JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

IMPLEMENTATION OF LSS METHODOLOGY TO REDUCE CYCLE TIME OF CUSTOMERS' COMPLAINTS IN AGRICULTURE FOOD INDUSTRY

[1]Ameena Abdulrahman Alhammadi, [2]Dr. Muhammad Usman Tariq

[1]MSQBE, Abu Dhabi School of Management, UAE, a.alhammadi198311@hotmail.com
[2]Assistant Professor, Abu Dhabi School of Management, UAE
Usmankazi100@gmail.com

Abstract
Most of the organizations around the world that aim to excellence and increase the quality of their services and products adopt LSS methodology. LSS is one of the essential methodologies implemented to reduce the cycle time, and this lead to increase the quality and reduce the cost. Implementation of LSS methodology helped the organization to achieve its goal by eliminating the waste from their process. The objective of the current research is to investigate the influence of implementation of LSS methodology based on the DMAIC technique on the cycle time of customers' complaints related to food safety. The secondary data obtained from the KPI teams of agriculture food organizations. The team was formed to investigate the impact of the implementation of LSS methodology in the cycle time of customers' complaints handling. The team started with formulating the Project charter. Other tools used Flow chart, SIPOC, Pareto chart, Fishbone diagram, Implementation chart, and PDCA. The results showed that the implementation of LSS methodology based on the DMAIC tool succeeded in reducing the cycle time in responding to customers' complaints from 3 days to 2 days, including holiday days. Also, by using LSS tools, the steps within processes reduced from 14 to 11 steps.
Key Words: Lean Six Sigma, DMAIC, SIPOC, Cycle time, customer's complaint\

Introduction:

For decades, the quality of services has been a goal for companies and organizations due to its significant impact on the satisfaction and loyalty of customers as well as its impact on raising the company's performance and achieving profits (Seth et al. 2005). Quality of service is a result of a comparison between the expectation of the customers as well as their perceptions (Caruana, 2000). One of the significant parts of quality services is a complaint management system. Complaints are an essential resource for information that helps organizations to know the quality of their services or to help them to improve their quality (Bosch et al. 2005). The customer complaint management system is subject to some elements such as the processing time from receiving the complaint to responding to it, and the percentage of the close of received complaints. These elements measure the extent of the success of the system (Bosch et al. 2005; Tariq, 2013). Cycle time of the process in complaint handling contributes to influencing the quality of active investigation in the complaints and the method of handling. One of the types of complaints is customers' complaints related to food safety. The Agriculture and Food Safety is responsible for the investigation of those complaints. The call center is responsible for receiving these complaints and providing the customers with the results of the investigation. The long process of the cycle time of complaint handling may negatively affect the quality of responding to the complaints.

There are several techniques and tools of quality that can be implemented to improve the quality of responding to customer complaints. One of these tools is Lean Six Sigma (LSS). LSS is one of the practical techniques that can be implemented to reduce the cycle time of customer's complaints handling through eliminating the non-value-added process and thus accelerating the responding to the complaints (Al-hosani and Tariq, 2020). One of the LSS tools used to improve the quality of the process is DAMIC that includes the phases of defined, measure, analyze, improve, and control. The current research shows the impact of using LSS on the cycle time of customers' complaints handling related to food safety organizations (Al-shamsi and Tariq, 2020). The research shows the literature review, the case study of AgriHub Ltd, the implementation of LSS through using DMAIC, other tools such as flow charts, project charter, and implementation charts within DMAIC phases. In the end, the research illustrates the results of the implementation of Lean Six Sigma with discussion and recommendation.

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Literature review:

Total quality management tools

The tools of total quality management (TQM) are an essential ingredient to success in the improvement processes in the quality program. Today more than one hundred various tools of TQM are available that each of them can be used in different phases (Basu, 2004). The tools of total quality management (TQM) are an essential ingredient to success in the improvement processes in the quality program. Today more than one hundred various tools of TQM are available. Each of them can be used for different purposes (Basu, 2004; Tariq, 2013). Seven basic quality tools (7QC) are considered as the essential tools used in quality. 7QC is implemented for various reasons, such as identifying the problems and finding the solutions. 7QC is used as a basis for other quality techniques. Seven basic quality tools (7QC) are considered as the essential tools used in quality. 7QC is implemented for various reasons, such as identifying the problems and finding the solutions. 7QC is used as a basis for other quality techniques. 7QC includes Flow chart, Pareto diagram, Check sheet, Control chart, Histogram, and Scatter plot as well as the Cause-and-effect diagram (Fishbone diagram). Some of these tools can be applied in the process identification such as Flow chart and Check sheet, while some of them can be applied in process analysis such as Pareto and Cause and effect diagrams. However, sometimes the tools can be used in both processes (identification and analysis) (Soković et al. 2009). LSS methodology is implemented for various purposes, such as improving quality and reducing the cycle time of processes (Al-mentheri and Tariq, 2020). The implementation of LSS methodology requires the effective use of data and focusing on analysis. LSS methodology adopts on DMAIC in the improvement process. Different quality tools can be used within each phase of DMAIC to realize the phases.

LSS methodology

LSS is considered one of the most modern strategies well aiming to improve the speed, cost, and quality of products and services introduced to customers (Johnstone et al. 2011). LSS methodology improves the process of service and manufacturing companies' effectiveness and efficiency (Antony et al. 2003). LSS is a methodology used to improve the process starting with the voice of the customer (VOC) and then determines the most effective method to attain customer satisfaction by limiting variables in each process stage, whether in goods production or services (Mohammed and Tariq, 2020). Systematically reducing the variability of the process by implementing LSS leads to achieving two company's strategies that are to improve the products and services and reduce the production process costs (Dragulanescu et al. 2015). LSS is a structured and systematic approach that is the basis of statistical data and analysis (Tariq, 2013). Increasingly, LSS methodology is becoming more used in companies to conduct an accurate employees' sizing because LSS allows for an objective evaluation of process inefficiencies and the determine activities that do not add value but consume the time and sources in conjunction with improving the quality of production process (Dragulanescu et al. 2015).

