Applying Lean Six Sigma to Improve Telephone Bill Payment: A Case Study of A Real Estate Developer

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Abstract

This case study is about deploying Lean Six Sigma methodology to improve performance as well as assist in developing improvement practices in organizations. The objectives of this study are to focus on process efficiency and to ensure that the payment lead time is within the due date. The steps have been taken through systematic thinking, including DMAIC, and by utilizing Lean tools to streamline the process. The Six Sigma methodology uses data and facts to identify the root causes of the problem, while the Lean method eliminates wastes and non-value-added steps. Process Flow, Fishbone Diagram, and Failure Mode and Effects Analysis (FMEA) are utilized to confirm causes and provide potential improvement actions. In the end, the accounting staff reduced the workload in handling the telephone bill payments from five days to two days per month. The administrative staff and the management have spent less time dealing with all the telephone invoices. This was done by eliminating some non-value-added steps. Moreover, the payment lead time can be processed on time with accuracy.

Keywords: DMAIC, FMEA, Lean Six Sigma, Payment Process, Process Improvement

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การประยุกต์ใช้ลีนซิกซ์ซิกม่าในการปรับปรุงกระบวนการชำระบิลค่าโทรศัพท์จากกรณีศึกษาของบริษัทพัฒนาอสังหาริมทรัพย์

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บทคัดย่อ

กรณีศึกษาเรื่องนี้เกี่ยวกับการนำกระบวนการลีนซิกซ์ซิกม่ามาใช้ในการปรับปรุงการดำเนินงาน ซึ่งรวมถึงการพัฒนาปรับปรุงวิธีการปฏิบัติงานในด้านต่างๆขององค์กรให้ดีขึ้น วัตถุประสงค์ของการศึกษามุ่งที่ความมีประสิทธิภาพของกระบวนการ เพื่อทำให้มั่นใจว่าระยะเวลาในการชำระเงินอยู่ภายในกำหนดเวลา ขั้นตอนการดำเนินงานได้ผ่านกระบวนการคิดอย่างมีระบบและได้ใช้หลัก DMAIC ร่วมกับเครื่องมือของลีนในการช่วยให้กระบวนการสั้นและกระชับ วิธีการของซิกซ์ซิกม่าใช้ข้อมูลและข้อเท็จจริงในการหาสาเหตุที่แท้จริงของปัญหา ในขณะที่กระบวนการลีนลดความสูญเสียและขจัดขั้นตอนที่ไม่ก่อให้เกิดคุณค่า แผนภูมิแสดงกระบวนการไหล แผนภูมิก้างปลา การวิเคราะห์ข้อบกพร่องและผลกระทบถูกนำมาใช้เพื่อแสดงสาเหตุของปัญหาและแนวทางการปรับปรุงกระบวนการ สุดท้ายแล้วพนักงานในแผนกบัญชีสามารถลดปริมาณงานในการทำจ่ายบิลค่าโทรศัพท์จาก 5 วัน เหลือเพียง 2 วันในแต่ละเดือน พนักงานที่ทำงานธุรการและผู้บริหารต่างใช้เวลาลดลงในการจัดการกับบิลค่าโทรศัพท์ ซึ่งมาจากการลดขั้นตอนที่ไม่ก่อให้เกิดคุณค่ายิ่งไปกว่านั้นการทำจ่ายบิลค่าโทรศัพท์อยู่ภายในกำหนดเวลาและมีความถูกต้อง

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Introduction

To compete in a dynamic business situation and explore ways to enhance the bottom line, organizations are looking for strategies for process improvement. Six Sigma was introduced and applied more than 20 years ago. Lean Six Sigma has received extensive use around the world. Applying Lean Six Sigma (LSS) is one of the popular tools used to help organizations succeed in improving their processes that enhance customer satisfaction and financial savings (Gijo, Antony, & Sunder, 2019; Snee, 2010). Lean Six Sigma can enhance many business areas, such as streamlining the process flow to reduce complexity, improving product quality, and reducing process variation (Snee, 2010). In addition, the benefit of using LSS is its methodology in situations where the solutions are unknown and the root causes are not understood (Gijo et al., 2019). Applying Lean Six Sigma requires a systematic approach to attack the problem (Antony, 2012). Then, the team must analyze and identify root causes based on data and facts. Therefore, improvement should be made properly and able to solve the problem effectively.

This case is conducted by applying the Lean Six Sigma practice to one of the land developers in Thailand. The company has been unidentified and is named SA Company. The company constructs condominiums, houses, and townhouses, and each construction site is called a "project site." This study focuses on the payment process of telephone bills. This payment process has involved several units of the organization, including telephone and internet users, administrators of each unit, accounting, and treasury departments. The various process steps, including obtaining an invoice and preparing a memorandum, until processing payment in the system, are quite complicated and time-consuming. Sometimes, administrators who are involved in document preparation are confused with various due dates and different service providers; therefore, delayed payments happen. If this kind of problem persistently occurs, service providers may terminate and stop the services for those specific phone numbers. Therefore, the management has realized the importance of paying the telephone bills on time. Once, the company has implemented Lean Six Sigma training and desires to improve several projects related to customers as well as enhance the efficiency of the process. This project

has been assigned to the working team and has been deployed as the Green Belt project.

