing observations have been used as an indicator for high possibility and capability of these four solutions to reduce the amount of accessory products' accumulation problem at AUC-WT, and as a learning phase of monitoring period.



(Figure 16: Contribution to sales' Control Chart for Testing Period after omitting eight out of control points)

3.4.1.3 More Profitable Outcomes

After all solutions have been performed to fix the current problem of inactive products' accumulation, the project team observed and realized that such solutions had positive and profitable impact on accessory products' warehouse space utilization at AUC-WT. In fact, sorting and straightening actions provided two space outcomes: first, attaining smaller storage area for accessory products which leads to more efficient time, motion and process operation. Second, possessing a blank space area for accounting and marketing department employees as shown in Figure 17.

Appendix 5clarifies the exact area space that had been utilized through implementing those solutions. Actually, the total utilized area space is equal 70 meter square, 28 meter square has been used as office for finance and administrative employees, and the other area (42 meter square) is still empty for any possible future purposes. This area could be used in various ways of investment such as: leasing this area for third party, storing additional accessory products in case of importing directly from foreign suppliers. Therefore, the opportunity cost for this area valued by35,000 US Dollar on a yearly basis, (space area * price for each one meter square area, 70* 500). In conclude, AUC-WT has gained 35,000 USDon a yearly basis and have gained a new office for purchasing department which deemed as a profitable return for the company.

Unused space floor

After utilizing the space floor

(Figure 17: Transforming the unused space into blank, and make an office department)

3.4.2 Improvements for Long-Term Problem (Receiving and Storing Accessory Products)

As mentioned in analyze phase, the project team has pointed out all causes ofReceiving and Storing Accessory Products'issue. Then, the team highlighted that the most three causesare as follows: Price, Policyand Procedure, and each of these aspects have two causes. Figure 18 provides a clearer explanationof long-term problem identification mechanism.

(Figure 18:long-term problem identification mechanism)

After identifying all the six causes of Receiving and Storing Accessory Products' issue, the project teamhas adopted specific solutions for each cause.Table19 provides further details for each cause and its solution.

Causes	Solution
No systematic ordering technique	Having a standard ordering technique
Buying only from domestic suppliers	Import directly from foreign suppliers
No organizational structure	Outsource consultancy firm to build a new organizational structure
No job description	Outsource consultancy firm to identify job description for accessory department employees
Ordering is based only on manual counting and mental memorization	Implementing 5S tool
Lack of standardized storing procedure	Implementing 5S tool

(Table 19: Improvement Solution for each cause)

After identification the aspects, causes and solutions forReceiving and Storing Accessory Products'issue, the project team has started with pricing aspect, policy aspect and procedure aspect respectively as follows:

3.4.2.1 Pricing Improvements

The project team has started with pricing causes, because many actions and activities depend on accessory products' price, such as: promoting inactive products, having consistent and long-term contract with existing customers and continuously attracting new customers. Therefore, the price aspectwas considered as a vital issue that needed improvement. As a result, the project team has reached to these two price-improvement recommendations:

1- Focusing on product cost reduction by importing more from international suppliers instead of domestic suppliers as their prices are relatively high, and this results in selling these accessory products with higher prices.
2- Adopting standard ordering procedures which serves both parties "the company and its customers" to acquire lower priced products. This is because, having a various pricing lists from multiple domestic suppliers would assist AUC-WT to purchase products with the lower offered prices, hence, higher profit margins.

3.4.2.2 Policy Improvements

After the project team has pointed out the above two price improvement recommendations, the team members agreed that policy improvement for both causes are needed. They agreed to have an organizational structure with identified job description for each position. As a result, AUC-WT has requested help from consultancy organizationsto build new organizational structure and to provide a detailed job description for accessory department employees. Appendix 6 shows the new organizational structure and Appendix 7 and 8showjob descriptions for accessory department employees.

The main reasons behind forming new organizational structure and job description for accessory department employeeswere: having a cross-functional decision making and work duplication. Therefore, having such organizational structure and defined job description has provided a clear and identified responsibilities, duties, rights and authorities, and increased the employees' efficiency and effectiveness at work.

3.4.2.3 Procedure Improvements

The project team has figured out that the two causes of procedure aspect complementing each other, storing process would continuously affect the ordering process and the vice versa. More specifically, having no standard storing procedure had a considerable effect on ordering process, in the same time, having no ordering technique also had the same effect on storing procedure.

When accessory department's employees were storing products in a random manner regardless their turnover, family and size , the ordering process been affected by either ordering unneeded products or\and ordering needed product with high or low quantity. Simultaneously, ordering wrong quantity or quality of products and accept them anyway,would accumulate unneeded products in accessory warehouse.

As a result, the project team decided to collaborate with employees to adopt and implement the “5S” lean techniquein order to have attractive product store and to form new standard procedure for storing process. The5S steps tool (Sort, Set in order, shine, standardize and sustain) implemented as described below:

3.4.2.3.1 Sort

The Project team has divided Accessory Products into three categories using three color technique: active, inactive and scrap products. As mentioned before, green color for the active products, yellow color for inactive products and red color for scrap products. Moreover, each kind of product was allocated separately in its designated location as follows: active products in main warehouse, Inactive products in new showroom space and scrapped products either to be disposed or offered with free price.

3.4.2.3.2 Set in order

As mentioned before, set in order action has been used in order to arrange inactive products in one place and create attractive showroom for them. Set in order stepwas also used to arrange all active products in turnover, family and size.

3.4.2.3.3 Shine

Shine phase was important in cleaning all the floor, shelves and product from dust, and also in discarding all unused products/ scrapsaway from warehouse. Shining action was achieved in daily basis in order to have clean and lean environment.