LSS tools and techniques:

LSS is considered as a hybrid methodology because LSS stemmed from the Six Sigma model established by Motorola General Electric (Pande et al. 2000), and lean model created by Toyota. Lean model is a strategy aiming to eliminate waste such as unnecessary time, efforts, and materials, and thus all process steps add value from the perspective of customers (Taylor, 2008). Besides, by eliminating waste, Lean speeds up all processes across an organization and thus improving the performance of the firm (Womack et al. 1990). However, Six Sigma is a philosophy using the methodology of continuous improvement to reduce variations and eliminate the waste in the processes by implementing statistical tools and techniques (Banuelas et al. 2003). Six Sigma is a robust methodology that is not only customer-focused but also it is data-driven to minimize the number of errors/defects to 3.4 occasions per million opportunities. Both Lean and Six Sigma have common objectives in terms of seeking to achieve customer services. Therefore, when these methodologies are integrated under the umbrella of LSS, value is added to customers, defectives and wastes are reduced, value flow is streamed, and the time of delivery is improved (Salah et al. 2011). There are various Lean and Six Sigma tools and techniques, such as the define-measure-analyze-improve-control tool (DMAIC). The methodology of LSS adopts the DMAIC, which is an improvement cycle of Six Sigma, and lean tools are integrated into suitable stages (Snee, 2010). The figure 1 below shows the elements of DMAIC:

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

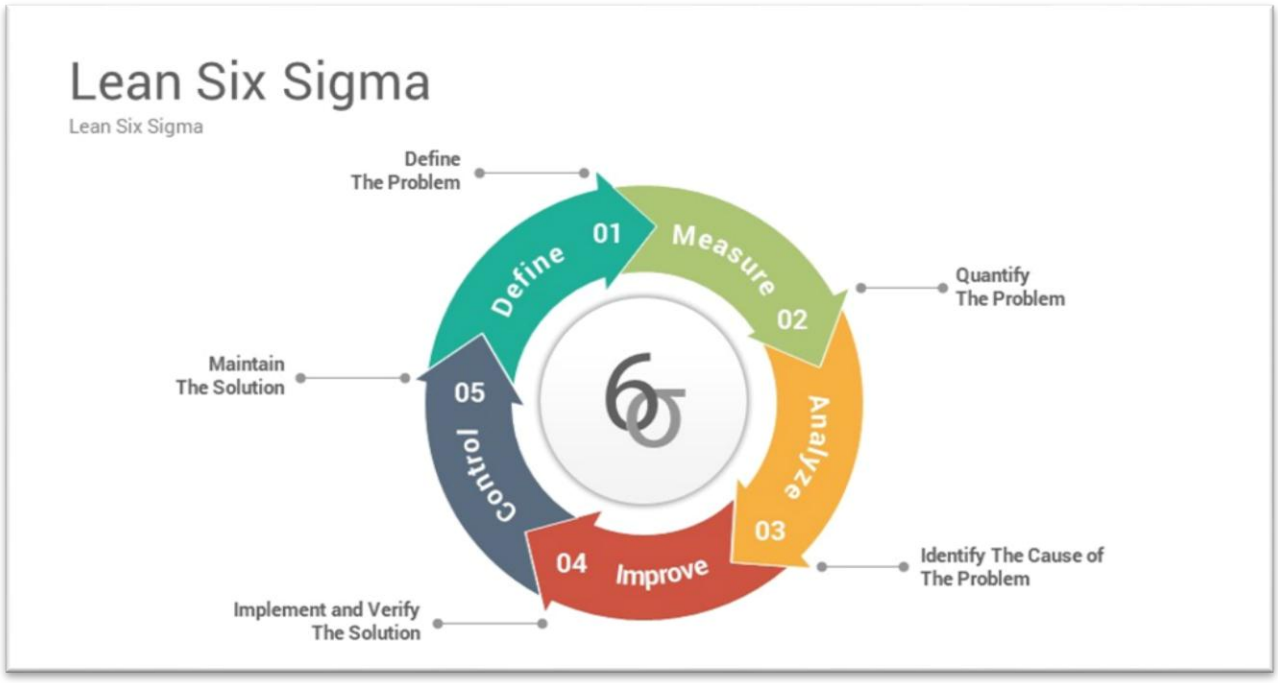

Figure 1: steps of DAMIC

Application of LSS tools to improve cycle time of processes

LSS is no longer limited to the manufacturing industry, as it started, but also LSS is applied in several industries such as healthcare, finance, technology, banks, and education (Bhat et al. 2014). One of the desired objectives of LSS is to reduce the cycle time of the process and thus increase the quality of services. The research conducted by (Bhat et al. 2014) aimed to reduce the cycle time of service of the out-patient department (OPD) in the Indian rural hospital by implementing LSS methodology based on DMAIC and Lean tools. The issue was that the cycle time average of the service process in the hospital's OPD exceeded the required limit of 2 minutes. As a result of that, the average patient's waiting time increased up to 32 minutes in the system as well as the average line length increased to 11 patients with an existing staff level. Therefore, slow service and declining productivity led to the impact negatively on the quality and timely service to the patients. The team was formed to decrease the cycle time in OPD to less than 2 minutes and also reduce the patients' line length to less than two patients. However, to reach the objective, various tools and techniques were used, including Project charter, SIPCO (supplier, input, process, output, and customer), Cause and Effect Diagram, and Control Plans. Also, Lean tools, including Kanban and 5S, contributed to process improvement and maintenance effectively. The results after applying Lean Six Sigma tools showed that the process cycle time in OPD reduced from 4.27 minutes to 1.5 minutes, and patients' queue length was reduced by 91%. Therefore, the finding approved that implementation of LSS in OPD led to reducing cycle time and thus customer satisfaction. Another research applied to LSS to reduce the cycle time was conducted by (Mukhopadhyay 2013). the objective of the research was that using LSS tools, including DMAIC to decrease claim settlement process cycle time in the insurance sector. The specification limit for settling the claim was 30 days, but the issue was that 97.41% of claims, and this means that were exceeded the upper specification limit of 30 days. The average cycle time of claims was 90.25 days. Several LSS tools and techniques applied, such as Process Mapping and Pareto Chart. However, the process cycle time was reduced by making changes in the process. The results illustrated that the compliance of claim settlement within the specific limit, which was 30 days, was increased by 95%. The results of both of the research showed that the implementation of LSS tools based on the DMAIC technique contributed to reducing cycle time, and this led to customer satisfaction.