Currently, the administrative staff of each project site prepares the documents for the payment process. These documents are approved by the management and sent to the Accounting Department for processing the payment to the vendors. Telephone costs are one of the main utility expenses of the SA Company. The current payment processes are time-consuming and require an accounting staff to proceed with the transactions for five days per month. For each project site, the administrative staff prepares the documents based on due dates, which are different every week. Therefore, SA Company decided to deploy LSS to improve process efficiency.

This case study has incorporated LSS methodology to improve telephone bill payment by combining Lean tools with the Six Sigma concept (Define, Measure, Analyze, Improve, and Control phases). LSS is the right choice since the root causes of the problem and solutions are not unknown. Wastes and non-value-added steps are identified by Lean tools. The Six Sigma method has helped team members become more organized and rational in their approach to the problem. This case has shown how to apply lean LSS with the support of team members and make conclusions based on facts rather than gut feelings. Some tools have scoring and rating methods that can reduce subjectivity in the transactional areas.

Literature Review

Six Sigma

Six Sigma is a business concept first developed by an engineering team of Motorola in 1979 that includes various tools used for reducing process variation (Harry & Schroeder, 2000). The structure of Six Sigma involves statistical tools to obtain knowledge and identify the root causes of problems (Breyfogle III, 1999). Companies deploying the Six Sigma methodology improve their process quality, which is consequent upon the final product or service and can enhance customer satisfaction. Furthermore, companies can increase their profitability through quality and efficiency improvement (Harry & Schroeder, 2000). GE claimed that Six Sigma delivered more than $300 million in operating income in 1997 (Breyfogle III, 1999). Moreover, many world-class companies, for example, Motorola, Honeywell, and Sony, have reported substantial benefits of the Six Sigma practice (Lee et al., 2013). According to the study by Smutkupt and Naratornsawatdikul (2019), the practice of DMAIC steps supports the solution to eliminate delayed delivery problems and ensure improvement sustainability in the long term.

Six Sigma methodology consists of five phases, which are Define, Measure, Analyze, Improve, and Control (DMAIC) (Sheila & Shahbaz, 2012). The objective of the Define phase is to identify the problem, customer, and scope of the project. A project charter is prepared during this phase to reveal necessary information to be shared among the team members and a project champion. The main objective of the Measure phase is to understand the current state of the process. The data collection plan must have been conducted. In the Analyze phase, the root causes of the problem are investigated and confirmed based on the collected data (Schroeder et al., 2008). The objective of the Improve phase is to develop improvement actions to reduce/eliminate the root causes and validate the improved results. In the Control phase, the improved actions are monitored by the process owner to ensure that the root causes will not reoccur (Sangphang et al., 2020; Sheila & Shahbaz, 2012).Generally, projects are identified as Black Belt, Green Belt, or Yellow Belt as they depend on the complexity of the problems under investigation (Gijo et al., 2019). Normally, Black Belts have been assigned

to work full-time to be responsible for executing their application projects, while Green Belts are part-time and can take on mini-projects of their own (Harry &Schroeder, 2000). Black Belt can initiate and implement large-scale and cross-functional projects. Green Belt usually leads Six Sigma projects within their functional units. Regarding Yellow Belt, the roles and responsibilities are less than the Black Belt and Green Belt. Yellow Belt is usually assigned as a team member of Black Belt or Green Belt projects. Another main concept that is widely used in the process improvement project is the Lean methodology, which is discussed in the next topic.

Lean Concept

The Lean philosophy is introduced and is mainly based on the Toyota production system, which develops the production processes to remove overburden, enhance smooth production, and eliminate waste (Furterer & Elshennawy, 2005). The concept of Lean normally focuses on streamlining the process by eliminating non-value-added work and achieving zero waste in the system, which helps provide better quality (Chahal & Narwal, 2017). Lean operations are considered very efficient and have few wasted resources (Bowersox et al., 2010). Under Lean, originally, there were seven types of waste, which were overproduction, delays, excess transport or defects from transport, overprocessing, excess inventory, excess movement, and making defects (Langley et al., 2008; Villareal et al., 2012). Since Lean has evolved into the rest of the organizations around the globe, additional waste and non-utilized talent have been added.

In a study conducted by Villareal et al. (2012), the Lean manufacturing approach was also applied to eliminate waste in the distribution operation by using value stream mapping and paying attention to bottleneck facilities. In addition, a study by Chahal and Narwal (2017) reviewed the literature on Lean manufacturing and Lean strategies. They mentioned that it was not practically easy to implement because no one had wanted to change it until it was highly required. However, Lean practices have more advantages than the traditional system and are still popular nowadays. Later, the combination of the principles and tools of Lean and Six Sigma emerged and was named Lean Six Sigma.