3.4.2.3.4 Standardize

The project team has reached to standard storing procedurebased on turnover rate, product family and product size.Products’ identity labels as shown in Figure 20, were set on store shelves in order to help employees and customers to reach for required products. Moreover, formed organizational structure and job descriptions would have a considerable effect on employees’ adhering to storing procedure.

(Figure 20: Product Identity Card)

3.4.2.3.5 Sustain

Implementing new standard procedures for storing process and providing specific tasks for each employee were vital steps, but adhering to these procedures and tasks was more important. For this reason, the general manager himself took the full responsibility to execute a daily inspection of employees' commitment.

Lastly, the project team has found that implementing 5S tool had a considerable effect not only on warehouse layout attractiveness, employees' motion and ordering process, yet it had a major influence on stocktaking process. Having a stored products with a standard manner and clarified tags would reduce the time and power to count all accessory products at the end of each month.Figure 21, indicates the 5S effect on Accessory warehouse at AUC-WT.

(Figure 21: Implementing 5S tool at Accessory and Store area)

3.5 Control Phase

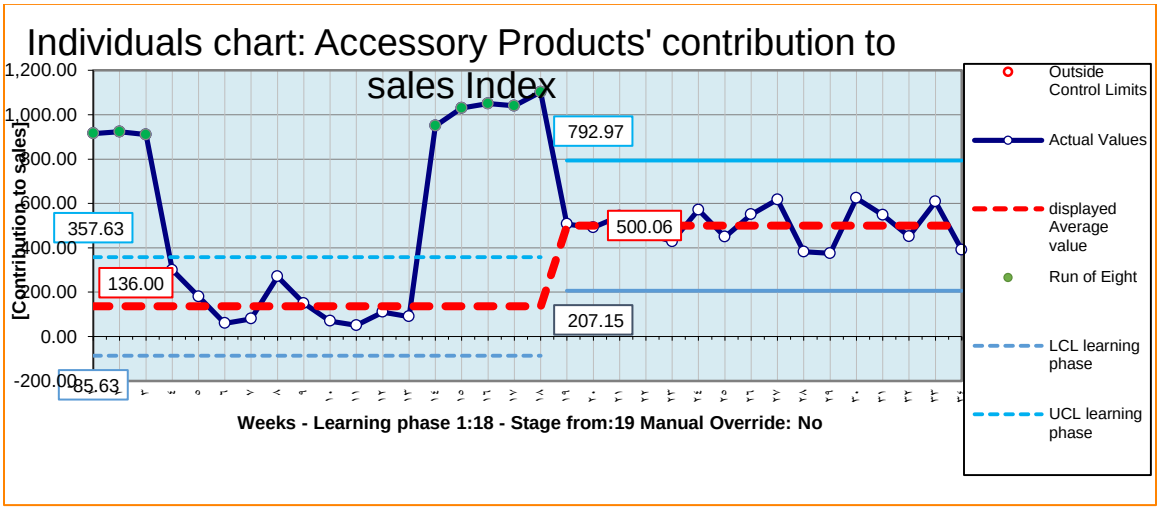
The last step of the DMAIC methodology is Control Phase. So far, all solutions have already been identified, validated and implemented, but they needto be continuously maintained and monitored (Pham, 2006). In fact, controlling helped the project team to assure that the process (contribution to sales) wouldn'tget back to the old performance and improvements have been become a daily routine at AUC-WT (George, 2003).

As a result, the project team have monitored the improved process by using control chart, created modified and improved flowchart for Receiving and Storing Accessory Products, and formed checklist of instructions and procedures.

3.5.1 Monitoring Process Performance

After implementing and testing improvements, the project teamhas monitored the performance of the process using the measure: “Accessory products’ contribution to sales” for the period between 31th of May to 19th of July, with sixteen points of observation (each week two points of observations are collected).

After eighteen points of testing, sixteen points of monitoring have been observed for accessory products’ contribution to sales. Therefore, figure 22shows these sixteen points with an UCL, Average and LCL of 792.97 NIS, 500.06 NIS and 207.15 NIS respectively.The monitoring period had higher average contribution to sales and stable points of observationsthan the previous period (average of 136 NIS). That is because, promotion and sales agent “Israa” has had deep understanding of customer’s needs and requirements. So, he started promoting and sellingthe needed products to the right customers.