Framework and hypothesis:

LSS can be implemented to improve quality in all organizations in the UAE. Herbs Ltd was selected to implement LSS tools based on the DMAIC model to reduce cycle time through improving processes of customers' complaints

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

related to food safety. The objective of the research is to investigate the influence of implementation of LSS tools based on the DMAIC model on the cycle time of customers' complaints handling related to food safety in Herbs Ltd. Based on the objective of current research, the following hypotheses were formulated:

H1= the implementation of LSS tools has a positive impact on the cycle time of customers' complaints handling

H2= the implementation of LSS tools does not have a positive impact on the cycle time of customers' complaints handling

Figure 2: the defects impacting on the cycle time of customers' complaints

Case Study Herbs Ltd

Herbs Ltd is a local authority specialized in agriculture, food safety, and bio-food security. One of the Herbs Ltd's tasks is monitoring and inspection of food establishments. Herbs Ltd seeks to ensure food safety throughout all stages of the food chain for all members of the community. Therefore, responding to customers' complaints are one of the significant tasks of Herbs Ltd. The routine inspection visit schedules based on the risk level related to food activity and grade for the last visit, so sometimes nonconformance points related to food safety does not appear during the inspection visit, but the customers may be exposed to them such as finding hair in the customer's food and observing poor food handlers hygiene. Because of the importance of food safety and customer satisfaction, Herbs Ltd was cooperating with call center designed processes to respond to the customers' complaints. Customers' complaints related to food safety is one of the Key Performance Indicator (KPI) of Herbs Ltd. according to the KPI, the response time to customers' complaints is within three working days in Hebrs LTD. The call center adopts 24 hours to receive and respond to food customers' complaints. Responding to customers' complaints related to food safety, even if within KPI days, has two issues, which are:

1- The processes from receiving the customer complaints to respond is a long

2- The time of responding to customers' complaints in Herbs LTD does not include the holiday days.

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Therefore, these issues lead to a delay in response to customers' complaints. However, the indicator for responding to customer complaints have to be more realistic, practical and achieved the desired goal of ensuring food safety for all community and customer satisfaction. Therefore, the processes of responding to customer complaints related to food safety have to be reviewed and also have to be reduced by decreasing the cycle time. Also, the cycle time of responding to complaints has to include all days, not only working days.

Methodology:

To achieve the objective of the study, the team was formed to conduct quantitative research to explore the influence of implementation of LSS methodology on the cycle time of customers' complaints handling in Herbs LTD. Secondary data related to customer complaints were collected from the KPI team in Herbs LTD. The team implemented DMAIC and lean tools to examine some factors such as not working at the weekend, missing complaints' information, and delay in transferring the complaints (independent variables) on the cycle time of customer's complaints (independent variable) in Herbs LTD. Several tools and techniques were employed within the DMAIC tool. For example, SIPOC, Project Charter, and Flow Chart were used in the define phase, while Pareto Chart implemented to determine the most frequent defects impacting the customer's complaints cycle time in the measure phase. Fishbone diagram was used to determine the root causes of the problem in the analysis phase, whereas the Implementation plan was formulated in the improvement phase, and the end, PDCA tool was used in the control plan.

Lean Six Sigma Implementation

The project was initiated to reduce cycle time in responding to customers' complaints in Herbs Ltd by using LSS methodology. The team decided to adopt DMAIC phases to test the hypotheses. Beside DMAIC, other techniques were integrated into the appropriate stages of DMAIC.

Define Phase:

In the define phase, the team initiated to formulate the goals of the project to achieve the main objective. Also, the team identified the scope and processes targeted for improvement. The essential elements of the project charter were determinate by the team, as shown in Table 1 below:

Table1: Project Charter

<table>
<tr><th colspan="4">Project chart</th></tr>
<tr><td>Problem statement</td><td colspan="3">Business case benefits</td></tr>
<tr><td>Several years ago, the cycle time of responding to customer complaints related to food in Herbs Ltd took three working days. This impacts on the quality and timely service and thus food safety and customer satisfaction</td><td colspan="3">The improvement in process cycle time by eliminating non-value-added steps across the processes to save the time and employees' efforts and to accelerate the investigation in the complaints and thus improving the reputation of Herbs Ltd in responding to complaints</td></tr>
<tr><td colspan="4">Goal statement:
Reducing the cycle time of customers' complaints handling related to food from 3 working days to 2 days (including the holiday and weekend).</td></tr>
<tr><td>scope in/out</td><td colspan="3">Timeline</td></tr>
<tr><td rowspan="3">1st Process Step: receiving the complaint from one of the Call</td><td>Phase</td><td>Planned completion date</td><td>Actual</td></tr>
<tr><td>Define</td><td>January 10 th</td><td>January 18 th</td></tr>
<tr><td>Measure</td><td>January 30 th</td><td>March 10th</td></tr>
</table>

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Center channels. Last Process Step: responding to the customer by the results of the complaint investigation Scope in: process cycle time scope out: policies cycle time	Analysis	March 12 th	April 12th
	Improve	April19 th	May 8 th
	Control	May 9 th	June 10 th
Team members			
Position	Person	Title	% of time
Team leader	Ameena	Team lead	20%
Team leader	Fatema	Team member	20%
Team member	Jameela	Team member	20%
Team member	Mariam	Team member	20%
Team member	Asma	Team member	20%

Project charter was used to determine the problem statement, project goals, business case and benefits, scope in/out of the project, and project timeline and members. The specific responsibilities and roles were distributed to each member of the team at different phases of the project. Identifying the elements of the Project charter helped the team to follow the right track during working in the project.