Lean Six Sigma (LSS)

Lean Six Sigma (LSS) concept focuses on enhancing quality, reducing variation, eliminating waste (Furterer & Elshennawy, 2005; Snee, 2010), improving cycle time, and eliminating non-value-added steps (Snee, 2010). Currently, a number of researchers apply LSS to improve the organization's performance in the manufacturing process, services, and support functions. Technically, Lean tools are used to focus on the speed of the process, while Six Sigma is used to improve the accuracy (Salmon, 2017) by identifying the root causes of the problems (Sangphang et al., 2020). Generally, LSS is focused on finding the variables that account for the main variations in the process, which is aligned with the Pareto concept (Snee, 2010).

Burch et al. (2016) presented a case study on the application of LSS in service-based logistics organizations. The LSS methodology helped to identify the potential areas for improvement, eliminate development rework, and speed up the proposal review process. Also, various quality tools related to this study were applied. A house of the quality diagram (QFD) helped to identify a number of engineering requirements that reflected the customers' viewpoints. A Fishbone diagram was used in the Measure phase to identify the root causes of the problem. Moreover, a Pareto chart was used in the Analyze phase to point out the main causes of issues. This case has demonstrated how LSS helped to streamline the processes of selecting and implementing a new ruggedized handheld device for their field workers.

Additionally, in a study by Gijo et al. (2019), the authors applied the LSS methodology to reduce the complaint resolution time from 12.5 to 8.5 hours and the turn-around time of all main processes in the company. The authors have utilized a case study approach in the system maintenance department. They have worked systematically through the define, measure, analyze, improve, and control phases. In the Define phase, identifying the problem and scope were addressed. After that, in the Measure phase, collecting data to understand the current process and the performance baseline was conducted. During the Analyze phase, the team used a flow chart to understand the process complexity by investigating value-adding

or non-value-adding activities. Moreover, brainstorming with the team to identify potential causes of delay in complaint resolution was also applied. After that, the selected solutions for the root causes were implemented. Finally, in the Control phase, the sustainability of the results such as standardization procedures and training employees was implemented.

According to previous research, the LSS approach can be applied to several situations, and numerous quality tools can be properly chosen to handle different types of data based on the company's evidence.

Process Flow

The Process flow is a tool used to recognize the inputs, outputs, and other factors that can affect the process. It represents the sequence of products, paperwork, operator activities, or administrative procedures. Generally, the Process flow is often a starting point for process improvement and can be used to identify unnecessary complexity, duplication, or redundancy, and it also helps generate ideas for improvement (Salmon, 2017).

A number of studies used the Process flow/map as one of the key tools in dealing with process improvement issues. For example, a study by Kuaites et al. (2020) confirmed that the Process map helped to see the complete working steps more clearly; therefore, the delays, bottlenecks, or incorrect steps were identified. A study by Lee et al. (2013) revealed that the team used this tool to collect information about the refund process to establish relationships between input and output variables and to identify possible sources of processing errors and inefficiencies. Moreover, a study by Sangphang et al. (2020) used the Process map to visually highlight delays and breakdowns in the process. After that, the operation team brainstormed potential actions to improve the process. Then, the new Process flow was redesigned and verified; consequently, the process lead time was reduced from 11 hours to 4 hours.

Fishbone Diagram

A Fishbone diagram or a Cause-and-Effect diagram is a useful tool to initiate ideas about potential causes of the problem (Burch et al., 2016; Kuvvetli & Firuzan, 2019). Generally, it is often appropriate to deliberate on six areas of causes, including materials, machines, methods, personnel, measurement, and the environment (Breyfogle III, 1999). Salmon (2017) supported that the Fishbone diagram can be accomplished easily in a group setting because it is used as a concept of visual display and helps to brainstorm on the potential causes of the problem. Moreover, the sub-cause branches or sub-bones of the causes can be expanded. The information generated from this diagram can help the team members obtain more ideas for further actions, such as planning to collect detailed data to confirm the root causes (Aummontha & Smutkupt, 2017; Smutkupt & Naratornsawatdikul, 2019). The case studies by Burch et al. (2016) and Gijo et al. (2019) also used the Fishbone diagram with a team brainstorming approach to identify potential causes of issues.

Failure Mode and Effects Analysis (FMEA)

Failure mode and effects analysis (FMEA) is a structured method for identifying how a product or a process fails and for removing or reducing the risk of failure. FMEA can be used in process design or improvement actions (Lee et al., 2013). Breyfogle III (2000) supported that organizations apply FMEA to recognize and remove concerns early in the development of a process or design. If the process is well designed, defects or incorrectness can be prevented. Moreover, applying FMEA to the existing products or processes is used to recommend potential improvement actions to reduce failures from reaching the customer/user (Milena & Arvilla, 2014). This tool is very beneficial in enhancing process efficiency.