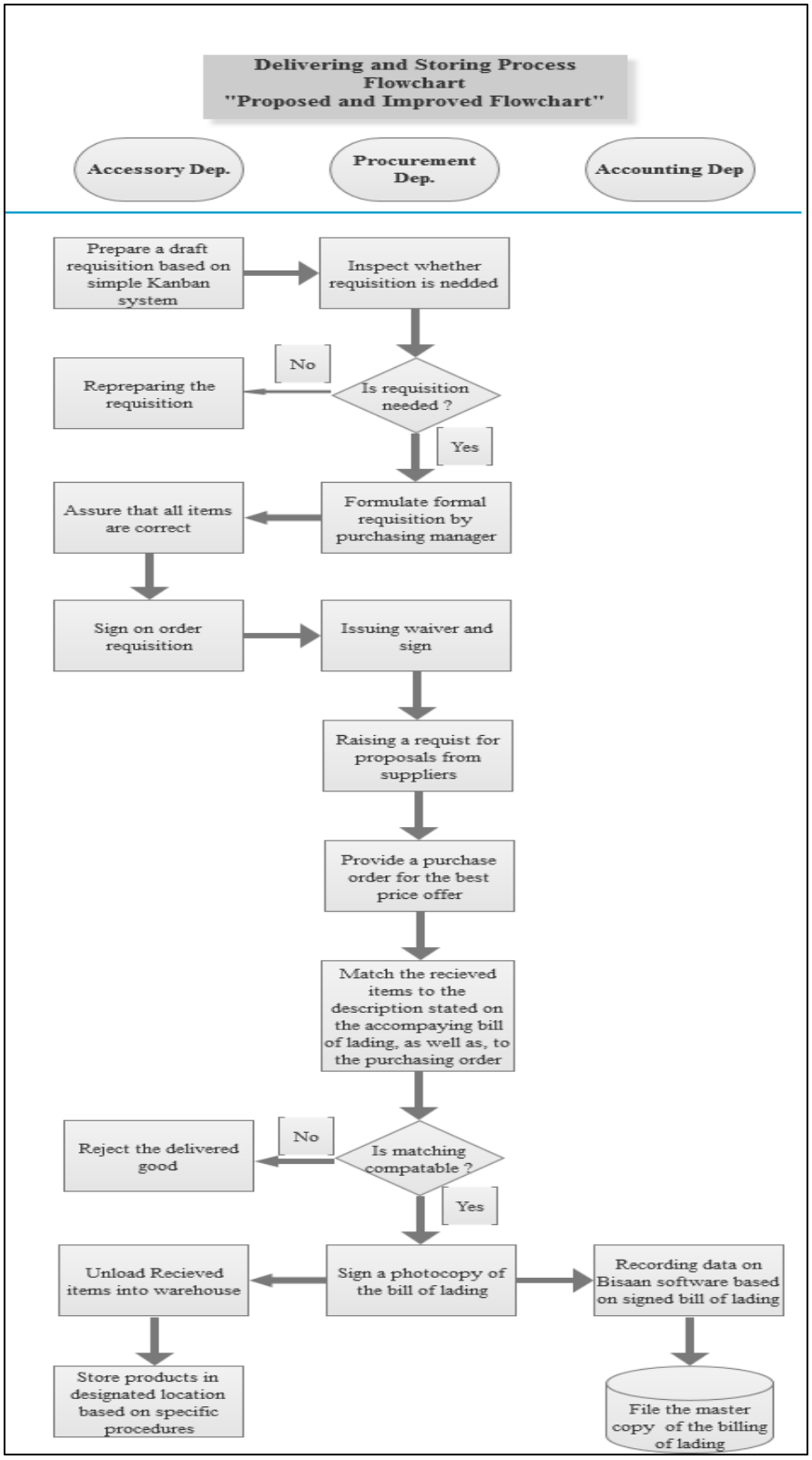
(Figure 22: Contribution to sales’ Control Chart from the 16 points of performance at Monitoring Period)

3.5.2 Modified and Improved Process Flowchart

After DMAIC methodologyhad reached the end and all analysis and improvements have been adopted, a new flowchart was created for Receiving and Storing Accessory Products. The aim behind creating this flowchart for Receiving and Storing Accessory Products was preventing accessory products’ accumulation from reoccurring again. Figure 23 shows purely the new flowchart for Receiving and Storing Accessory Products, and detailedprocess stepsas the following:

1- Accessory Department’s employees prepare a draft requisition based on simple Kanban system and send it to Procurement department. That prevents requesting excess accessory products.
2- Procurement Department’s employees must inspect whether received requisition is needed or not. In case requisition is not needed, it must be returned to accessory department to prepare a new one. If it does, purchasing manager must formulate a formal requisition.

3- A formal requisition must back again to accessory department, in order to assure that all items included in formal requisition are correct. Then, sign on order requisition.
4- A procurement department must also put its signature beside accessory department one. Then it should raise a request for proposals/ quotations from suppliers, in order to possess the best offered price. After having the best offer, it should provide the purchase order to the best supplier offer.
5- Upon receipt of delivery, procurement officer must match the received items to the description stated on the accompanying bill of lading, as well as, to the purchasing order. If matching is not compatible, they should reject the delivered goods, but if it is, department should sign a photocopy of the bill of lading that indicates that delivered goods have been inspected and accepted. Then, two parallel steps would be executed.
6- Photocopy of signed bill of lading should be send to accounting department in order to record all data properly and thoroughly on BISAAN software. Also, the department should file the master copy of the bills of lading.
7- Accessory department's employees should unload received goods into accessory warehouse and then store all products in designated location.



(Figure 23: Improved Process Flowchart)

3.5.3 Checklist of Instructions and Procedures

After implementing 5S tool as an improvement technique, it's vital and necessary to adopt a checklist sheet as auditing step for 5S implementation in accessory area and storage area at AUC-WT. This checklist has considerable effect as a helping hands on adhering to all steps in the process. Furthermore, this checklist can assist AUC-WT to stay more organized by assuring that no single step in the process has been neglected or skipped, and to complete repetitive tasks more quickly, efficiently and with fewer mistakes. More often than not, using checklist in the daily work would motivate employees to take actions and complete tasks, allowing them to master the repetitive work and utilizing themental skills for creative activities. Therefore, as part of the Control Phase, the project team has formed a 5S auditing checklist to monitor the process in a weekly basisto remain competitive in today's marketplace with strong retail execution strategy. Appendix 9 shows the English version of checklist.

The previous checklist has been translated into Arabic version in order to be used as weekly monitoring sheet. The reason behind translation is to have an effective and understandable monitoring tool used by Accessory department’s employees.Figure 33 shows the Arabic version of checklist.