To understand more about the process of complaints handling in Herbs Ltd, the team used Flow Chart to clarify the process as shown in Figure 3 below:

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

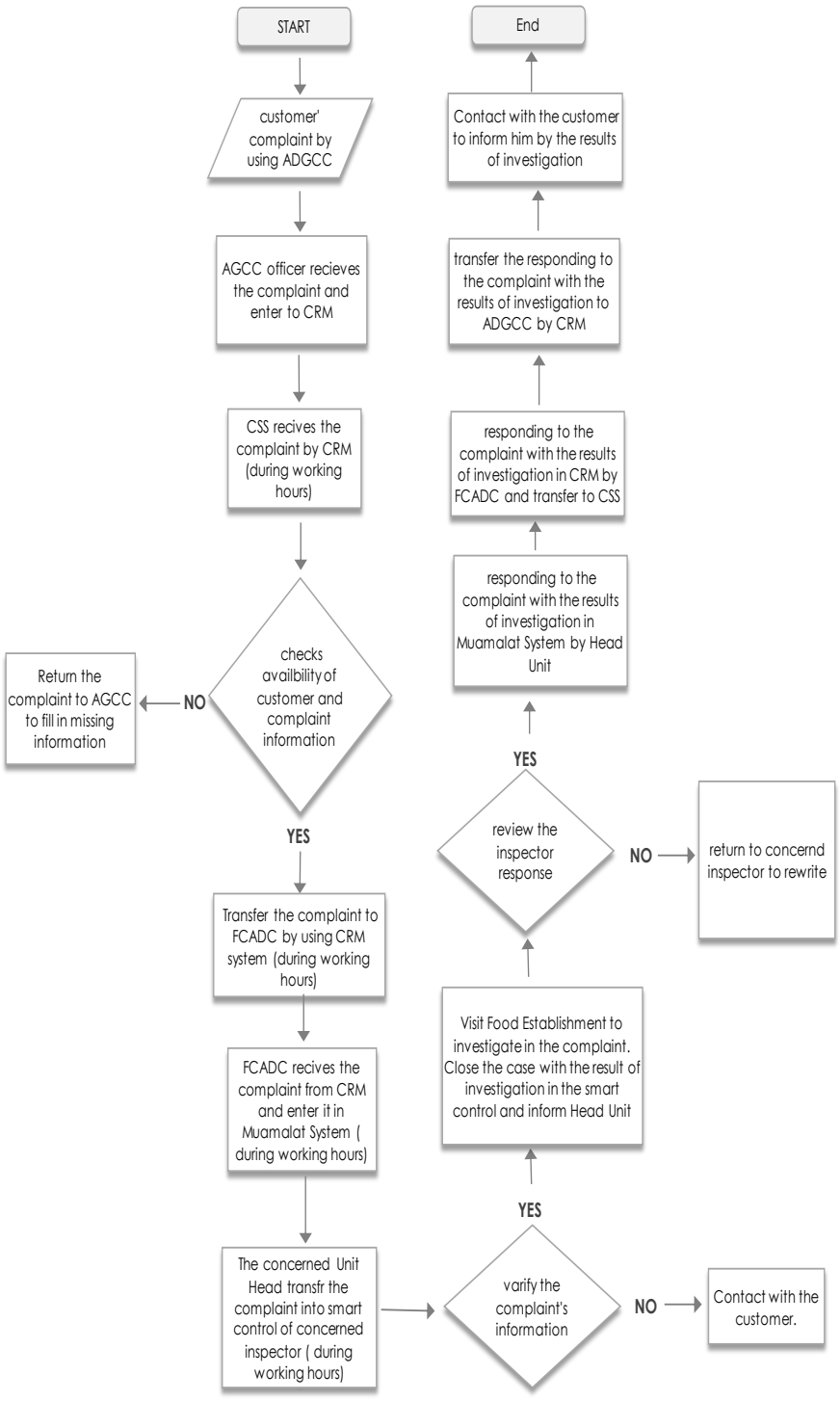

Figure 3: Customer's Complaints handling process

The team used a Flow chart to clarify the process of customer' complaints related to food safety. Through using a Flow chart, the team recognized non-value-added steps that caused an increase in the cycle time of the customer's complaint.

Moreover, the team used SIPCO tool, which refers to the supplier, input, process, output, and customer, to identify the scope of each process, as shown in table 2:

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Table 2: the process of the cycle time of customers' complaints

Supplier	Input	Process	Output	Customer
• Customer • Call Center • Customer service Section (CSS) • Food Control and Animal Division Coordinator • Head of the unit • Concerned inspector	Customer complaints related to food safety		Action is taken based on the results of the investigation (e.g., satisfactory (in case of incorrect complaints), warning and violation) Responding to customer's complaint	customer
Process				
• The customer submits the complaint by using one of the call center • Call center officer enter the required information about customer complaint related to food safety to Relation Management System (CRM) • CSS receives the information of complaints from CRM and transfer to FCADC • FCACDC enters the complaints in information system and transfers to concerned Head of Unit • Head of Unit receives the complaint and transfers it into smart control of the concerned inspector • The concerned inspector follows up the food complaint by visiting the food establishment to investigate. Action taken by concerned inspector according to the investigation results and then closes the case of complaint in the smart control and informs the Head of Unit. • Head of Unit forwards the responding of the complaints with the results of the investigation to FCACDC by using information system • FCADC enters the results of the investigation in food complaints into CRM and forwards to CSS • CSS forwards the results to the call center by using CRM • The call center officer contacts the customer to inform by the results of the investigation in the complaint. Call center officer closes the customer's complaint in the CRM system				

Measure

In the measure phase, the team identified the current defects, which increased the cycle time of the customer's complaints handling by using the data collected from the KPI team. The data showed the types of defects happening, and their frequents, as shown in Table 3 below:

Table 3: Types of defects

Defects/ Errors	Frequent	%

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Missing information	25	13
Wrong information	4	2
Delay in transferring complaint	27	15
Neglect the food complaint	2	1
Not working on holiday and WK	97	52
Rewrite the respond to the complaint report	30	16

Table 3 shows several defects that led to an increase in the complaint cycle time, including not working on holiday and weekend. Although inspectors have work shifts on vacation days, CSS officers and FCAD Coordinators do not have this system, so they only transfer complaints on working days and during working hours, and this leads to non-response to the complaint on holiday days and thus delay in responding to the customers' complaints. Another defect observed was missing information. Sometimes, the complaints were returned to the call center due to a lack of information such as the location of the complaint or missing information in the content of the complaint. Other defects detected were wrong information such as the incorrect customer's phone number and delay in transferring of food complaints, rewrite the response to the complaint as well as neglect the food complaint. The frequent of the defects were measured by using Pareto chart