A study by Salmon (2017) mentioned that the implementation of FMEA in the case of a public school district was unsuccessful due to its complications, which required in-depth information on the causes of failure. Studies by Lee et al. (2013) and Appollis et al. (2020) applied FMEA for business process improvement when implementing Statistical Process Control (SPC) in a chemical manufacturing

company and found that it is one of the most powerful tools to identify causes and help find a way to remove them.

To apply FMEA to the project, key processes that contain defects/errors should be identified. Practically, the main factors to evaluate the current process performance include the potential failure mode, potential effect of failure, potential cause of failure, and current control in place to prevent the cause from happening (Salmon, 2017). In addition, the four key measurements of FMEA, Severity, Occurrence, Detection, and Risk Priority Number, must be brainstormed among the team members. Severity (SEV) is used to assess the seriousness of the effect of the potential failure mode. Normally, it relates to the harm produced to the customer (Milena & Arvilla, 2014). Occurrence (OCC), which estimates the possibility that causes the potential failure mode, is measured. Detection (DET) of the ability of the existing control to notice the subsequent failure mode of the process is assessed. The product of SEV, OCC, and DET is identified as a Risk Priority Number (RPN). A higher RPN should be given high priority for process improvement rather than a lower RPN. However, a high severity rating even though the RPN score is low may get special attention (Breyfogle III, 1999).

Research Methodology

This study applied the five steps of DMAIC and used some Lean tools. DMAIC helps all the team members make decisions based on facts. In this study, Lean tools played an important role in identifying non-value-added steps and potential wastes that occurred in the current operations. After collecting the necessary data, various tools were revealed and analyzed to come up with the root causes of the delay in payment. Improvement actions were conducted. The new process (to-be process) has been set as a standard of the operating procedure. Monitoring and controlling the improvement factors are handled by the process owner to ensure that the problem will not reoccur. The details of the five phases are discussed below.

Define Phase

This study focused on the process efficiency of paying all telephone bills on time and with accuracy. Under this phase, the problem statement must be identified and

communicated with all concerned parties. At the beginning of the project, a project charter was developed, which contained the necessary information, as shown in Table 1.

Generally, the project charter was developed by Green Belt with the support of a team member and a project champion. This chart was used to communicate key information with the team members and to monitor the overall project scope. When team members reviewed the details and agreed on the project scope and timeline. After that, the management approved the project charter. Then, the Measure phase started.

Table 1: Project Charter

Topics	Details
Problem Statement	The current processes related to all telephone bill payments are inefficient, which impacts the process lead time and the correctness of payment transactions.
Project Goals	To improve the payment process efficiency To pay the correct telephone bills on time To pay only active phone numbers (terminate no longer used numbers)
Project Scope	To cover all types of telephone bills, which include office telephone (landline), mobile phone, and internet numbers
Project Benefits	To improve the process efficiency that helps reduce wrong/delayed payments and eliminate non-valued-added steps
Project Milestones	Tentative-around 6 months Define phase – July Measure phase – August Analyze phase – September Improve phase – November Control phase – December
Team Members	Accounting Department Administrative staff from key project sites

Measure Phase

Under the Measure phase, understanding the current workflow is necessary. Green Belt worked with the team members to develop the current process flow, as shown in Figure 1. Potential non-value-added steps were discussed among the team members.