Chapter Four: Results, Recommendations and Lessons Learned

For a DMAIC project to succeed, it requires a great but flexible project plan, top management commitment, and persist and patient project leaders and project teams. Following six months of meticulous improvement work, the DMAIC project has reached to the end with helpful tools that have considerable positive effects and successful results in AUC-WT's Ramallah branch. These results are presented as follow:

1- Based on internal customers' needs and requirements and stakeholders' interests, accumulation of inactive accessory products had been selected as an issue necessary to be understood and improved. Therefore, the Project Charter, SIPOC diagram, verifying process with data and Project Contract have been created or implemented in the Define Phase.
2- While accumulation issue has been confirmed as a problem needed to be addressed by team members, the "accessory products' contribution to sale" was selected as a metric to evaluate the current performance of Receiving and Storing Accessory Products. Thence, data were collected over 16 weeks (30th Sep, 2017 to 15thMarch, 2018) andthe contribution to sales was zero NIS all over that period. As a result, there was a necessity to execute Quick Wins based on four criteria: take less than 1 week, cost less than 1000 NIS, reversibility and within team's authority. The selected quick win to be implemented was transferring inactive accessory products with a value of 23,700 NIS into AUC-WT's Al-Ram branch, and all the transferred products have been sold to market.
3- After acquiringsufficient understanding toward accessory products' accumulation issue, cause and effect analysis was carried out to figure out and identify the primary causes of such an accumulation. Old products and inappropriate warehouse layout, no showroom for inactive accessory products, and lacking of special offers for external customers were identified as the root causes of accumulation. In addition, this analysis resulted in identifying further causes for theReceiving and Storing Accessory Products' issueand these causes are related to: inappropriate pricing and lack of Policies and Procedures.
4- The team started implementing improvements to address the inactive products accumulation issue. These improvements included:implementing the first three steps of the 5S tool (Sort, Shine and Straighten), creating showroom for inactive products, promoting inactive accessory products and having a special price offer for external customers
5- Applying these improvements for addressing the inactive products' accumulation issue resulted in: a considerable space utilization effect on accessory warehouse at AUC-WT by making available for use an area of 70-meter square, which contained the inactive products. AUC-WT's management hasdecided to use 28-meter square of this area for a new Purchasing department and has hired two employees in this department. Moreover, the remaining area of 42-meter square is now free for other

uses. The value of the space made available is approximately $35,000 (70 meter square *$500) i.e. this amount could be seen as a saving of $35,000 on a yearly basis.

6- The team has monitored the effect of improvements on contribution to sales by collecting sixteen points of observations using control chart. In addition, team members have created a new flowchart for Receiving and Storing Accessory Products in order to prevent inactive products accumulation from reoccurring again, and a checklist of instructions to affirm employees' commitment for procedures.
7- The total contribution to sales for accessory products is 42,112 NIS (23,000 NIS from quick win, 10,420 NIS during testing period and 7,992 NIS during monitoring). As a result the value of accumulated inactive accessory products have been decreased from 90,000 NIS to 47,888 NIS (decreased by 46.79%).
8- Both temporary (showroom) and permanent storage areas for accessory products have been organized and a new standard which includeslabelling system has been created and adopted.
9- An organizational structure and job descriptions for all employees including the accessory department's employees were created which will contribute to better run the system and its sustainability.

Following the achievement of above results which will affect positively the performance of Receiving and Storing Accessory Products now and in the future, the following specific recommendations will help sustain the good performance of this process:

1- Purchasing manager should inspect whether draft requisition from Accessory department is needed or not.
2- Purchasing manager/ officer should raise a request for proposal/ quotation from domestic suppliers to obtain the best price offer.
3- Purchasing manager/ officer should inspect and match the received items with the description stated on the accompanying bill of lading, as well as, to the ordered items and quantity. That is because, if not matched, received goods will be rejected.
4- After purchasing manager signed a photocopy of the bill of lading, the accounting department should record the data on BISAN software based on that bill.
5- Accessory department's employees must store all received goods in designated locations.
6- General Manager should use aweekly-based checklist to inspect accessory department store, in order to assure if the employees are following the new standard and procedure.

At the end, nobody can deny the immense transformationthatDMAIC methodology couldaccomplish in the form of raising the competitive edge of companies, increasing customer satisfaction and spreading teamwork and collaboration. Thence, lessons that researcher has learned from implementing DMAIC at AUC-WT are as follow:

1- Adhering to the DMAIC methodology during accomplishing the improvement study at AUC-WT's Ramallah branch was the best guideline to follow. Those five

collaborated and overlapped phases (Define, Measure, Analyze, Improve and Control) help team members to execute the studyin sequential, logical, smooth and organized manner.

2- Implementing the DMAIC methodology let the project team adopt as many as possible Lean Six Sigma tools and techniques, and to recognize new ones as well. Moreover, DMAIC serves as a guideline to implement these tools properly and perfectly.
3- The DMAIC methodology emphasizes on the importance of collecting and analyzing information. Therefore, it helped the project team in collecting, treating and analyzing information to acquire data. In addition, it expandedthe skills of team members especially in the use of improvement tools, creating standards and collecting, analyzing and interpreting data.
4- The DMAIC principles are best defined asa way of working not as set of procedures or improvement methodology. In order to make it a culture, these principles have been practiced during the improvement study at every stage and in every segment of the organization.

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Appendix

Appendix 1 (Quick Win Criteria Template)

Quality Concern	Potential Solution (Quick Win)	Take less 1 week	Costs less than 1000 NIS	Is reversible	Within Team's scope to authorize
Accumulation of inactive accessory products	Having salesperson to promote all inactive products	No	No	Yes	No
	Having a show room to promote all inactive products	No	Yes	Yes	Yes
	transmitting inactive product into other branch (Al-ram)	Yes	Yes	Yes	Yes