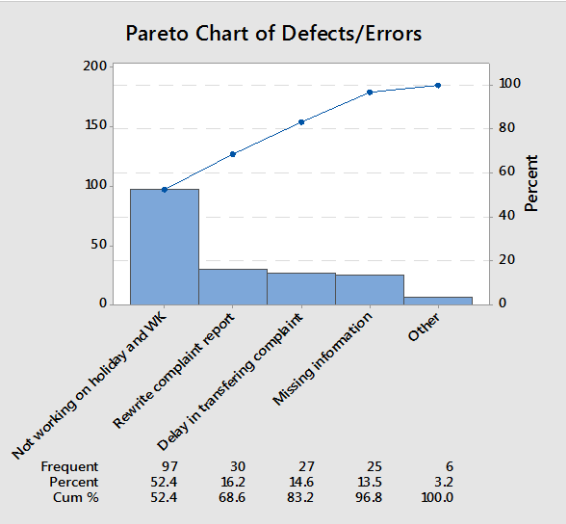

Figure 4: Most frequent defects

Pareto chart was applied to clarify the most frequent defect causing to increase the cycle time of customer's complaints related to food safety and thus causing the delay in responding to the food complaints. It was important to know which defect has a high impact on the cycle time of complaint handling because this contributed to finding solutions to eliminate the defects. The most frequent defect, as shown in Figure 4, was no working during the weekend and the holiday (52%), followed by rewriting the respond to the complaint (16%), delay in transferring complaint (15%), after that, missing information (13%). The team decided to focus on these four defects to find the root causes in the next phase.

Analysis phase:

The purpose of the analysis step is to determine the root causes of the defects. Brainstorming was performed by the team to find out the potential root causes influencing the cycle time to handle the customer's complaint related to food safety. Potential root causes were identifies based on 6M, which was manpower, measurement, method, material, and machines. Cause and Effect diagram was formed to present the root causes, as shown in Figure5:

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

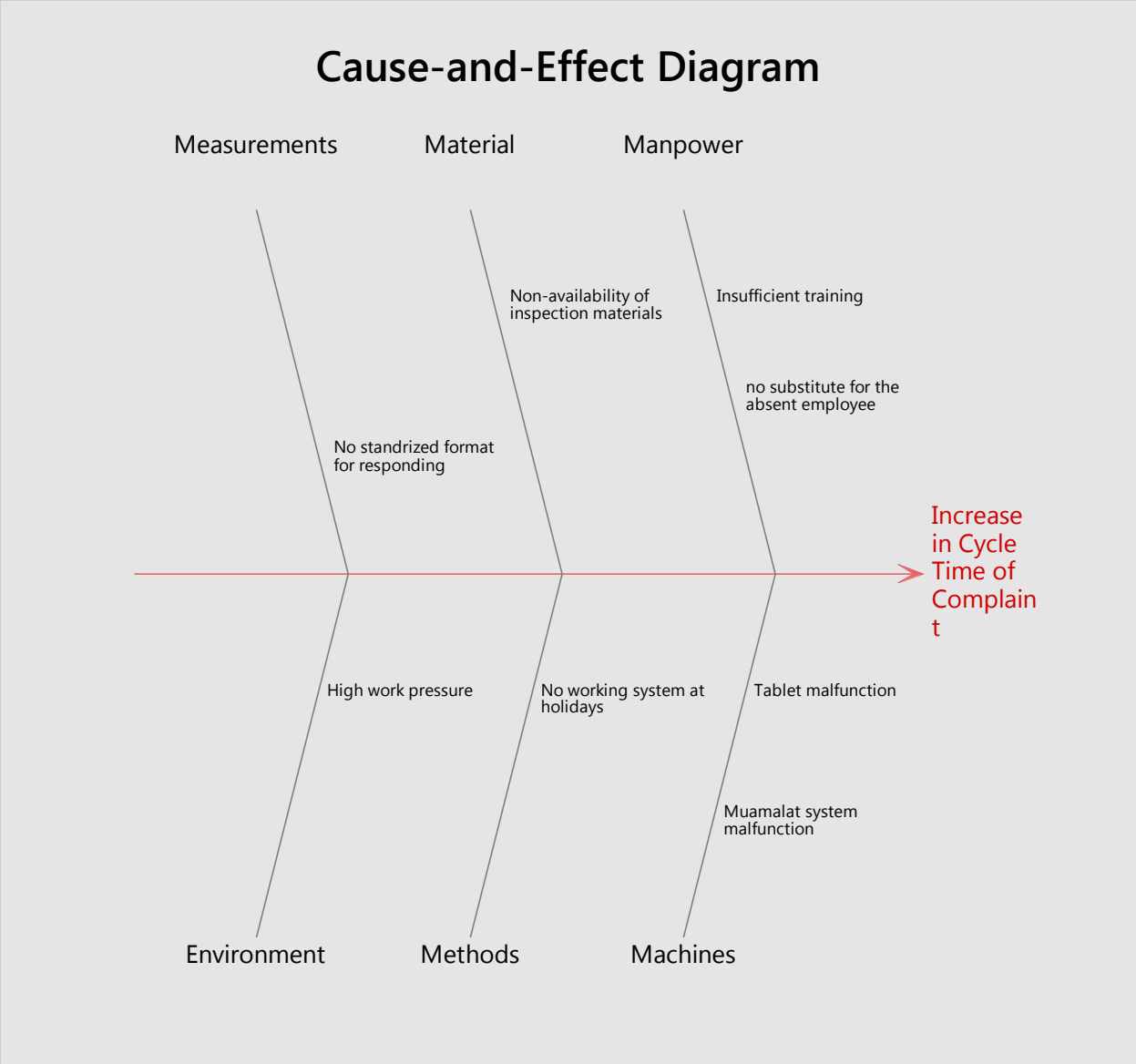

Figure 5: the potential root causes of the selected defects

Figure 4 illustrates the potential root causes of the defects, which led to an increase in the cycle time of complaints. The root causes were determined by conducting brainstorming and data collected from the KPI team. Fishbone diagram was plotted to distribute the potential root reasons according to specific elements, including manpower, methods, measurement, environment, method, materials, and machines. From the data collected, there were vital few causes that led to increasing the cycle time of complaint handlings, such as no working system at holiday for CSS officers and FCADC. However, the team decided to focus on all the root causes to solve them and thus eliminating the defects.