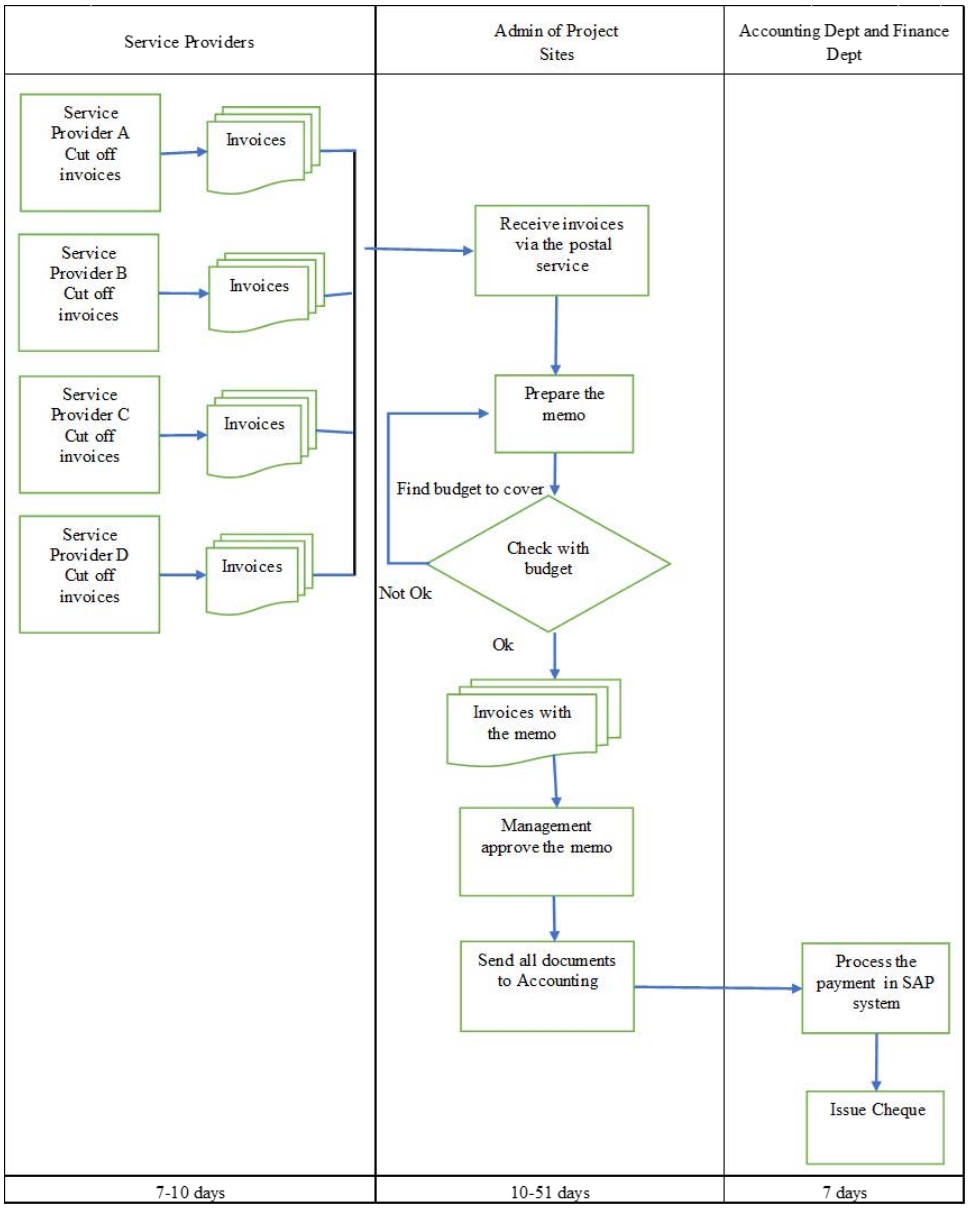

Figure 1. As-Is Process Flow with Lead time

According to the flow, telephone invoices come from different service providers based on usage, including telephone lines, mobile phones, and internet numbers. Once the administrative staff receives the bills, they have to prepare a memo and get management approval. After that, those documents are sent to the Accounting Department. In some cases, the administrative staff of the project sites face problems such as budget inadequacy, invoices exceeding the dateline, and the urgent payment process by the Accounting Department that needs to be conducted. In a normal case, after the Accounting Department receives the complete documents, the payment will be processed in the SAP system on a weekly basis.

During this phase, Green Belt liked to confirm the lead time of each process step to identify the potential causes of the delay in payment. So, Green Belt randomly selected some invoice transactions and measured the range of lead time of the key process steps, as shown in Table 2.

Table 2: Sample Data of Lead time of Key Process Steps

Process Steps (dd/mm)	Transaction # 1		Transaction # 2		Transaction # 3		Transaction # 4	
	Date (dd/mm)	No. of days	Date (dd/mm)	No. of days	Date (dd/mm)	No. of days	Date (dd/mm)	No. of days
Cut-off Invoice (Service Provider)	09/06		21/06		29/02		12/03	
Issue Tax Invoice (Service Provider)	14/06	5	26/06	5	07/03	7	17/03	5
Received Tax Invoice	17/06	3	29/06	3	10/03	3	20/30	3
Prepare a memo	29/06	12		2		0		0
-First approval	29/06	0		0		0		0
-Second approval	05/07	6		4		0		0
All documents sent to Accounting dept	08/07	3	08/07	3	30/40	51	30/40	41
Accounting process and issue cheque	15/07	7	15/07	7	07/05	7	07/05	7
Total		36		24		68		56

Table 2 shows four samples of data on the lead time of the key process. Overall, Green Belt found that the average lead time to process the payment was around 30 days from the invoice date. However, in some cases (transactions #3 and #4), the lead time was high because the administrative staff failed to receive the invoices and did not realize that those invoices were overdue already. Hence, when overdue cases are found, an urgent procedure must be followed to ensure that the invoices are paid as soon as possible.

In addition, Green Belt used the Fishbone diagram to identify the potential causes of the inefficient payment, as shown in Figure 2.