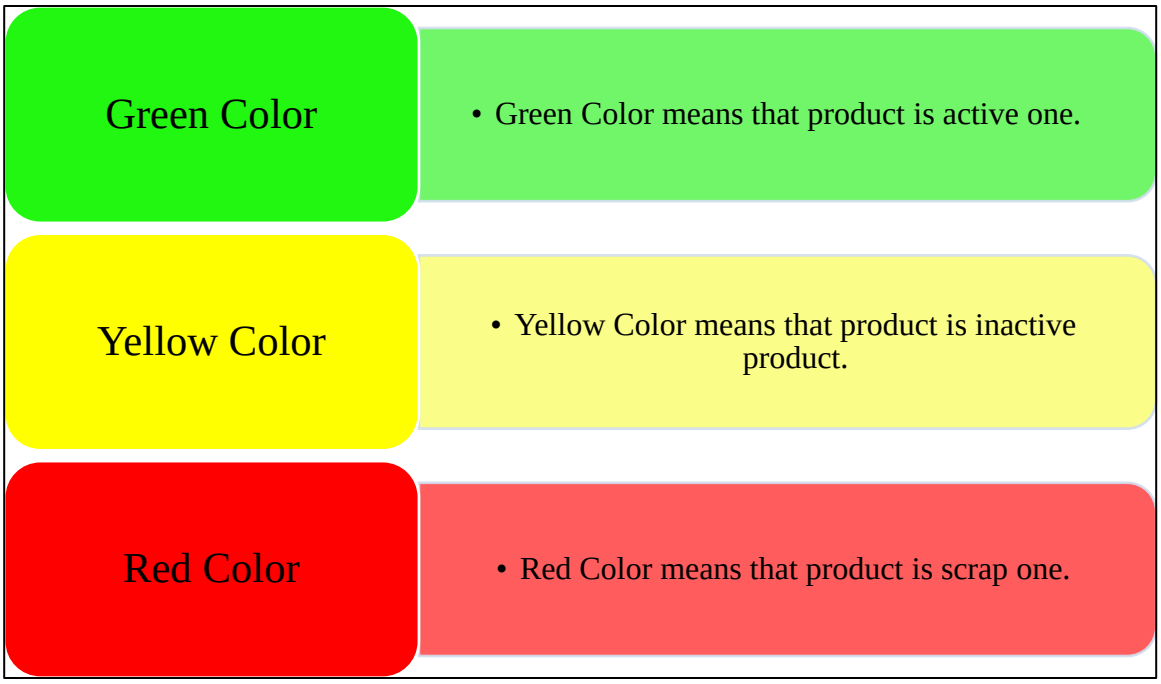
Appendix 2 (Selected Quick Win Items, Quantity and Value Table)

Items	Quantity	Price/ unit	Total Value
عجال ميرا	3	50	150
كعاب أرجل	360	1.5	540
سحاب صيني (50 سم)	250	6	1500
زرافيل ميمي مشلح	100	30	3000
كاسات عمدان	200	7	1400
مرابط	40	50	2000
ستوب باب	150	7	1050
كرانيش جوز طبيعي	100	70	7000
كررانيش جوز طبيعي مدور	5	50	250
كنت سابا	80	15	1200
كرانيش 2سم	40	13	520
سحابات بلوم 35 سم	125	19	2375
سحابات بلوم 45 سم	125	21	2625
أزرار بلاستيك	30	3	90
Total Amount in NIS =			**23700**

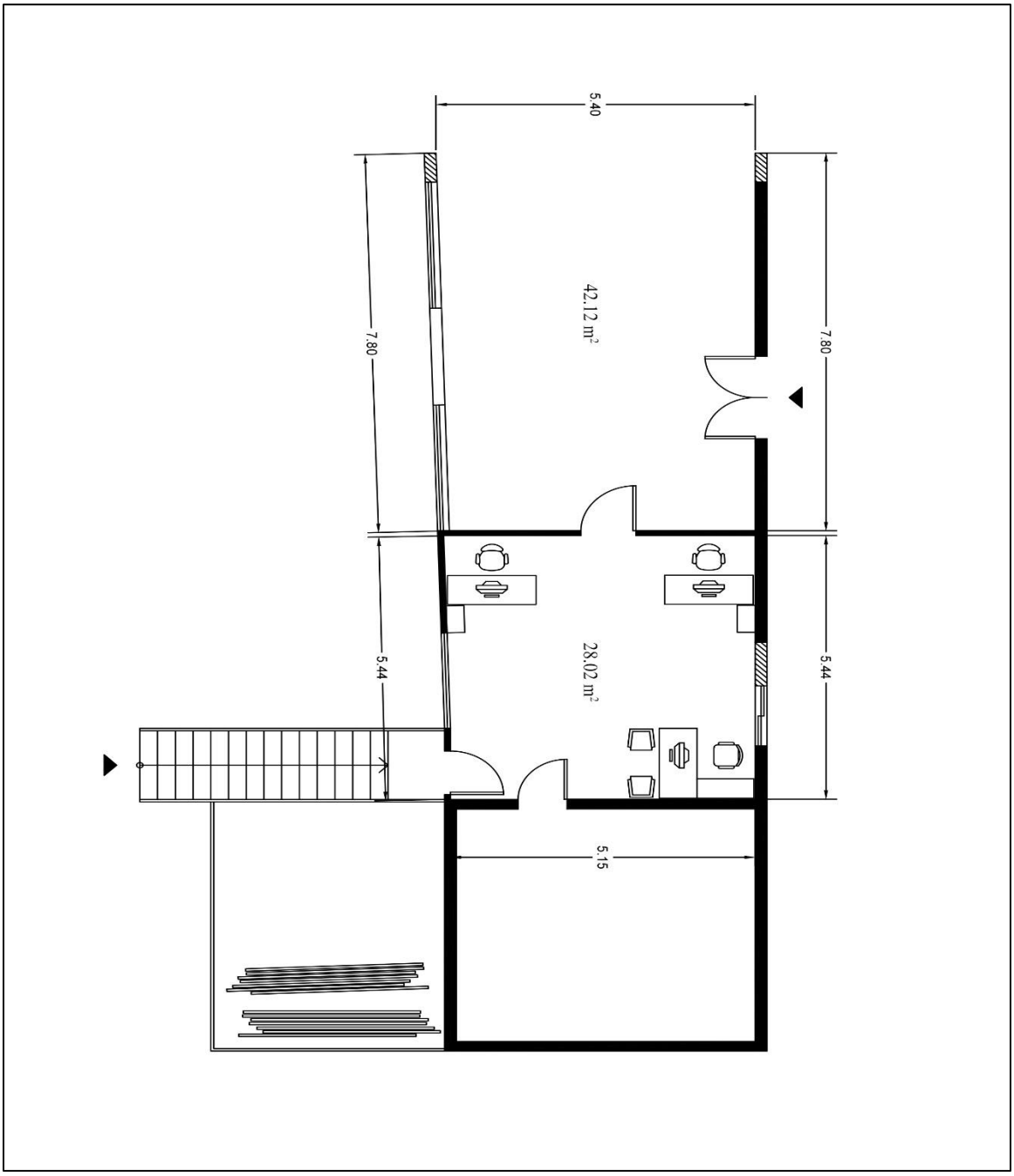
Appendix 3 (Prioritization Matrix for Current Causes Table)