Improve phase

The team conducted brainstorming sessions to find out solutions for the focused root causes. The implementation chart shows the solution of selected root causes

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Table 4: the implementation plan

Defects	Root causes	Action Item (List steps required to implement solutions)	Responsible (List person(s) responsible for action steps)	Due Date (Indicate when action items must be completed)
Missing & wrong information	Insufficient training	Meeting with the call center to find effective solutions related to the accuracy and correctness of the information of customers and complaints before sending (call center's employee's training courses are suggested)	Ameena	20 April
Delay in transferring the complaint	no substitute for the absent employee	Circular to all employees to specify an alternative before taking leaves.	Mariam	22 April
	System (Muamalat system) malfunction	Meeting with the IT department to find solutions for frequent malfunction of system and tablet	Fatema	25 April
	Tablet Malfunction		Fatema	25 April
	Tablet Malfunction	Circular to the inspectors to using the approved documents in case of a defect in the system	Mariam	Immediately

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

	High work pressure	Meeting with CSS and FCADC to identify only specific employees to convert complaints and give complaints a high priority	Jameela	20 April
	Non-availability of inspection material	Requesting Food Control Division to form a team to ensure the availability of inspection's equipment and raise the needs to the concerned department	Mariam	25 April
Rewrite the complaint report	No standardized format for responding	Form a standard formulation to respond to the complaint and circulate it to the inspectors	Ameena	25 April
Not working in the holiday and weekend	No working system at holidays in both CSS and FCADC	Meeting with CSS and FCADC to agree to follow up the customers' complaints at the weekend and vacations.	Fatima	25 April
	No working system at holidays for both CSS and FCADC	Meeting with the IT department in the presence of CSS and FCAD Coordinators to agree to give access to the system to CSS officers and FCAD Coordinators to be able to enter the system by using a telephone or personal	Asma	25 April

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

		computer and thus to follow up the complaints after finishing work hours		
	No working system at holidays for both CSS and FCADC	Circular to Food Department Administrative Assistants to send a list of inspectors' names working on evening and holiday shifts every week to the coordinators	Ameena	20 April

The implementation plan showed the action items which formulated based on the root causes of defects. Also, the implementation plan illustrated the names of responsible persons in the team with a due date to complete the plan.

Control Phase

The last phase of DMAIC is the control phase. In this phase, the team verified that the processes are working as required to achieve the desired results. This step is considered as challenges to Herbs Ltd because sustained improvement has to be achieved. Therefore, the team decided to follow the results of the implementation plan by using Plan-Do-Check-Act (PDCA). The team reflected the results of the implementation plan in the action plan in the table below. Also, the Figure showed the steps followed by the team during the implementation PDCA tool.

Table 5: Action plan implemented in PDCA tool

Target Improvement Area	Plan
No working system in both CSS and FCADC	Allocate Customer Services officers and Coordinators to transferring the customer's complaints on holidays and vacations as well as after working hours
	Giving these employees access to complaints system from anywhere.
	Providing the coordinators with the list of inspectors' names working on evening and holiday shifts weekly.
	Vacations are only approved in the system if there is an

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Delay in transferring of food complaints	alternative
	The new equipment team follow up the inspectors' needs and makes sure that they obtain the required equipment periodically
	Specific employees were allocated in both CSS and FCADC to convert complaints
	The inspectors use the approved inspection reports in case of a defect in the system
	IT updates continuously on the system so the malfunction of the system and tablet reduced
Missing information & Wrong information	Adding a feature to the system that the system will not send the complaint without filling in the mandatory information
	Ensure that the customer's phone number is correct when registering for the complaint