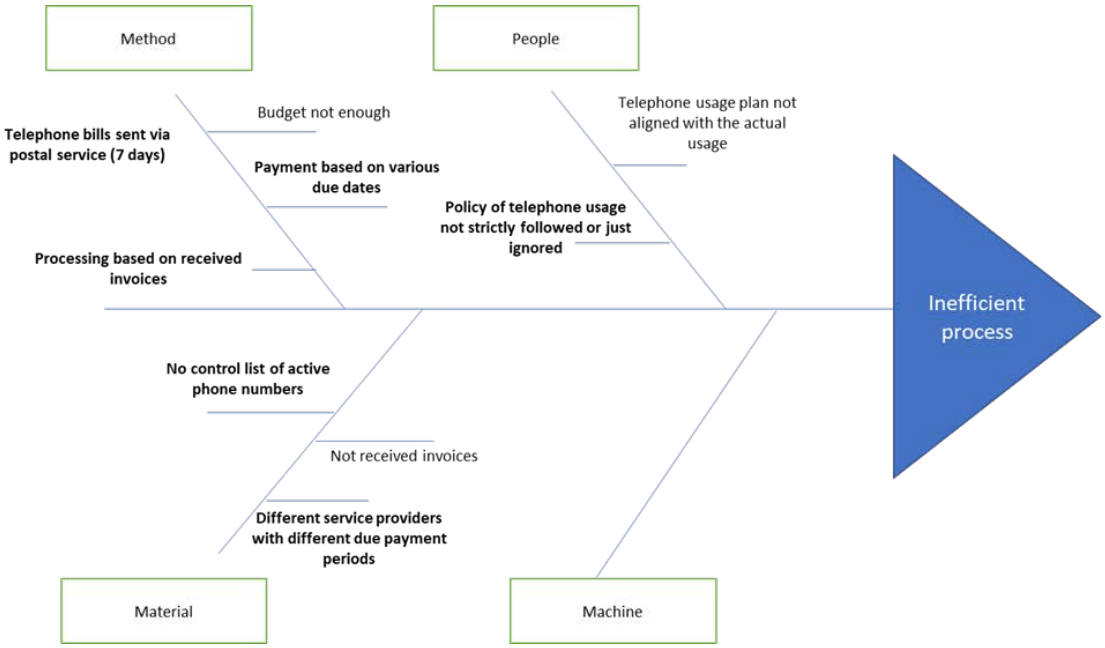

Figure 2. Fishbone Diagram

All potential causes were generated by the team members and concerned parties familiar with these process steps. The causes are grouped into three categories: Method, Material, and People, which can be broken down into sub-bones: processing based on received invoices; invoices sent via postal service; payment based on various due dates; lack of control list; different service providers with various due dates; and telephone usage policy not strictly followed. Based on the data from the actual lead

time and Fishbone diagram, the root causes were further examined and finalized in the Analyze phase.

Analyze Phase

According to the current process flow, Green Belt and the team members applied the Lean concept and identified two types of waste, which are defects and over-processing.

The two defects were the missing payment of some invoices and the payment of inactive numbers. First, the administrative staff did not realize that the invoices needed to be processed because they had not received the actual invoices from the service providers. For this defect, there is no tool to remind them about the numbers that require payment and the due dates. Therefore, if they are busy with other work, they may forget to monitor and perform their jobs on time. Regarding the second defect, the team found that the company had kept paying for the telephone bills, which numbers were no longer used. This case happened because some users were rotated to other functions or had resigned from the company, but their mobile phone numbers were not updated. In this situation, if invoices are sent to the administrative staff, they will process them as usual. Green Belt asked each concerned function to review the inactive numbers, and the team found that 100 numbers out of 460 numbers were no longer used and should be terminated.

Regarding the over-processing of waste, various phone numbers have different due dates from various service providers. The operations and the accounting staff have to proceed with the payment transactions on a weekly basis to meet the variability of due dates. Moreover, the project sites are responsible for the various telephone invoices from the different service providers, and the staff must prepare a cover sheet based on the different due dates of each service provider. This practice is time-consuming and is classified as over-processing since the process is conducted every week.

Besides wastes, Green Belt also used the Failure Mode and Effect Analysis (FMEA) to prioritize major failures. Firstly, the potential failure modes of the key processes and their causes and effects were examined. The severity score (SEV) of each failure was discussed. It was based on the failure's effect on the customers. If the failures are caused by "no payment" to the service provider, the SEV score is assessed as high. If the failures lead to a delay in payment, the SEV score is low. Next, the occurrence score (OCC) is based on the frequency of the cause. Scores are given based on the experiences of the team members who are familiar with the processes. Lastly, a detection (DET) of failures or causes is identified. In a current situation, if there is a tool or step to control or prevent the causes, the DET score is low. On the contrary, if there is no tool to control or detect the causes, the DET score is high at 8–9.

Finally, the products of Severity, Occurrence, and Detection were calculated and resulted in the risk priority number (RPN). After that, the team members brainstormed and discussed the current situation, and all the information was put into the template, as shown in Table 3. According to the key steps, the main causes are also shown in the table.