Cause	Impact	Easy to fix	Total
Scrap and old products	V	V	VV
Inappropriate warehouse layout and having no showroom for inactive products	V	S	VS
Having no special price offers	V	S	VS

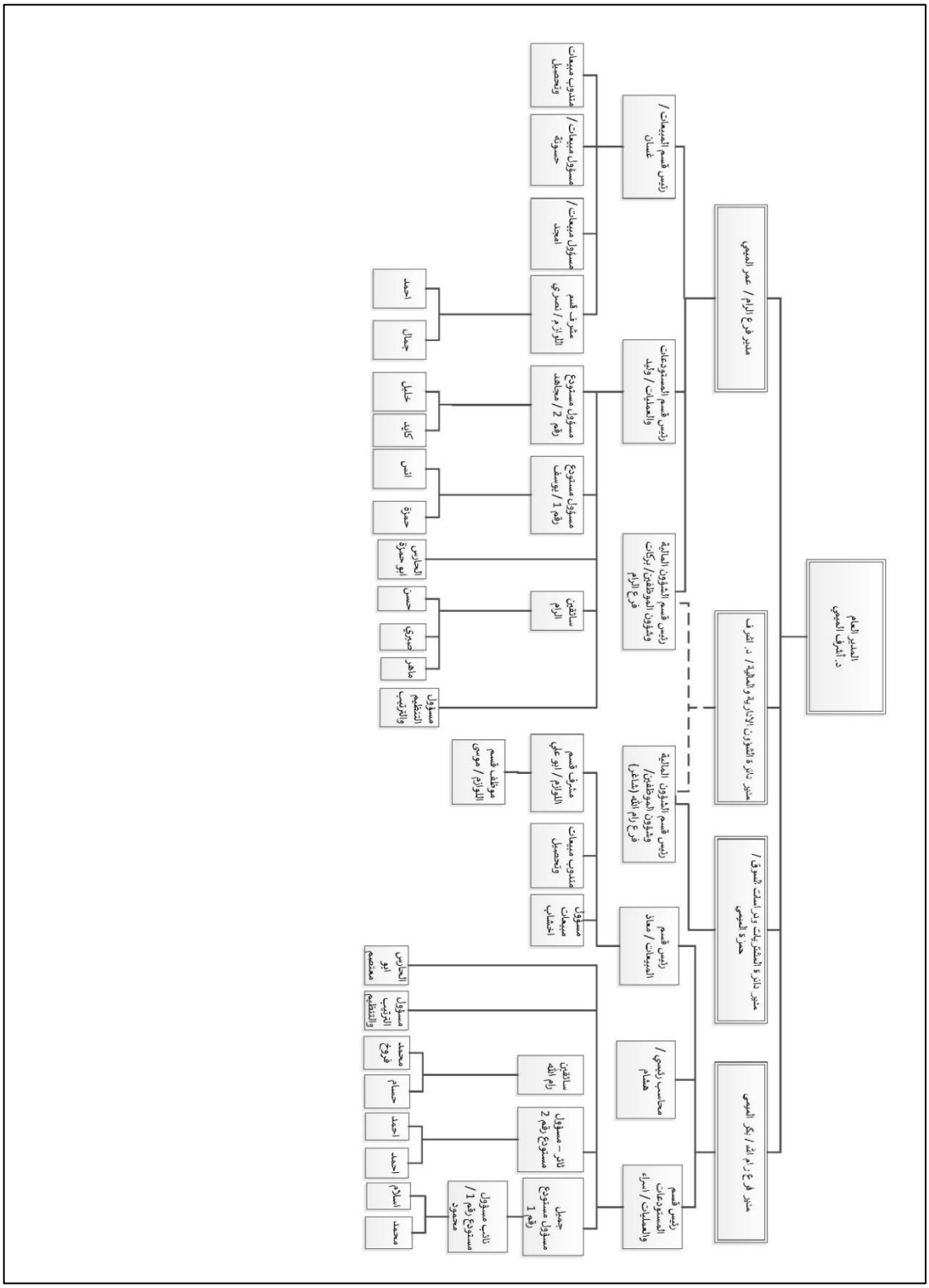
Appendix 4 (Three-color technique of Sorting)



Appendix 5 (Utilized Space Floor Plan View)



Appendix 6 (Organizational structure for AUC-WT)



Appendix 7 (Job description for accessory department supervisor)

بطاقة وصف وظيفي: مشرف مبيعات اللوازم

التبعية الإدارية: قسم المبيعات في الفرع.

الهدف و الغرض من الوظيفة:القيام بأعمال البيع تبعاً للسياسة المتبعة للمبيعات والمعتمدة من المدير العام للشركة.

الرئيس المباشر: رئيس قسم المبيعات.