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

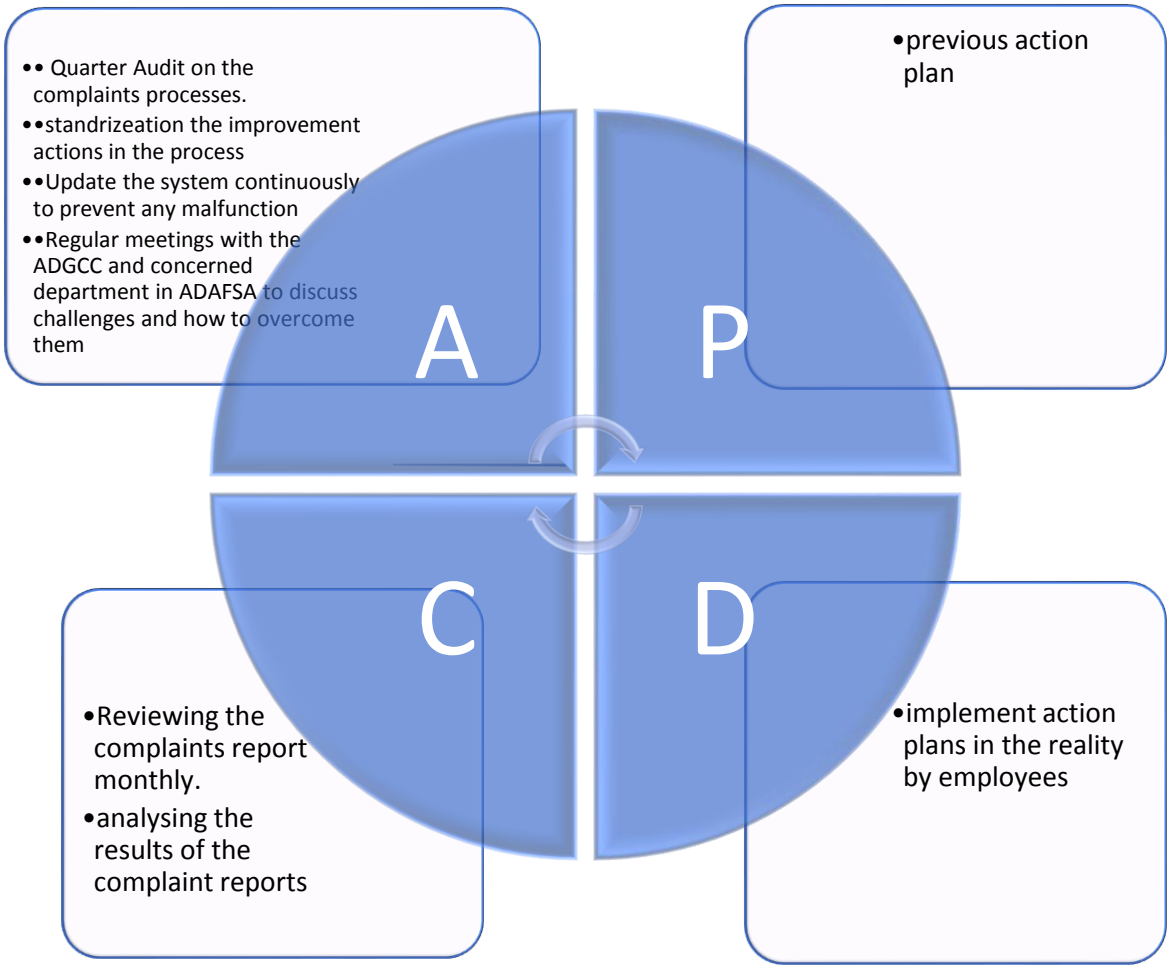

Figure 6: the actions in each step of PDCA

After agreeing with the concerned departments to implement the plans, the actual implementation started in a step "DO," The team monitored the results of implementation on the reality in the step "Check" through reviewing the complaints reports monthly to verify if the implementation of action plan achieves the required results. In the step "Act," The data from complaints reports showed that after implementing the action plan, the cycle time of customers' complaints handling reduced to mostly one day and not exceeded two days. Also, there was no delay in responding to customers' complaints during the holidays, as well as no defects impacting on increased cycle time. Therefore, the results of the implementation action plan led to reducing the cycle time by improving the process.

Discussion:

The cycle time of customer's complaints related to food safety took a long time, which affected the effectiveness of the complaint investigation and, thus, customer satisfaction. The main objective of this study was to examine the impact of the implementation of LSS based on DMAIC on the cycle time of customer complaint handling in Herbs Ltd. The study aimed to investigate the impact of defects such as not working in the weekend, missing complaint and customer information, delay in transferring the complaint and rewrite the response to the complaint (independent variables) on the cycle time of customers' complaints related to food safety (independent variable) in Herbs Ltd. As a result, the hypothesis was formulated, that was:

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

H1= the implementation of LSS tools impacts the cycle time of complaint handling through improving the processes.

H2= the implementation of LSS tools does not impact on the cycle time of complaints handling through improving the processes

To examine the hypotheses, the team was formed to implement LSS tools based on DMAIC on the cycle time of the customer's complaint. In the "define" step, the team formulated the project charter to be a road map for the team during the implementation of the DMAIC steps. Also, Flow chart and SIPCO were applied to clarify the processes and identify the non-value-added steps within the process. After that, in the measure phase, the team determined the defects causing the increase of the cycle time of the customer's complaint by using the data collected from the KPI team. Then, the team identified the most frequent defects impacting the cycle time of the customer's complaint by using the Pareto chart. The most frequent defects were that CSS and FCADC were that not working on holidays as well as out of the work hours. Also, missing information by ADGCC, rewrite the response to the complaint by concerned inspector and delay in transferring the complaint, all these defects caused the delay in responding to the customer's complaint. Therefore, in the "analysis" phase, the team conducted brainstorming to find out the root causes related to the most frequent defects by using the Fishbone diagram. The root causes were classified into six elements that were manpower, measurement, method, machine, material, and environment. Based on these root causes, the team used the implementation plan in "improve phase" to identify tasks (action items) and distribute these tasks to the members of the team with determining the specific date to compliant. The team used PDCA to achieve the objective. In the "plan" phase, the team formulated the action plan based on the results of the implementation plan. After that, the team follows up on the implementation of an action plan through complaint reports provided by the KPI team. The team analyzed these reports to verify the effectiveness of the action plans. The implementation of the action plans led to the improvement in the process by eliminating non-value-added steps and reduce the cycle time of customer complaints. The results showed that there are changes in the steps of the process of the cycle time of customer complaint as shown below:

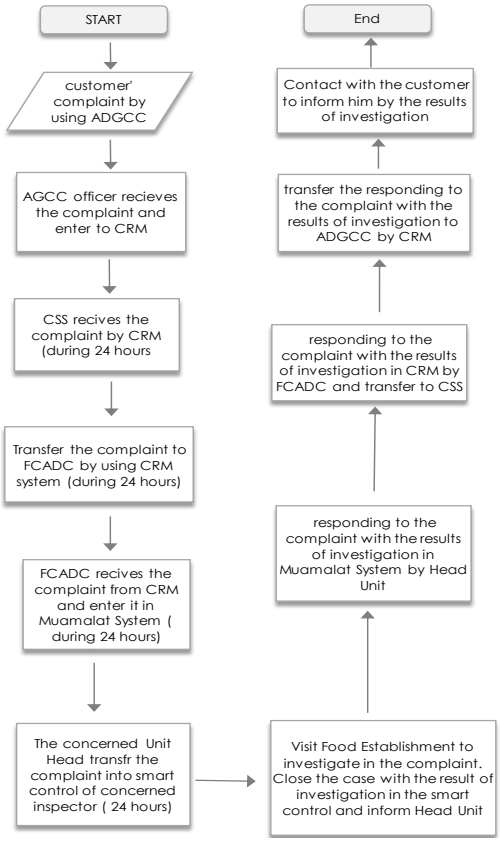

Figure 7: The new process after implementing LSS approach

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

The steps of the process were 14 in the previous Flow chart, but now, in the current process, it became 11 after eliminating the defects, and that led to eliminating non-value-added steps. Also, the important improvement change is that responding to the complaint is not limited only in working hours but now became during the whole day. Therefore, the cycle time of customer complaints does not exceed two days, mostly completing the responding within one day. All of these results approved the H1 that was the implementation of LSS tools impact the cycle time of complaints handling through improving the processes. The hypothesis was conferment based on prior studies conducted by Bhat et al. (2014) and Mukhopadhyay (2013.).