Table 3: Failure Mode and Effect Analysis (FMEA)

Item/Function	Potential Failure Mode	Potential Effects of Failure	SEV	Potential Cause	OCC (Prevent/Detect)	Current Process Control	DET	RPN
Preparation of a cover sheet based on received invoices/bills	Did not realize which invoices/bills are missed from the process	No payment	9	Many telephone numbers and no active telephone list	8	No	9	9
Process the payment Various due dates	Time-consuming	Late payment	9	Many telephone numbers and no active telephone list	8	No	504	648
	Time-consuming	Time-consuming payment	9	Many telephone numbers and no active telephone list	8	No	9	9
Invoices sent via the postal service	Delivery late	Late payment	9	Many telephone numbers and no active telephone list	8	No	504	648
Request/transfer/ cancel phone numbers (policy deployment)	Confusion during payment process	Wrong/delay payment	9	Many telephone numbers and no active telephone list	8	No	9	9

When the processes had been improved, the To-Be process was drawn, as shown in Figure 3. Overall, the range of lead time for each step has been shortened.

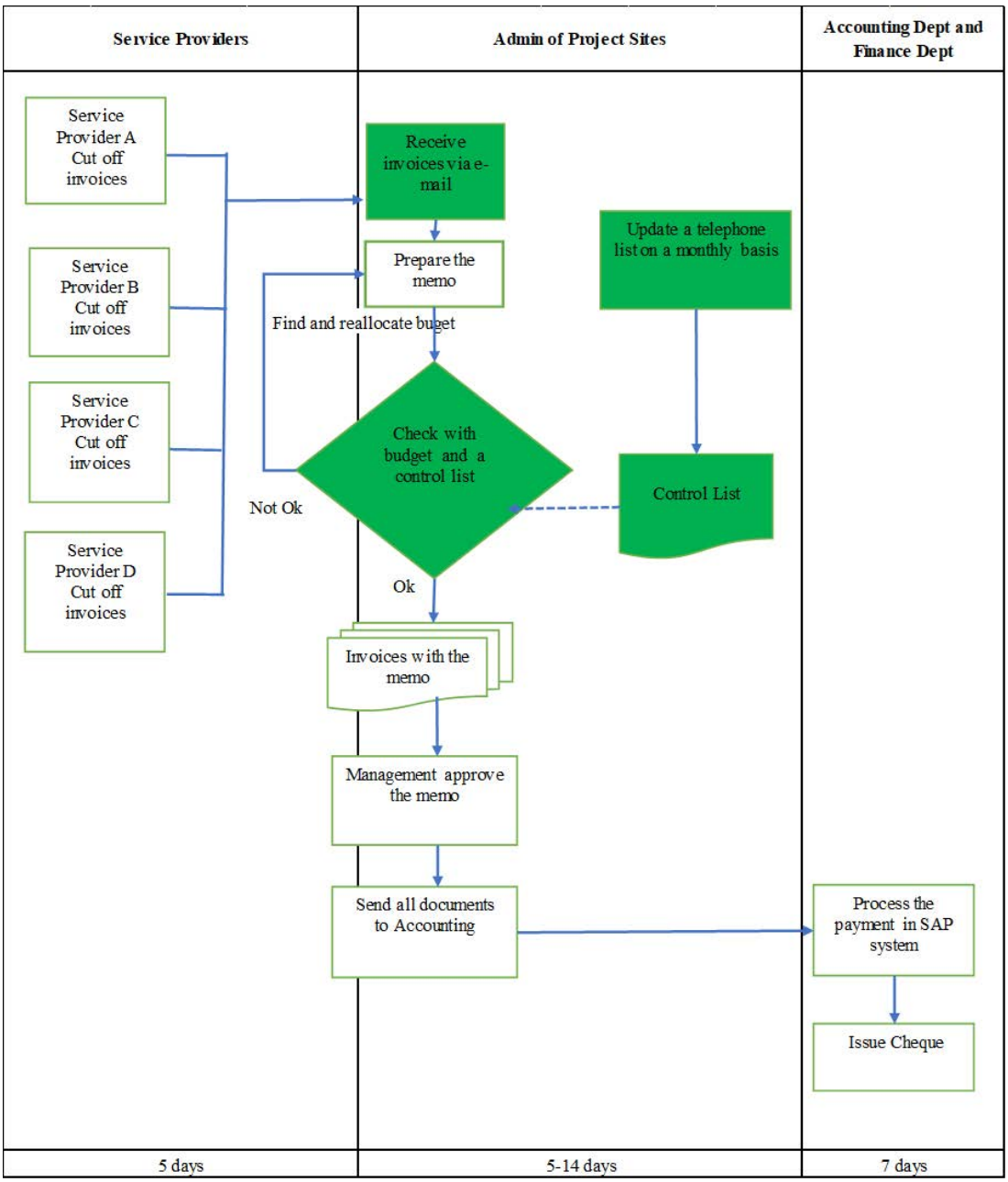

Figure 3. To-Be Process with New Lead time

Overall, the average lead time has reduced significantly. The maximum lead time of the overall process has been reduced from more than 60 days to 26 days. The main result came from eliminating the missing invoices to proceed at the project sites. The new practice ensures that transactions are paid on time.