كود الوظيفة: MS-002

المؤهلات والخبرات

- دبلوم إدارة اعمال.
- إجادة اللغة العربية والعبرية قراءة وكتابة ومحادثة.
- خبرة في مجال المبيعات لمدة لا تقل عن 5 سنوات.
- خبرة في مجال مبيعات اللوازم والأخشاب لمدة لا تقل عن 3 سنوات.

الواجبات والمسوؤليات

- تنسيق عمليات البيع اليومية للوازم مع موظف اللوازم .
- عرض كل اصناف اللوازم التي تبيعها الشركة على الزبائن.
- تزويد الزبائن بالمعلومات الكافية عن اصناف اللوازم المتوفرة ومزاياها وانواعها واسعارها واحجامها واستخداماتها وجودتها.
- استلام طلبات البيع ومتابعة تسليم الكميات المطلوبة للزبائن بالتنسيق مع موظف اللوازم.
- التحقق من اسعار المبيعات قبل عرض الاسعار على الزبائن.
- التفاوض مع الزبائن على الاسعار وجودة المبيعات وعلى البضاعة المرتجعة ايضا للتوصل الى تسوية مناسبة مع الزبائن.
- تقديم الزبائن الراغبين بالحصول على خصومات على المبيعات لرئيس قسم المبيعات لاخذ قرار بمنحهم الخصومات وفقا للصلاحيات المقرة.
- إعداد جدول المبيعات اليومي محدد عليه أسماء الزبائن، نوع اللوازم المباعة، الكمية المتفق عليها/المباعة ومكان التسليم وتسليمها لرئيس قسم المبيعات.
- محاولة الوصول إلى تسوية مناسبة مع الزبون في حال إرجاع بضاعة من قبل الزبون.
- اية مهام اخرى يكلف بها من قبل المسؤول المباشر.

Appendix 8 (Job description for accessory department employees)

بطاقة وصف وظيفي: موظف مبيعات لوازم

التبعية الإدارية: قسم المبيعات في الفرع.

الهدف و الغرض من الوظيفة:القيام بأعمال البيع تبعاً للسياسة المتبعة للمبيعات والمعتمدة من المدير العام للشركة.

الرئيس المباشر: مشرف مبيعات اللوازم.

كود الوظيفة: MS-004

المؤهلات والخبرات

- ثانوية عامة مع شهادة حسن سير وسلوك.
- إجادة اللغة العربية والعبرية قراءة وكتابة ومحادثة.
- خبرة في مجال المبيعات لمدة لا تقل عن 2 سنوات.

الواجبات والمسوؤليات

- القيام بعمليات البيع اليومية للوازم.
- المشاركة في عرض كل اصناف اللوازم التي تبيعها الشركة على الزبائن.
- المشاركة في تزويد الزبائن بالمعلومات الكافية عن اصناف اللوازم المتوفرة ومزاياها وانواعها واسعارها واحجامها واستخداماتها وجودتها.
- استلام طلبات البيع ومتابعة تسليم الكميات المطلوبة للزبائن بالتنسيق مع مشرف مبيعات اللوازم.
- التحقق من اسعار المبيعات من مشرف اللوازم قبل عرض الاسعار على الزبائن.
- ترتيب البضائع بالشكل الصحيح في منطقة العرض وفي مستودعات اللوازم ووضع بطاقة تعريف عليها بحيث يسهل الوصول لها دون عناء.
- التأكد من سلامة التخزين في المستودعات ووجود وسائل السلامة ضد الحريق.
- المساهمة في تطوير نماذج إدارة / دائرة المستودعات.
- المحافظة على نظافة مستودعات اللوازم والتأكد من سهولة الوصول إلى البضاعة.
- اية مهام اخرى يكلف بها من قبل المسؤول المباشر.

Appendix 9 (Checklist of Instructions and Procedures)

#	Checklist Questions	Yes	No
1	Are there any un-needed items in accessory area?		
2	Are there any un-needed items in storage area?		
3	Have all un-needed items been removed from the work area?		
4	Do the items that are needed in accessory area have a proper location?		
5	Do the items that are needed in storage area have a proper location?		
6	Have all needed items been placed at the closest location to where they are used the most to minimize the waste of motion?		
7	When items not in use, are they returned to their home?		
8	Are work stations and floors in the area clean and tidy?		
9	Are all walls in the area clean?		
10	Are all items in the area clean?		
11	Are all shelves in area clean and tidy?		
12	Are safe work practices in place being followed?		
13	Is there any product that has not been sold by the previous 3 months?		

Appendix 10 (Arabic Version of Checklist of Instructions and Procedures)

لا	نعم	أسئلة قائمة التحقق	#
		هل هناك أي عناصر غير ضرورية في منطقة اللوازم؟	1
		هل هناك أي عناصر غير ضرورية في منطقة التخزين؟	2
		هل تم إزالة جميع العناصر الغير ضرورية من مكان العمل؟	3
		هل تم وضع العناصر الضرورية في منطقة اللوازم في مكانها المناسب؟	4
		هل تم وضع العناصر الضرورية في منطقة التخزين في مكانها المناسب؟	5
		هل تم وضع جميع العناصرالضرورية في أقرب نقطة عن المكان التي تستخدم فيه وذلك للحد من ضياع الوقت والجهد؟	6
		عند الإنتهاء من استخدام العناصر، هل يتم إرجاعها إلى مكانها المناسب؟	7
		هل مكان العمل والأرضيات نظيفة ومرتبة؟	8
		هل جميع الجدران نظيفة؟	9
		هل جميع العناصر في المكان نظيفة؟	10
		هل جميع الرفوف نظيفة ومرتبة؟	11
		هل يتم اتباع ممارسات العمل الآمن في المكان؟	12
		هل هناك أي منتج لم يتم بيعه في الشهور الثلاثة الأخيرة؟	13

ملخص البحث

في الآونة الأخيرة، أصبحت المنافسة المحلية بين شركات تصنيع و تجارة الخشب أكثر حدة. كل يسعى للتميز والمنافسة في الأسواق إما عن طريق تحسين العمليات التشغيلية أو توفير منتجات/ خدمات عالية الجودة بأسعار معقولة، والعمل على تطوير كل ما يمكن أن يحسن الوضع المالي للشركة. وبناءً عليه، تسعى شركة الميمي المتحدة للأخشاب والتجارة ممثلة بمديرها العام "د. أشرف الميمي"وجميع موظفي فرع رام الله، بالتعاون مع قائد البحث "شوقي الحاج حسن" لتحقيق هدف مشترك.