Recommendation

Several recommendations can improve the quality of the process of customers' complaints handling. One of these recommendations is to restructure the process of customers' complaints by receiving the complaint directly through the Customer Service Section. Also, another recommendation is the allocation of a hotline to receive complaints so that it is through the Customer Service Section and transferred directly to the concerned inspector while the inspector is in the inspection field. That will lead to increased efficiency in responding to complaints and thus ensuring food safety and customer satisfaction. Besides, changing the cycle time in responding to customers' complaints from 3 days (working days) to 2 days (full day, including the holiday days) in the KPI system. It will benefit from reviewing the results of customers' complaints continuously.

This research conducted to examine the impact of the implementation of lean six Sigma by using the DMAIC model on the cycle time of customer complaint handling in Herbs Ltd. To achieve the objective, the team was formatted to implement LSS tools, including the DMAIC model. In each phase of the DMAIC model, the team used several tools to help them to reach the goal. In the first phase "define" phase, the team used Project charter that helped them to identify many elements such as problem statement and the goal of the project. Also, Flow chart and SIPCO were applied to clarify the process of the cycle time of customers' complaints. In the next step, the "measure" step, the team recognized the defects that led to an increase in the cycle time of customers' complaints. By using the Pareto chart, the most frequent defects were determined. Therefore, in the "analysis" step, Besides the data collected and brainstorming, the team recognized the root causes of the defects and classified these root causes into manpower, machines, material, method, measurement, and environment. In the "improve" plan, the team applied the implementation plan after that based on the results of the implementation plan. The team implemented the PDCA tool to ensure the effective implementation of the action plan and reach to desired results as well as maintain the quality of the process. The findings showed that the cycle time of complaints reduced from 3 days to 2 days, mostly one day. Also, the steps within the process decreased from 14 to 11 steps. These results were achieved because of changing the time of responding to complaints to include now the holiday days. Also, it was reached by improving the quality of the process by eliminating non-add-value steps and also eliminating the defects that contribute to increasing the cycle time of customers' complaints. This research approved hypothesis 1 that the implementation of LSS based on the DMAIC model has a positive impact on the cycle time of customers' complaints.

References:

AlHosani, FA., Tariq, M.U. (2020). Improving service quality of smart banking using quality management methods in UAE, *International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), 10* (3), 2127-2140

Al-Shamsi, AO., Tariq, M.U. (2020). Improving registration process and service quality in dental care department in a uae hospital using lean six sigma methodology, *International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), 10* (3), 2109-2126

Al Mentheri, K.K., Tariq, M.U. (2020). Quality Improvement of Audit processes duration by implementation of Lean Six Sigma in UAE Aviation Industry: Case Study, *Journal of Advanced Research in Dynamical and Control Systems- JARDCS, 12*(5)

Antony, J., Escamilla, J.L. and Caine, P. (2003), "Lean sigma", *Manufacturing Engineer, 82* (2), pp. 40-42.

Banuelas, R. and Antony, J. (2003) 'Going from Six Sigma to design for Six Sigma: an exploratory study using analytic hierarchy process', *The TQM Magazine, 15* (5), pp.334–344.

Basu, R.(2004). *Implementing Quality – A Practical Guide to Tools and Techniques*, Thomson Learning, UK.

Bhat, Shreeranga & Ev, Gijo & Jnanesh, N.A.. (2014). Application of Lean Six Sigma methodology in the registration process of a hospital. *International Journal of Productivity and Performance Management. 63*. 10.1108/IJPPM-11-2013-0191.

Bhat, Shreeranga & Jnanesh, N.A.. (2014). Application of Lean Six Sigma methodology to reduce the cycle time of out-patient department service in a rural hospital. *International Journal of Healthcare Technology and Management. 14*. 222. 10.1504/IJHTM.2014.064257.

Caruana, A. (2000). Service loyalty : The effects of service quality and the mediating role of customer satisfaction. *European Journal of Marketing, 36*(7/8), 811-828

Dragulanescu, Irina-Virginia; Popescu, Delia (2015): Quality and Competitiveness: A Lean Six Sigma Approach, *Amfiteatru Economic Journal, 17* (9), pp. 1167-1182

Johnstone, C., Pairaudeau, G. and Pettersson, A.J. (2011) 'Creativity, innovation and lean sigma: a controversial combination?', *Drug Discovery Today, 16* (1/2), pp.50–57.

Mohammed, O., Tariq, M.U. (2020). Reduction in recruitment time in the mechanical department at the automotive industry using lean six sigma methodology, *Journal of Advanced Research in Dynamical and Control Systems-JARDCS, 12*(5)

Mukhopadhyay, Arup. (2013). Improvement of Claim Processing Cycle Time through Lean Six Sigma Methodology, by Ashok Sarkar, Arup Ranjan Mukhopadhyay & Sadhan Kumar Ghosh, *International Journal of Lean Six Sigma, 4* (2), pp. 171-183.

Pande, P. S., Neuman, R.P. and Cavanagh, R.R., 2000. T*he Six Sigma Way: How GE, Motorola and other Top Companies are Honing Their Performance*. New York: McGraw-Hill

Salah, S., Rahim, A. and Carretero, J.A. (2011) 'Implementation of lean Six Sigma (LSS) in supply chain management (SCM): an integrated management philosophy', *International Journal of Transitions and Innovation Systems, 1* (2), pp.138–162

Seth, N., Deshmukh, S. G., & Vrat, P. (2005). Service quality models: a review. *International Journal of Quality Reliability Management, 22*(9), 913-949.

Snee, R.D. (2010), "Lean Six-Sigma – getting better all the time", *International Journal of Lean Six-Sigma, 1*(1), pp. 9-29.

Soković, M., Jovanović, J., Krivokapić, Z., & Vujović, A. (2009). Basic quality tools in continuous improvement process. *Journal of Mechanical Engineering, 55*(5), 1-9.

Tariq, M.U., (2013). A Six Sigma Based Risk Management Framework for Handling Undesired Effects Associated with Delays in Project Completion, *Journal of Lean Six Sigma, 4* (3), pp.265-279

Taylor, G. (2008), *Lean Six-Sigma Service Excellence: A Guide to Green Belt Certification and Bottom Line Improvement*, J. Ross Publishing, New York, NY

Womack, J.P., Jones, D.T. and Roos, D. (1990) *The Machine that Changed the World*, Rawson Associates, New York.