In addition, combining the due dates of each service provider obviously reduces the processing time of the accounting staff who takes care of all the invoices, from approximately 5 days to 2 days per month. The improvement in working time also frees up the accounting staff, so they can handle additional work if needed in the future. Besides, the workloads of the accounting staff, the administration, and the head of each project site dealing with the telephone invoices have been reduced in preparing and reviewing those documents. The goals of this project are achieved since SA Company can pay its telephone bills on time with accuracy, improve process efficiency by eliminating some process wastes, and reduce the working hours of the Accounting Department.

Although the actions revealed an improved process, Green Belt needs to develop a monitoring plan to ensure that the root causes will not reoccur.

Control Phase

The purpose of the Control phase is to develop a control strategy to maintain the improved process in the long term. The critical elements must be regularly reviewed. Implementing an error-proofing tool is preferable. The telephone list of each project site can be utilized as the control checklist and can support the administrative staff in controlling invoice payments. The updated list has been set as the standard operating procedure (SOP). In addition, the heads of the project sites agree to monitor and update the list monthly to reflect the active numbers. Furthermore, the procedure/policy of requesting and terminating the mobile phone has been reviewed and communicated to all users to make them aware of the mobile phone utilization. In addition, the heads of the project sites are responsible for controlling the telephone costs and managing the utility budget efficiently. Overall, the lead time of the telephone bill payment will be checked by accounts payable to ensure that the invoices for each service provider will be paid on the agreed due dates.

Discussion of Results and Conclusion

This study presents a real-world case of how the LSS DMAIC methodology enhances the process efficiency of invoice payment and eliminates some non-value-added steps. If the organization follows systematic thinking and uses facts in making decisions, it can eliminate the root causes of the problem and improve the process in the long term.

Green Belt started by revealing the actual detailed process flow, and the lead time of each process shows the potential causes of the delay in the payment process. A data collection plan was conducted. The random sampling cases helped to confirm the average and range of the lead times of the key steps and to point out potential delays. In addition, the team brainstormed by using the Fishbone diagram to discuss all the potential causes. However, applying Failure Mode and Effect Analysis (FMEA) revealed more details of failures, causes, and current control methods. Combining varied quality tools and using the collected data facilitated the team members' analysis and confirmed the root causes. After the root causes had been declared, the improved actions were generated from the knowledge and experiences of the team members. Moreover, all members have studied the situation, and they have come up with potentially improved alternatives. The improvement actions were implemented and monitored for a certain period.

The objectives of this project have been achieved. The telephone bill payment process is more efficient. The repetitive transactions have been eliminated. Wastes and non-value-added steps were reduced. The staff's workload has decreased. The accounting staff confirmed that the processing time has been reduced by three days a week. The available time can support more tasks for a future project. Moreover, the payment lead time can be met on time and with accuracy. The control list makes each project site aware of the numbers required to pay each month. The missing numbers or delay in payment should be prevented. In addition, the problem of budget utilization for the utility will be regularly monitored and controlled.

Finally, the control characteristics were identified and implemented. The actions in the Control phase were updating the telephone control lists according to the SOP and monitoring the payment lead time regularly. The control list is used to regularly monitor the active phone numbers to ensure that the company pays for the in-use numbers that support the mistake-proofing concept.

In conclusion, this case study provides a systematic problem-solving procedure to tackle a real-world issue through the effective implementation of LSS. The concept of LSS can be applied to service and support functions to identify the root causes of a problem and fix it permanently (Breyfogle III, 1999). Lean tools generally help to identify wastes (Furterer & Elshennawy, 2005) and non-value-added steps (Chahal & Narwal, 2017), while the Six Sigma methodology supports the team to work systematically by following the DMAIC method (Antony, 2012; Sheila & Shahbaz, 2012), and it uses facts to make the right decisions. The root causes of the problem were properly identified and solved (Sangphang et al., 2020; Sheila & Shahbaz, 2012). Critical to quality (CTQ) related to critical key elements was monitored regularly in the long term. The project owner and the working team can be assured that the problem will not occur anymore (Sangphang et al., 2020; Sheila & Shahbaz, 2012). In addition, several quality tools were revealed and were able to show orderly steps on how to attack problems, identify root causes, and take improved actions. The author believes that this case study will provide certain benefits not only to scholars but also to practitioners by showcasing the application of LSS in transactional functions within a real estate developer.

Moreover, the LSS approach can contribute to bottom-line benefits for the organization along with bringing process improvements. The significance of continuous improvement, employee engagement, and process thinking was created by the success of the process improvement project. Typically, the project was recognized by the top management, and the project team got appreciation from several levels in the organization. Consequently, the successful execution of simple projects in supported processes can motivate practitioners to tackle harder initiatives in the future.

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