في البداية، قرر الفريق "المكون من ستة أشخاص" بناءً على احتياجات العملاء ومصالح أصحاب المصلحة الحد من كمية منتجات اللوازم الغير متحركة والمتراكمة (حيث أن مبيعات منتجات اللوازم كانت في تراجع مستمر)، كما ويهدف التوجه الإصلاحي إلى تحسين عملية التسليم والتخزين. لذلك، قام الباحث في مرحلة التعريف ببناء ميثاق المشروع ومخطط SIPOCوعقد المشروع وعملية تحقق تعتمد منهجية جمع البيانات المتوفرة والمعتمدة. بعد ذلك، تم تنفيذ مرحلة القياس لفهم خطوات عملية التسليم عن طريق رسم مخطط مفاهيمي متكامل وتحليل أنواع الهدر الثمانية لكل خطوة في العملية. نظرًا لكون هدف مرحلة القياس هو تقييم الأداء الحالي للعملية، فقد كان من المهم تحديد "مساهمة منتجات اللوازم في المبيعات" كمقياس موثوق به ومعتمد لتقييم أداء العملية الحالي. بناءً على ذلك،تم استخدام مخطط التحكم لفهم الأداء الحالي لمساهمة منتجات اللوازم الغير نشطة في المبيعات خلال فترة زمنية معينة (16 نقطة بيانات) ، علماً بأن قيمة معدل المساهمة والحد العلوي للتحكم والحد السفلي للتحكم تساوي صفر. وهذا يعني أن عملية التسليم والتخزين في شركة الميمي المتحدة تعاني من مشكلة حرجة ومن الضروري التحقيق في الأسباب الرئيسية.

بعد الفهم الكامل لعملية التسليم والتخزين في شركة الميمي المتحدة، أصبح من الضروري جداً اكتشاف و فهم الأسباب الجذرية لتراكم منتجات اللوازم. تبعاً لذلك، تم فتح الباب لتقديم الفريق أسباباً محتملة لتراكم منتجات اللوازم من خلال جمع الملاحظات اليومية وجلسات العصف الذهني. وضع الباحث رسمًا بيانيًا يستند إلى الفئات الثمانية P’s(السعر والترويج والأشخاص والعملية والمكان والسياسات والإجراءات والمنتجات). وخلصت النتائج إلى أنه من الممكن تقسيم الأسباب إلى فئتين: الأولى، أسباب التراكم الحالي لمنتجات اللوازم (تخطيط المستودع غير المناسب والخردة والمنتجات القديمة وعدم وجود صالة عرض للمنتجات الخاملة وعدم وجود عروض بيع خاصة تهدف لقلب البضائع الغير مطلوبة) ، ثانياً، أسباب تعزى لعدم كفاءة وفعالية عملية التوصيل والتخزين في مستودعات الشركة مثل: البيع بسعر مرتفع نسبيًا وعدم وجود عروض ترويجية وقلة الانضباط والمسؤولية وعدم وجود هيكل تنظيمي ووصف وظيفي،بالإضافة الى عدم تواجد تقنية منهجية في عملية طلب البضاعة ومعايير تصنيف واضحة لمدخلات المستودعات.

فيما يتعلق بأهداف مرحلة التطوير، لم يهدف الفريق لإيجاد حلول للمشكلة الحالية فقط وإنما هدف أيضًا إلى منع تكرار الأسباب في المستقبل. ولذلك، فإن الحلول كانت تعالج نوعين من الأسباب: أسباب التراكم الحالي لمنتجات اللوازم وأسباب عدم كفاءة و فعالية عملية التوصيل والتخزين. إن النوع الأول من الحلول هو: أول ثلاث خطوات من أداة 5S(الفرز والتنظيف والضبط)، بالإضافة إلى إنشاء صالة عرض للمنتجات غير النشطة والترويج لجميع المنتجات غير النشطة وتقديم عرض سعر خاص للمستهلكين. أما النوع الآخر من التحسينات لعدم الكفاءة و الفعالية في عملية التوصيل والتخزين والتي تعتبر بمثابة إجراء وقائي وتتكون من ثلاث فئات رئيسية:السعر (وجود طريقة موحدة لطلب منتجات اللوازم والاستيراد المباشر من الموردين الغير محليين)، السياسات (الاستعانة بشركة استشارية خارجية ل بناء هيكل تنظيمي جديد وصوف وظيفية لموظفي قسم اللوازم)، وإجراءاتالعمل(من خلال تنفيذ أداة 5S).

في النهاية، نجح أعضاء الفريق في الوصول إلى النتائج المرجوة، إلا أنهم حتى اللحظة يسعون إلى التحسين المستمر. ولضمان الاستمرارية المستقبلية، قام الباحث باستخدام مخطط التحكم كأداة مراقبة للعملية الجديدة، وبناء مخطط تفصيلي جديد لعملية التوصيل والتخزين كما أعد قائمة الفحص(checklist) للمدير العام للتأكد من التزام الموظفين بالتعليمات والإجراءات.